

1955

# TECHNICAL REPORT WRITING

Civilian Personnel Division, Office of the Chief of Engineers, Department of the Army

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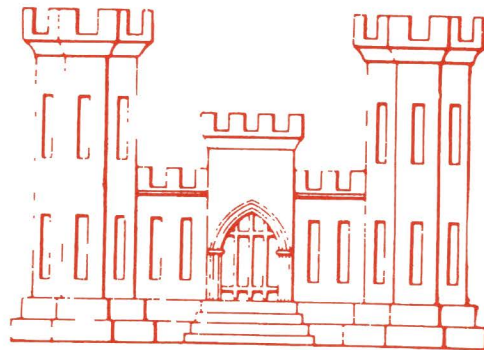
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# **TECHNICAL REPORT      WRITING**



**DEPARTMENT OF THE ARMY  
CORPS OF ENGINEERS**

# TECHNICAL REPORT WRITING

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\*Papers prepared for a conference on the use of English in Corps of Engineers reports—  
North Atlantic Division.

CIVILIAN PERSONNEL DIVISION  
OFFICE OF THE CHIEF OF ENGINEERS  
DEPARTMENT OF THE ARMY

1955

# TECHNICAL REPORT WRITING

## INTRODUCTION

Junior Engineers, Junior Management Assistants, and other Corps of Engineer employees in professional, scientific, and technical fields write memos and reports as routine duties of their respective assignments. A large number of these are reports on civil works for which the general content and format are prescribed in Orders and Regulations (O & R) of the Corps of Engineers; even in such cases, when the young author knows what he ought to put into his report, he still has the problem of writing the main text in accurate, readable, and interesting fashion. This handbook is for him—and for others who help him in the preparation and review of his report.

Technical Report writing is restricted to report writing; moreover, it is limited to reports, mainly on civil works, of the Corps of Engineers.

Several Federal agencies have issued publications on report writing, and of course, textbooks are available from commercial publishers. These books, though some of them are excellent for employees of the issuing agency and for the college student, are not too helpful from the standpoint of the Junior Engineer in the rotational training period. In the first place, these books give much space to the development of outlines; this is fine—except that in many instances the outline for the engineering report is readymade and prescribed by the Orders and Regulations. In the second place, textbooks are too general for practical reporting, and agency manuals are keyed to their own projects. Examples in this handbook are selected for the dual purpose of showing the various types of reporting required in the Corps of Engineers and of *forming the O & R habit*, as it were; by acquainting the Junior Engineer with the assistance to be gained from Orders and Regulations, it is hoped that he will automatically turn to the appropriate regulations before he commences his report.

## CIVIL WORKS

The Corps of Engineers is charged with both military and civil works.

Civil works operations are those functions assigned to the Chief of Engineers relating to the maintenance and development of rivers, harbors, and waterways for navigation, flood control (including major drainage), other water uses and related purposes, and shore protection.

Civil works operations include: investigations for reports to Congress on possibilities for improvements; planning, construction, operation, and maintenance of projects authorized by Congress; administration of laws concerning protection and preservation of navigable waters of the United States; collection and dissemination of information on waterborne commerce; maintenance of surveying and charting of the Great Lakes, the Mississippi River, and other inland waterways; preservation of Niagara Falls; supervision through control boards of boundary waters between the United States and Canada; and providing the water-supply system for Washington, D. C. (O & R 4201.02).

Each of the operations named above is covered by some kind of report.

The Corps of Engineers has been making reports on civil works for more than a century. It has gradually standardized its regular reports in format and in content. Uniformity of outline simplifies review and summary, for the reviewer can run through the reports quickly to see whether coverage is complete, or he can turn rapidly to separate items for comparison of projects. Filing and storage are easier when reports are of the same size and are bound in the same manner. Above all, standard reports are limited to essentials as tested by experience. The most serviceable outlines are printed in the Orders and Regulations of the Corps of Engineers.

## ORDERS AND REGULATIONS

If you are a newly appointed Engineer, the first thing to do when you are given a reporting assignment is to look in O & R for directions.

Orders and Regulations consist of the following parts and chapters, all packed with information you will need in your work:

- Chapter I. Organization.
  - II. General Administration.
  - III. Personnel Administration.
    - Part I. Military Personnel.
    - II. Civilian Personnel.
  - IV. Operations.
    - Part I. Military Works.
    - II. Civil Works.
    - III. Civil Works Supply Policies and Procedures.
  - V. Real Estate Operations.
    - Part I. Military Works.
    - II. Civil Works.
  - VI. Property Administration.
    - Part I. Military Works.
    - II. Civil Works.
  - VII. Procurement, Contracts and Claims.
    - Part I. Military Works.
    - II. Civil Works.
  - VIII. Fiscal Administration.
    - Part I. Military Works.
    - II. Civil Works.
  - IX. General Index.

References to Orders and Regulations are usually given in figures, as 4216.20b, 4219.07, or 2009.09. Since the regulations comprise several bulky volumes, a key to the plan saves unnecessary handling: The first number is the chapter; the second shows whether it is Part I, Military, or Part 2, Civil Works; the two figures before the decimal point refer to the section; and the numbers after the decimal identify the paragraph and subdivision.

Example: Chapter 4, Part 2, Section 16, Paragraph 20, Subdivision *b* would be 4-2-16.-20-b; that is, 4216.20b.

Excerpts from O & R in this handbook are sometimes abridged or paraphrased to illustrate a point; such excerpts, of course, must be verified by reference to original regulations for any official use.

## THE LANGUAGE OF REPORTS

The emphasis in Orders and Regulations is on "form and style easily readable and understandable even by those not familiar with Corps of Engineers procedure"; and on writing "in such manner that the objects to be attained may be readily understood by anyone unfamiliar with the works without reference to other reports or docu-

ments." The standard for annual reports is given a special paragraph:

Accuracy and clarity of statement will be the primary considerations in preparing data for the annual report. Brevity is essential but will be obtained by the use of simple, direct language and good grammatical construction and by limiting the information presented to essential statements rather than by use of abbreviations or shortened expressions that may not be clear in meaning to the average reader. Technical descriptions or discussions which may be of interest but not essential to the purposes of the report will not be included in the report. (4242.04c)

*Shun big words*, but remember that the big word is the word unfamiliar to your reader. "Mobilization planning," "technological advances," and "renegotiated contracts" are not big words to those who use them every day in routine work. Sometimes in technical reports the precise meaning is best conveyed by such phrases as "condensation of moisture" and "congealed vapor." If this and nothing else is what you mean, say it; but if the thing you are talking about is what we ordinarily call rain, dew, frost, or hail, use the familiar word.

*Vary your sentences* for interest. Make some of them short, some long; some simple, some complex, and some compound. Use loose, periodic, balanced, and mixed sentences. Count the words in an average page or in an average paragraph of your writing to find whether your style tends to length or brevity; analyze your writing from every standpoint you can; but DON'T do it while you are composing. By being self-critical while you are writing, you will inhibit the free flow of thought. Get your ideas on paper first. When you have recorded the facts, then read your draft critically for meaning, interest, and style.

*A loose sentence* is "natural" writing—a simple recording of facts in good order but without special attention to form. Observe in the following example that the narrator could have stopped his sentence at any one of the points marked with dots, in each case making sense, but each addition gave a little more information.

Navigation improvements at coastal and Great Lakes harbors generally involve the dredging of channels . . . and anchorages, . . . and frequently the protection of entrances . . . by jetties . . . and the creation of protected areas . . . by breakwaters.

*A periodic sentence* is one that keeps the reader in suspense until the end. The period is the first

stopping place. A stop before the period is reached leaves the meaning incomplete.

Even though appropriations and expenditures for civil works were reduced substantially below the levels of the past two years, the fiscal year 1954 was a most active one.

A *balanced sentence* is made up of elements of equal rank connected by "and," "but," or other coordinate:

Dike repairs were completed in October 1953, and breakwaters were commenced the following spring.

*Mixed sentences* are combinations of the other types.

One type of sentence is as good as another, none is best for all purposes. Be familiar with them so that you can write any kind at will. Vary them. Too many consecutive periodic sentences seem pedantic. Too many short sentences give a choppy impression. Excessive coordination, as in balanced sentences, is tiresome. Break the monotony, but wait until you are ready for revision.

Here is a sentence from the Annual Report, probably revised, perhaps originally set down in the first draft as short factual sentences like this:

The outlet works consists of a gate-control house and eight conduits. Each conduit is 20 feet in diameter. The dam and the powerhouse are located on the right abutment.

This is the sentence as it appears in the Annual Report:

The outlet works, consisting of a gate-control house and eight conduits, each 20 feet in diameter, and the power house are located on the right abutment.

*Parallelism* merits the attention of the careful reporter. One example is a balanced sentence, but a parallel construction may be an impressive array of coordinate elements—clauses, phrases, or words—always of like structure.

*Wrong.* It is suggested that consideration be given to *elimination* of the proposed north breakwater and *extend* the south breakwater, etc.

"Elimination" and "extend" are not parallel; one is a noun, the other a verb. An indorsement by higher authority restated the comment correctly:

*Right.* It would probably be better to *eliminate* the north breakwater and *extend* the south breakwater at equivalent cost.

Here is a longer example:

Flood control is accomplished—  
by improvement of channels and streams to increase carrying capacity,  
by creation of reservoirs for storage or detention of flood flows, and  
by construction of levees and floodwalls to protect areas subject to damage.

Parallelism would have been observed also if the reporter had written "by improving channels," "by creating reservoirs," and "by constructing levees." It would have been incorrect to write "by improving" and "by creation," for these are not parallel constructions.

*Clarity* is essential to accurate reporting. Writing lacks clarity when the reader has to ask what a statement means.

Other maintenance work, by hired labor forces, consisted of French clearing of 1,132 acres and spraying stumps, weeds, and new growth to improve flowage.

This is not clear to the layman, who is likely to ask: How does *spraying stumps* improve flowage? Or does the reporter mean that spraying stumps, weeds, and new growth are among the things cleared away from this large acreage?

Counting of fish, using the two ladders at the dam, was initiated in March 1954.

Readers who are familiar with the engineering luxuries provided for fish on recent projects will assume that the count is made of fish that use the two ladders at the dam. Others will interpret the statement to mean that the counters use the two ladders to tabulate the fish in the water below.

*Repetition of words* is one of the most common faults in report writing. The fault may be remedied by using synonyms or by grouping the ideas. First, take an example of reporting in which repetition is nicely avoided.

Saddle dikes, spillway, and lining of tunnels *were completed*. Construction of intake structures *was well advanced* and work on the main dam *had commenced*. Design and manufacture of turbines and generators *was being continued*. Work in connection with land acquisition and relocation of roads and utilities *was in progress*. Work *remaining to be done* includes completion of dam, powerhouse, and switchyard; acquisition of lands and relocation of roads and utilities; and clearing of the reservoir area.

Here is another example from the Annual Report. The names of the Counties are changed so that the report writer, who may have been obliged to meet a last-minute deadline, will not feel that his writing is being unfairly criticized.

Relocations of telephone and power transmission lines are complete. Relocations of Grand and Small County roads are complete. Relocations of cemeteries in Grand and Small Counties are complete. Relocation of Forest Service trails is complete. Relocation of State Highway No. 27 is in progress. Relocation of power lines in connection therewith is complete. Construction of reservation buildings is complete. Clearing of the reservoir is complete except for topping of trees. Topping of trees is in progress.

Another writer in the Annual Report overworks the words *contract* and *continued*.

A contract for the design and preparation of contract plans and specifications for the hydroelectric power plant was continued. Acquisition of land for the dam site and reservoir area was continued. Contracts for furnishing hydraulic turbines, turbine governors, and for furnishing and installing generators were continued. A contract for the construction of the powerhouse substructure, intake structure, spillway, and stage II earthwork was continued.

These paragraphs may be improved by listing the projects and by grouping them under like subjects. Slight rearrangement will obviate the necessity of ending sentences with the same words.

RELOCATIONS.....COMPLETE.

Telephone and power transmission lines.  
Roads in Grand and Small Counties.  
Cemeteries in Grand and Small Counties.  
Power lines on No. 27 (Omit—covered by first item).  
Forest Service Trails.

Construction of reservation buildings.....COMPLETE.

Clearing of reservoir (except topping trees).....COMPLETE.

Relocation of State Highway No. 27.....in progress.

Topping of trees in reservoir area.....in progress.

*Revised:* Construction of reservation buildings, and relocations of telephone and power transmission lines, roads and cemeteries in Grand and Small Counties, and Forest Service Trails are complete. Relocation of State Highway No. 27 is in progress. Clearing of the reservoir site is complete except the work, now in progress, of topping trees.

Similar grouping of the second example follows:

CONTRACTS.....CONTINUED.

Design, plans, and specifications for hydroelectric power plant.  
Furnishing hydraulic turbines, turbine governors.  
Furnishing and installing generators.  
Construction of the powerhouse substructure, intake structure, spillway, and stage II earthwork.

Acquisition of land for the dam site and reservoir area....CONTINUED.

*Revised:* The following contracts were continued: Design, plans, and specifications for the hydroelectric power plant; the supply of hydraulic turbines, and turbine governors; the supply and installation of generators; construction of the powerhouse substructure, spillway, and stage II earthwork. Acquisition of land for the dam site and reservoir area is in progress.

Special attention is needed to keep verb tenses consistent and to avoid omission of auxiliary verbs when there is any difference in form between the omitted auxiliary and the one used.

Example: Sixteen gates *have been erected* and the operating equipment *installed*.

*Revised:* Sixteen gates *have been erected* and the operating equipment *has been installed*.

*Tenses* give much trouble. The narrator must take a certain position in the past, present, or future, and stay at that fixed point to relate the events in order of time.

The act of March 2, 1945, *provided* that dredging of the anchorage basin shall not be commenced until local interests furnish assurances to the Secretary of War that they will remove the abandoned water intake pipes.

“Provided” is the time peg. The narrator stands right there and hangs the other tenses on it, changing them as necessary for agreement. If he says *provided*, he must say *should not be commenced*, *furnished* assurances, they *would remove* the pipes.

Since the act is still in force, however, it would

be equally correct to say that the act of March 2, 1945, *provides* for the proposed actions; in that case, the tenses will appear to be consistent without other change.

## ANNUAL REPORT

The annual report of the operations on river and harbor and flood control works and other civil activities under the jurisdiction of the Chief of Engineers, arranged by Districts, for the fiscal year ending 30 June, is a compilation of project descriptions, including progress and status, for Congress. Volume I of two volumes is a summary of the second and of another volume on statistics of waterborne commerce of the United States.

The civil works program covers "improvement works for navigation, flood control, and protection against beach erosion. There also are comprehensive multiple-purpose projects for development of river basins in the combined interests of navigation, flood control, hydroelectric power, irrigation, major drainage, industrial and municipal water supply, recreation, pollution abatement, conservation of fish and wildlife and other benefits."

The foregoing is an excerpt from the summary volume, 1954; another shows the growth of the program:

Beginning with a \$75,000 appropriation in 1824 for snagging and channel clearing in the Mississippi and Ohio Rivers, the program has grown over the 130 intervening years to a present scope of over 3,000 projects, including work in each of the 48 States, the District of Columbia, the territories and overseas possessions.

The Civil Works program grew in accordance with Congressional authorizations until as of 30 June 1954 it included improvements completed, under construction, and not started, with a total estimated cost of \$18.1 billion. Although the Federal activity in providing navigation improvements dates back for more than a century, the major growth of the Civil Works program has occurred since 1928, when Congress adopted the project for flood control and navigation in the Alluvial Valley of the Mississippi, and since 1936 when Federal participation in flood control on a nationwide basis was first authorized by Congress.

*Contract and Hired Labor.* The term "hired labor" is generally applied to Federal employees of the trades and crafts (skilled, semi-skilled, or unskilled), working on construction and maintenance projects, and also to foremen and supervisors of such workmen. Although a few scattered ex-

amples are found in the Annual Report of the extension of the term "hired labor" to professional and administrative personnel in Division, District, or Area offices, this usage is contrary to standard practice. The following paragraph from the summary volume defines the policy of the Corps in regard to contract and hired labor.

The Corps of Engineers for many years has consistently adhered to its policy of having construction work done by contractors in all cases except when the best interests of the United States require hired labor operations. This past year was no exception to the policy. In fact, 94 percent of all construction work was performed by contract and only 6 percent by Government plant and hired labor. In recent years the amount of construction by hired labor has remained at this low percentage. A larger percentage of the maintenance work has been performed by hired labor. The hired labor work on construction projects has been limited to such types of operations as dredging in exposed harbor entrances by Government-owned hopper dredge, the construction of erosion control and levee revetment works, and grouting operations. The nature of such work does not readily lend itself to advertising and performance by contract.

*Outlines for Reports.* Up-to-date Orders and Regulations and current volumes of Annual Reports are available to Junior Engineers for reference in all District and Division Offices; for this reason more space is being given in this handbook to Annual Reports than to any other type of report. By comparing the outline and detailed directions in Orders and Regulations with acceptable examples in the printed Annual Reports—and by trying a few for practice—the Junior Engineer should soon "get the swing" of this kind of writing. He will also learn what kind of assistance to look for in Orders and Regulations on other types of reports.

The Annual Report is a cyclopedia of information on civil works projects of the Corps of Engineers. It is closely packed reporting, every corner jammed with figures and facts. One paragraph on a project could be expanded into a magazine story—and would have to be expanded to hold the reader's interest; it is not magazine writing. "The biggest in the world," "the colossal, breath-taking spectacles of towering stone and concrete," are kept within bounds of so many feet in length and so many feet in breadth and height. There is no room in this type of reporting for the "literary" or the "psychological" approach; but it is the type that has been found to serve the intended purpose,



and the type that young engineers in the Corps should learn how to do well; moreover, it is excellent practice for the Junior Engineer because it forces him to keep to minimum essentials and yet permits considerable scope for ingenuity in ferreting out the facts and analyzing data; and it will be good training for the technical reports he may wish to write under his own name eventually for professional publications.

*Outline for Annual Report.* The headings to be used for each project on which expenditures have been made during the fiscal year are listed below, together with O & R references:

- Location (4242.06)
- Previous projects (4242.07)
- Existing project (4242.08)
- Recommended modifications of project (4242.09)
- References to published articles not previously reported (4242.10)
- Local cooperation (4242.11)
- Terminal facilities (4242.12)
- Operations and results during fiscal year (4242.13)
- Condition at end of fiscal year (4242.13)
- Cost and financial summary (4242.15)

In the following examples of directions from Orders and Regulations and of illustrative reports, sentences are lifted from their context for brevity, and therefore, neither show a complete picture of any project nor full assistance given in filling out the details of the report.

Directions for outline from Orders and Regulation:

*Location:* The location of the project will be stated briefly. Name the river and State to show distance and direction from the nearest city. . . .

Examples from Annual Report:

The Snake River, which is the largest tributary of Columbia River, rises in Yellowstone National Park, in the western part of Wyoming, flows in a general westerly direction for about 1,000 miles, and empties into Columbia River near Pasco, Wash., 324 miles from the Pacific Ocean. . . .

The Mississippi River rises in Lake Itasca, Minn., flows in a general southerly direction for 2,350 miles, and empties into the Gulf of Mexico. Its drainage area, about 1,245,000 square miles, embraces all or part of 31 States between the Rocky and Appalachian Mountains and parts of two Canadian provinces. . . .

It is apparent from the above (and from following examples), that although outlines and directions are standardized, research for facts and

selection of items to go into the reports give room for the reporter to exercise initiative and express his own individuality.

*Existing project.* O & R directions:

Particular care will be exercised to make this paragraph brief and concise. Give first a statement of the whole project or plan of improvement in force at the time the report is submitted, usually beginning at the entrance for a harbor and going upstream for a river. Incorporate all authorized modifications, including work undertaken with both regular and special construction funds, in such manner that the objectives to be attained may be readily understood by anyone unfamiliar with the works without reference to other reports or documents.

Examples; (ROME, COOSA RIVER, GA.) The plan of improvement provides for the construction of a system of levees and concrete flood walls consisting of the following features: about 6,000 feet of earth levee and 546 feet of concrete flood wall along the right bank . . .

(BLACKWATER RESERVOIR, N. H.) The dam is of the rolled-earth type with a dumped rock blanket on the upstream face and a downstream rock toe. . . .

(BALL MOUNTAIN RESERVOIR, VT.) This project provides for the construction of a concrete arch dam with a crest length, including spillway overflow section, of 1,140 feet. The dam will rise 247 feet above river bed. . . .

(DETROIT RESERVOIR, OREGON). . . . Detroit Dam is a concrete-gravity structure approximately 1,580 feet in length and 379 feet in height above riverbed. . . .

(HARBOR OF REFUGE, SEWARD, ALASKA). This provides for a south breakwater 580 feet long and a north breakwater 950 feet long, and dredging a basin about 207,000 square feet in area between the breakwaters to a depth of 12½ feet at mean lower low water. . . .

As in a good lead for a newspaper story, the report begins without preamble, and packs in the meaty facts. The thinking behind journalistic reporting is that in case the story has to be lopped off for want of space, or in case the reader does not care to read all the way through, the first paragraph gives the gist of it anyhow.

■ *Local Cooperation.* The extent of assistance furnished by local authorities varies from project to project. Sometimes the Corps of Engineers does the construction work and turns the project over to local-interests for operation, as in the following example:

(HAWAII, SAN FRANCISCO DISTRICT). Local interests are required to (1) furnish lands, easements and rights-of-way necessary for the

construction of the project; (2) bear the expense of all highway alterations, of removing the existing railroad trestle near the river mouth, and of replacing this trestle with a satisfactory structure if replacement is required; (3) hold and save the United States free from damages resulting from construction of the works; and (4) maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army.

(BODEGA BAY, CALIF.) Fully complied with for new work. Local interests are required to furnish disposal areas for maintenance dredging and to maintain suitable grasses or shrubbery to control the sands on the dunes west of the bay.

*Terminal Facilities.* The following examples show individual differences in reporters in gathering and interpreting facts.

#### O & R Directions:

For projects involving improvements for navigation, indicate briefly the character and the number or extent of wharves, piers, or other terminal and transfer facilities served by the improvement, noting especially those that are publicly owned, and separating those that are open to general public use from those that are not, and state whether these facilities are considered adequate for existing commerce. . . .

#### Examples from Annual Report:

(MONTEREY HARBOR, CALIF.) Within the protected harbor the existing commercial facilities consist of 2 publicly owned wharves with a total of about 2,600 feet of berthing space, 3 boat fueling stations, 2 net tanning plants, 2 machine shops and other facilities for servicing fishing boats, exclusive of facilities owned by the United States. Outside the protected harbor there are 1 boatbuilding and repair plant, 35 anchored floating fish-receiving hoppers connected by pipelines to the sardine plants ashore, 2 submarine pipelines between tanker moorings and shore plants for handling petroleum products, and other facilities for servicing fishing boats. The facilities are considered adequate for existing commerce, although a state of congestion generally exists within the protected harbor due to a lack of protected anchor mooring space.

(KAWAIHAE HARBOR, T. H.) There is one pier approximately 2,200 feet northwesterly from the location of the proposed project. It is 60 feet wide and 104 feet long, and provides 60 feet of wharf frontage and about 1,800 square feet of storage area. An approach to the pier extends 323 feet offshore and consists of a reinforced concrete substructure, 130 feet of timber decking, and 193 feet of reinforced concrete slab. There is a light hoist available for

handling freight, and a cattle chute for handling livestock. The pier is owned and administered by the Territorial Board of Harbor Commissioners and is open to all on equal terms.

The existing facilities are considered unsuitable for existing commerce and inadequate to permit year-round trans-Pacific and interisland shipping, and to meet the increasing shipping needs of the communities of the western half of the island of Hawaii.

(CLEVELAND HARBOR, OHIO) There are approximately 48 terminals for the handling of various types of cargoes, the most important of which are iron ore, steel products, coal, scrap, cement, sand and gravel, stone, grain, petroleum products, automobiles, newsprint, paper, salt, sulfur, and fish. In general, the terminals operated by the railroads, which include two of the iron-ore and a coal terminal, are open to shippers of the commodities handled. The city of Cleveland owns three terminals, one of which is leased for a miscellaneous freight and automobile terminal. . . .

## EXAMINATIONS, SURVEYS, AND REVIEW REPORTS

Orders and Regulations state that Examinations, Surveys, and Reviews for reports to Congress constitute one of the primary civil works responsibilities of the Corps of Engineers and involve special procedures and techniques for which personnel should regularly be maintained in the Corps of Engineers. (4202.12a)

The three types of reports are related in this manner: Local interests solicit the aid of their representatives in Congress to obtain a needed project for their community. Congress may authorize the Chief of Engineers to make a *preliminary examination* to determine from facts readily available whether there is a reasonable possibility that the improvement will be economically justified and whether the expense of a *survey* is warranted.

When a preliminary examination and survey are authorized by Congress, which is the usual case, the survey may be ordered at the discretion of the Chief of Engineers upon receipt of the preliminary examination report and the views of the Board of Engineers for Rivers and Harbors (or Beach Erosion Board, in applicable cases). (4202.02c)

The objective of a *survey* is to determine the most suitable plan for improvement and whether such improvement is economically justifiable.

The objective of a *review* report, in the usual case, is to determine whether different conclusions and recommendations are warranted in the light

of up-to-date information and conditions. Normally, a review report is made after an unfavorable recommendation as the result of a previous study.

These reports to Congress are not only important but extremely difficult to prepare.

Personal reconnaissance of the locality to be reported on must be made by the officer preparing the report. Quotations may be made from previous reports pertaining to the locality, but current reports should not be merely a restatement of facts and opinions formerly presented but should be based upon a new investigation and careful reconsideration. Reports should contain all the facts necessary to the formation of an opinion as to the worthiness of the improvement not only by the reporting officer but by others who may not be entirely familiar with the locality and the attendant circumstances. The facts should be presented in such complete form as will enable the reviewing authorities to reach a proper decision, and in such form as to show that the recommendations made rest upon a substantial basis. (4202.05e.)

*Outline—Surveys for Navigation.* Here is a sample outline (4206.03–30)

Authority.

Scope of survey.

Description.

Tributary area.

Bridges.

Prior reports.

Existing Corps of Engineers' project.

Local cooperation on existing and prior projects.

Other improvements.

Terminal and transfer facilities.

Improvement desired.

Commerce.

Vessel traffic.

Difficulties attending navigation.

Waterpower and other special projects.

Plan of improvement:

- a. Most practicable plan and alternative plans.
- b. Factors determining plans.
- c. Channel depths.
- d. Lands, rights-of-way, and relocations required; bridges; any multiple-purpose features.

Shore line effects.

Aids to navigation.

Estimates of first cost.

Estimates of annual charges.

Estimates of benefits:

- a. Basis of determination.
- b. Monetary evaluation.
- c. Savings in cost of transportation.
- d. Evaluation of waterways.
- e. Comparison of present and probable future water transportation costs.
- f. Comparison of present water freight costs with prospective contract rates.
- g. Comparison of average annual cost with expected benefits.

- h. Data on benefits from provision of facilities for small boats and for flood control.

Comparison of benefits and costs.

Proposed local cooperation.

Allocation of costs.

Coordination with other agencies.

Discussion.

Conclusion.

Recommendation.

The scope and technique for various types of investigations and studies for survey reports will be as prescribed in the *ENGINEERING MANUAL OF CIVIL WORKS*. (4206.04)

The work of report writing is reduced by the provision of a topical outline with specific directions for the kind of information required for each topic. Much work is saved by the provision of general patterns for reports even when considerable latitude is given for expansion, omission, or contraction of outlines. *Orders and Regulations*, therefore, is one of the best texts on report writing a Junior Engineer can find, but it is only a guide; it tells the reporter where to look, what to look for, and what to set down in ink. He has to analyze the facts he gathers, and he has to record them "in form and style easily readable and understandable even by those not familiar with Corps of Engineers procedure."

Fact finding, analyzing, and writing are minimum essentials. It is important to form the habit of really seeing when looking at something—of letting the object register on the mind; for analysis, the most difficult feature of reporting, is seeing things in their proper relation.

Reports to Congress, based on the O & R outlines, combine the work of a great many officers and civilians. A Junior Engineer in the training period would hardly be expected to write a complete report or even a considerable portion of a survey report unassisted; but he would be asked to aid in compiling information on which to base reports.

*Surveys and Annual Reports* differ in important respects. In most cases the data for the Annual Report is already in the office files, having been gathered for a survey or other investigation study. The task of the reporter is to select the pertinent items from this data and to present them in concise logical order as called for by the O & R outline. The Annual Report is a series of abstracts. Abstracting is an important type of reporting—and excellent practice—but it is not suited to all kinds of reports.

*The Problem* of the survey report must be kept in mind continually. Why is the survey being made? The objective of a survey has already been stated—to determine the most suitable plan for improvement and whether such improvement is economically justifiable. But *what* improvement? If the plan is for the protection of a city by a flood wall, the data to be gathered and the point of view of analysis will differ from that in the preparation of a report on improvement of a harbor by the construction of breakwaters. The O & R outline is the same in both instances, but the items to be passed over as inapplicable will be different, and the emphasis on such topics as are retained will not be the same. The size and cost of the project affect the choice of items also. The reporter keeps his eyes and ears open and records anything that has a *direct bearing* on the immediate problem, even the weather—and in some instances, especially the weather.

Here is a sample paragraph from a review report of survey scope:

(*Difficulties Attending Navigation.*) No harbor or refuge facilities are offered by any configuration of the shore line or by the river mouth at this locality. At times the bar at the mouth of the river will permit passage only of vessels drawing about 18 inches, and then only during calm weather. At times of low flow in Knife River the bar almost completely closes the mouth. The harbor at Knife River and adjacent coast line is simply a ledge-rock coast where small craft are launched and pulled up by means of skidways and winches. The number of days on which Lake Superior is sufficiently calm to permit this method of operation is not a matter of record. However, the fishermen and sportsmen contend that of the total number of days during which fishing operations could be conducted on the open lake, at least one-third are lost because of the surf conditions on the shore. The operation of setting or lifting nets can be conducted when the lake is moderately rough, but these waves and even smaller ones, as they break on shore prevent the vessels from using their crude skidways. In other words, fishing operations can be carried on only when

the lake is calm. Loss and spoilage of fish and destruction of nets by underwater debris are the inevitable result of irregular attendance by the fisherman.

Below is a paraphrased requirement (O & R 4202.15) for the form to be used in Examination, Survey, and Review Reports. It is also a good form for general use when the make-up of reports is not prescribed by regulations.

## TYPEWRITTEN REPORTS

**FORMAT**—Double-spaced on 8" x 12½" paper,\* one side, with 1½" binding margin at the top. Thin paper is banned.

**TITLE**—"Reports will be appropriately titled." That is, the title tells the reader what he may expect to read. It names the writing in a way that distinguishes it from others on the same or similar topics.

**TABLE OF CONTENTS**—To head all reports.

**SYLLABUS**—Required.

**REPORT PROPER**—Consult pertinent sections of O & R for subject matter and other aids.

**PHOTOGRAPHS**—To be captioned and placed near the related text.

**MAPS AND ILLUSTRATIONS**—To be segregated at the end of the report or in a separate volume.

See Section 4, Part II, Chapter IV (O & R 4204.01-18), "*Preparation of Maps, Drawings, and Photography.*"

**APPENDICES**—For detailed statistics, computations, compilations, and analyses of basic supporting data, such as geologic, hydrologic, and meteorologic records, and detailed cost and benefit estimates.

**COVERS**—Paper covers of substantial weight.

**BINDING**—Bound at the top in one or more volumes, and secured with metallic paper fasteners in order to facilitate the insertion of revised pages.

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\*Change to 8" x 10½" paper, side binding, is under consideration.

## THE PREPARATION OF REPORTS

By

F. E. B.

The preparation of examination and survey reports involves work of two general classes. One is the engineering study which includes work in both the field and office; the other is the actual writing of the report, which is done in the office. This paper deals with the writing of reports.

The technique of writing in the preparation of an engineering report is not different from that which is used in the preparation of other technical papers. Regardless of the type of composition, correct English is a prerequisite.

The prime requisite of a technical report are accuracy, completeness, and brevity. The descriptive reading should be expressed in simple, direct statements. Long, involved sentences and complicated words and phrases should be avoided.

The first step in writing a report is the preparation of an outline. Outlines for examination and survey reports are indicated in the Orders and Regulations. These outlines should generally be followed, but they can be expanded into a more detailed outline for a long report.

If tabular data and statistics or extended computations are to be included in a report, it is usually better to place them in an appendix, rather than in the body of the report. The same thing may be done advantageously with the discussion part of the report where the discussion must include the study of a number of plans. For example, a report of the Shore Protection Board, when made in connection with the study of an inlet or river mouth, is always submitted as an appendix.

With one exception, the general outline in the Orders and Regulations for examination and survey reports requires factual data up to the paragraph on "Discussion". Opinions and discussion should not be written into the factual part of a report. Especial care should be exercised to keep the first part of every report impartial and exact. Opinions and discussion should be reserved for the paragraph on "Discussion".

Generalizations, negative statements and inferences, and the use of unexplained or unfamiliar terms should be avoided in a report. Statements should be positive, definite, and concrete, for these reports are destined for a final review by Members of Congress, few of whom are engineers.

Repetition should be avoided. Verbosity is one of the most common faults of reports. Someone said, "Often the man with little to say attempts to conceal his mental poverty by multiplying his points". In many reports, not only are a great many needless words used but ideas are repeated many times.

Each paragraph in a report is made up of one or more sentences. Each paragraph should develop one idea. The first sentence should be a topic sentence. It should represent the idea to be developed in the paragraph, and the succeeding sentences should present the idea completely.

There should be coherence in a report. The report should be assembled into paragraphs under a title, and paragraphs should develop the subject in a logical sequence. To illustrate this idea, in describing a river, canal, or other waterway, begin with its source and describe it progressively to its mouth; or, reverse this order.

The inference has been made that sentences should be simple and direct. Too little is said in a sentence if parts of an idea scatter through several sentences. Too much is said in a sentence if many loosely related statements are crowded together into one sentence. A reference book which I use states that "Clear sentences are an evidence of clear thinking; muddled sentences nearly always go with muddled minds".

It is not the purpose of this paper to discuss the detailed grammar of English. Every person who writes reports should have a good text on grammar and should know its contents.

There are only four parts of speech (excluding interjections) when these are classified by function. Words that denote action are verbs; words that are

names or their substitutes are nouns and pronouns; words that modify are adjectives and adverbs; words that connect are prepositions and conjunctions.

Each action word should be given its proper voice, mood, person, number, and tense. Verbs must agree with their subjects, and pronouns agree with their antecedents in number and person. A pronoun should not be separated widely from its antecedent. A pronoun must not be used if its antecedent is uncertain or vague.

Modifiers should appear in sentences as close as possible to the words they modify.

The typed report should be checked to be certain that all words are spelled correctly.

The natural reaction to a partial listing of common errors is the thought, "I don't make those mistakes." Sentences have been selected from reports recently received which serve as bases for interesting discussions. How should they be corrected?

a. "However, there, no doubt, are some localities where some improvement of that nature may very well be justified."

b. "The present or prospective benefits to be derived from improvement of Blank River at Blank are not commensurate with the cost."

c. "There can be little question that maintenance would be more costly if there were no works at the mouth of Blank River."

## PLANS AND SPECIFICATIONS

It is the policy of the Chief of Engineers to require the highest order of engineering and techniques in the performance of work under his supervision. Pursuant to this policy, plans and specifications will be carefully prepared, on the basis of up-to-date engineering and sound experienced judgment, for all civil works projects. (4215.01a).

*Guide Specifications.* Junior engineers should know that use of guide specifications, as explained in O & R 4215.03c and 4215.11, facilitates the writing of specifications on new projects, because "guide specs" represent wording which has gradually evolved, and which is constantly being

improved by page revisions when ambiguities and discrepancies appear as a result of actual use. Not only do they make specification writing easier in the field, but the use of such a printed guide, changed and marked up as necessary to meet actual field conditions, and submitted in draft form, expedites review by higher authority as changes in the original printed copies are immediately apparent to the reviewer.

*Forms for Plans and Specifications.* (4215.02). Requests for bids on construction contracts will be assembled in the following order:

Invitations for Bids

Bid Forms

Table of Contents, and

Specifications in 4 parts:

Part I, Statement of Work

Part II, General Conditions

Part III, Special Conditions

Part IV, Technical Provisions

(For ENG Forms to be used with above, see 7113.28 to 7113.31, 7113.33c and d, 7207.04 and 7209.03.)

Standard specifications will be used whenever applicable.

*Types of Specifications.* Specifications will, in general, be classified as either "construction" or "supply." Construction specifications are those required for construction activity as distinguished from manufacturing, furnishing of materials, or servicing work. Construction activity includes buildings, structures, and improvements of all types, such as bridges, dams, power plant, highways, tunnels, sewers, power lines, pumping stations, railways, ships and vessels of special design and not wholly or substantially the same as an existing and adequate commercial design as determined by the contracting officer, piers, wharves, jetties, breakwaters, levees, canals, dredging, drilling, excavating, clearing and landscaping. Contract plans and specifications will be carefully prepared to eliminate all conditions or practices which might operate to delay the work or which might result in controversy and subsequent claims. (4215.05a).

## SPECIFICATION LANGUAGE

By

K. B. N.

The objective in specification writing is to create, in conjunction with a formal contract and the plans for the structure to be built, a legally binding, contractual obligation, equally enforceable on the contractor and the Government. The plans and specifications form that part of the contract which has been defined as "an accurate, detailed working plan, showing materials to be used and manner of construction." Another definition states: "The plans and specifications for the construction of a large building should be definite, specific, and certain, in justice both to the contractor and to the owner. Article 2 of the contract states: "In case of difference between drawings and specifications, the specifications shall govern."

Several definitions for the terms *specification* and *specify* occur, as for instance: *Specification* means an act of specifying, or making a detailed statement, or the statement so made; a definite or formal mention of particulars; as a "specification of one's requirements." *Specify* means to mention specifically, to state in full and explicit terms, or explicitly and in detail, to name expressly, distinctly, and particularly.

Based on the foregoing definitions, specifications should be definite, clear, and certain. The language used should avoid duplicity, vagueness, and circumvention. General requirements for specification writing may be subdivided for the purpose of discussion into:

a. Form.

b. General language.

c. Substantive requirements.

a. *Form.* For the purpose of executing the work of making the specifications valid, form is not important. Custom, usage, and the regulations of the Department require that previous specifications for similar types of work be followed in so far as practicable. An advantage of adhering to established and well-tested form is that it should avoid duplicity and repetition or omission of essential clauses or facts.

b. *General language.* The general language used in specifications should be grammatically correct. The time available, the editorial ability and knowledge of the writer, and the difficulty and complexity of the subject matter sometimes do not permit attainment of this goal. In interpretation and construction of the language used in specifications, the courts have rendered various decisions from which the following rules may be deduced for general application by the writer:

(*Note.* The citations to legal sources have been deleted from the paper to prevent confusion of objectives. The subject of this manual is English, not law. It is pertinent, however, to show the importance of clear language in legal documents.)

- (1) A contract is to be most strictly construed against the party who prepared it.
- (2) A contract is to be construed in strict accordance with grammatical rules, unless there are circumstances requiring a departure therefrom. The grammatical rules raise a prima facie presumption, and do not preclude the settling of the meaning by detracting from the exactness of the language to give effect to more cogent reasons of a different kind.
- (3) The construction of a written contract is determined by the words used, and their relation to each other, and not by the punctuation.
- (4) Nice grammatical construction is not always to be regarded, especially when instruments are inexpertly drawn.

c. *Substantive requirements.* Interpretation by courts of specification language has often differed from that intended by the writer. To state specifically what determines common errors of language and description is difficult and unsatisfactory. An attempt is made to point out what troubles have occurred in the past as determined by competent authority.

- (1) The word *may* is permissive and not mandatory.
  - (a) A contract for Government work which in terms gave the contractor the right under certain circumstances to apply for an extension of time for completion of the work, but left it optional with the Government to grant or refuse it, by such provision added nothing to the rights of the parties, and cannot be said to have provided for an extension, and the contractor's sureties were discharged by an extension made without their consent. Even an express provision in such a contract that in the event of the occurrence of certain causes of delay "additional time may in writing be allowed" the contractor, does not mean that it *shall* be allowed.
  - (b) *May* does not mean *shall*, and is not so considered in private contracts.
  - (c) The word *may* is to be construed in a permissive sense unless the intent is taken as mandatory. Where the words *may* and *shall* are used in similar provisions, the one must be taken as used in contradiction to the other.
- (2) Careful phraseology is required to avoid misleading the contractor. An advertisement for bids provided that: "The material to be removed is believed to be sand, clay, gravel, and boulders, but bidders are expected to examine the work and decide for themselves as to its character and to make their bids accordingly, as the United States does not guarantee the accuracy of this description." The cost of a complete and thorough examination of the work was prohibitive, and the successful bidder, believing the description given in the advertisement to be accurate, bid accordingly. But before entering into the contract the bidder inquired of the Government's representative as to the nature of the material to be dredged and was given no information beyond that contained in the advertisement, although the said representative knew that hardpan would be encountered, necessitating difficult and costly excavation. Held, that the contractor was entitled to recover

the additional cost of excavating the hardpan.

- (3) Only known facts should be stated in specifications. The damage incurred by a contractor in the repair of a dam for the United States because the existing dam was not backed with broken stone, sawdust, and sediment, as stated in the specifications, was recovered from the Government notwithstanding the cautionary provisions that quantities were approximate only, and that no claim should be made against the United States on account of any excess or deficiency, absolute or relative in the same, and that bidders or their authorized agents were expected to visit the site, ascertain the nature of the work, and make their own estimates. If the Government wished to leave the matter open to the independent investigation of the claimants, it might easily have omitted the specifications as to the character of the filling back of the dam.
- (4) The method by which quantities are to be determined and paid for should be stated. A specification for furnishing earth fill states: "An accurate topographical map of the grounds surrounding the terrace has been made, showing the horizontals of the surface for differences of level of 6 and 12 inches, which map can be seen in the office of the Washington Monument, where it will be filed permanently. This map will be used in determining the amount of filling deposited by the contractor by calculations of the contents of the masses deposited upon the present existing surfaces. These calculations shall be made in the office of the Washington Monument under the direction of the officer in charge, and the quantities determined shall be the quantities to be paid for by the United States." The contractor was to furnish, deliver, and deposit 250,000 cubic yards, more or less. The price is not for so many cubic yards of finished embankment, but for so many cubic yards of filling actually furnished. The method prescribed by the specifications for determining the quantity did not constitute an agreement to build an



embankment. The provision in the specifications that "the decision of the engineer officer in charge as to the quality and quantity shall be final" referred only to the measurement in fact. Contrary to the officer's decision, it was held that the measurement should be for loose earth.

The few quotations and remarks stated above do not take in all phases of specification language. If specifications are written in specific and clear English, most problems arising in their interpretation will be presolved.

## CONTRACTS

All contracts will be carefully prepared on the prescribed standard forms without change or alteration except as provided in the instructions for the use of such forms. (7209.01a).

*Modifications.* Since the contract is equally binding upon the parties thereto, it cannot be modified except as expressly provided by its terms and conditions or as mutually agreed to by the parties themselves. . . . Modifications are accomplished by *change orders* where the modification is authorized under the terms of the contract and within the scope thereof, and in all other cases by a *supplemental agreement* (7210.04).

*Findings of Fact.* . . . Contracting officers will in all instances prepare or cause to be prepared findings of fact, ordinarily personally signed by them, justifying the execution of each change order and supplemental agreement, irrespective of the type of contract being modified or the purpose of the change order or supplemental agreement. There will be set forth in each findings of fact:

- (1) necessity for the change,
- (2) reason for omission from original plans and specifications,
- (3) detailed breakdown justifying prices, and
- (4) statement of availability of funds.

Such findings of fact are not instruments and will not be distributed to disbursing officers of the GAO. However, they are a necessary part of the official record file and ordinarily contain essential information for those reviewing such documents for technical and legal sufficiency. The findings of fact may be incorporated into the letter of transmittal forwarding the change order. (See model transmittal letter in 7210.07½).

Section 51 of O & R outlines the procedure to be followed when an appeal from a ruling of the

contracting officer has been submitted by a contractor.

## DESIGN MEMORANDA

Definite project studies are required for all authorized projects to establish the most suitable overall project for accomplishment of the authorized improvement, and to establish the design of the project features. Such studies will correlate all components of the project to form the basis of orderly detailed design, preparation of plans and specifications, acquisition of lands, and execution of agreements; establish operating requirements and insure that the project will meet such requirements; coordinate the plan with the views of other governmental agencies and local interests; provide a basis for a reliable up-to-date estimate of cost; review the current economic aspects of the project; facilitate the orderly scheduling and programming of the detailed design and construction of the project; and provide a source of up-to-date information for members of Congress, other governmental agencies and the public. Unless otherwise indicated in these regulations, any presentation of the results of investigations, studies and designs made subsequent to the authorization of the project will be identified as a "Design Memorandum" (4214.01).

The results of definite project studies may be submitted either (1) in a *single design memorandum* including the appropriate coverage of the subjects and features as indicated by the outline in paragraph 4214.10, or (2) in a *series of design memoranda* including a general design memorandum as outlined in paragraph 4214.10 and supplemented by other design memoranda covering separate phases of the work as listed in paragraph 4214.09. Submitting the results of all necessary studies for review and approval in a single design memorandum is normally desirable only for the less complex projects. . . . (4214.02d)

*Outline for the General Design Memorandum* (4214.10) The general design memorandum will include the applicable items of the typical outline shown below and any additions required for the specific case at hand. Additional information on the technique and scope of coverage under the various items is given in the *Engineering Manual for Civil Works*.

- Pertinent data.
- Project authorization.
- Investigations.

Local cooperation and views required.  
Location of project and tributary area.  
Project plan.  
Departures from project document plan.  
Hydrology.  
Geology.  
Other plans investigated.  
Description of proposed structures and improvements.  
Sources of construction materials.  
Reservoir management and public use.  
Real Estate requirements:  
    General.  
    Guide (tentative) taking line.  
    Real property taking line.  
Relocations.  
Cost estimates.  
Schedules for design and construction.  
Operations and maintenance.  
Reservoir regulation.  
Health control.  
Benefits.  
Recommendations.

Outline for Series of Design Memoranda (4214.09). . . . The following sample outline indicates a possible subject coverage that would be considered suitable for the series of design

memoranda in the case of a hypothetical multiple-purpose project. The outline memoranda will be adjusted as necessary to suit the particular type of project involved.

Hydrology and hydraulic analysis.  
Site selection.  
Hydropower.  
General Design memorandum.  
Access roads and construction facilities.  
Concrete materials.  
Geology and soils.  
Powerplant—preliminary design.  
Real estate memorandum.  
Diversion plan.  
Relocations.  
Outlet works.  
Clearing.  
Navigation locks.  
Dam.  
Spillway.  
Embankments.  
Levees and internal drainage.  
Powerplant.  
Reservoir management, including recreation, fish and wildlife, and malaria control.  
Cost allocation.  
Other detailed design memoranda as required.

## THE USE OF ENGLISH IN DESIGN MEMORANDA

By

E. F. T.

(Note. The original title of this paper (here abridged) was "The Use of English in a Design Analysis." Since "Design analyses" as such are no longer submitted, the presentations of results of design studies are now identified as "Design Memoranda," the title has been changed as well as the phrases in the quoted paragraphs below. In so far as the use of English is concerned, this abridged paper is applicable to other types of engineering reports where accuracy of statement is—and where is it not?—essential.)

The major requirements for the design memorandum are in the following order of importance:

- a. Clearness in meaning.
- b. Complete coverage of information.
- c. Logical presentation of the facts.
- d. Exclusion of repetition and irrelevant matter.

Design memoranda usually comply in general with these four requirements. I have knowledge, however, of two memoranda that did not comply with these requirements. The first was written for a flood protection project consisting of a concrete wall 2,000 feet long and a levee seven miles long. The memorandum covered the design of the wall in detail. The levee was not mentioned. Levee borings were not shown on the plans. Information as to the materials to be used for the levee or as to the strength of the levee foundation was not furnished. The second memorandum was for an earth dam. No reference was made to an extensive coal mine that existed on the right abutment of the center line of the dam.

Recently the following sentence appeared in a memorandum:

Sand shall have not more than 10 percent passing a 200-mesh sieve and 100 percent passing a  $\frac{3}{16}$ -inch sieve.

The statement is incorrect and does not convey the intent of the designer; for under no condition could over 100 percent pass a  $\frac{3}{16}$ -inch sieve. By adding a second verb, *shall pass*, the sentence reads clearly as follows:

Sand shall not have more than 10 percent passing a 200-mesh sieve, and 100 percent shall pass a  $\frac{3}{16}$ -inch sieve.

The design memorandum should be complete. Repetition necessary to secure completeness and to prevent the excessive turning of pages to refer back to other paragraphs is justified.

The length of a design memorandum may be controlled to some extent by the exclusion of unnecessary data. I once read several pages of a design memorandum which gave the history of the rock at the site of the work for over a million years. The history was superfluous. The designer is interested in the properties of the rock; he is not interested in the manner in which the rock achieved these properties.

I once read the following statement in a design memorandum:

The stream has recently extensively eroded its banks at the dam site.

The geologist explained that the erosion had occurred *geologically* "recently"—perhaps 10,000 years ago.

### SPECIAL REPORTS

Emergencies of various kinds call for special reports. The following is an example:

*Airfield Pavement Failure Reports (4106.18a).*

- (1) A summary report will be prepared for each major failure of pavements (even though repaired or reconstructed) which occurs at airfields constructed by the Corps of Engineers for the Department of the Army or the Air Force, or used by the Department of the Army or Air Force. . . .
- (2) Reports will be brief and concise and contain a summary of all available information.

SUBJECT: *Pavement Failure Report, Name and Location of Field.*

- (a) *Location and Extent of Failure.* Attach site map, marking and designating areas of failure.
- (b) *Construction History.* State constructing agency and dates of construction. Give weather conditions during construction and other pertinent history.
- (c) *Subgrade.* Describe soil, soil conditions, drainage, etc. State tested or estimated pertinent soil constants. Refer to previous reports containing pertinent data.
- (d) *Pavement and Base.* State thicknesses, construction data, tested or estimated soil constants, etc. Describe materials, Refer to previous reports containing pertinent data.

- (e) *Traffic.* State wheel loads, quantity and type, prior to failure.
- (f) *Description of Failure or Distressed Area.* Includes pictures if available. Describe development, conditions, etc.
- (g) *Causes of failure.* List probable reasons for failure.
- (h) *Method of Repair or Reconstruction.*
- (i) *Other Pertinent Data.*

These reports will form the basis for selection by the Chief of Engineers for complete investigation, of those pavement failures which will yield the greatest amount of information on the widest variety of pavement types and soil conditions . . . for the purpose of establishing the validity of present design procedures, or of indicating the need for modification. . . .

## REPORTS NEEDED FOR REPLIES TO CONGRESSMEN

By  
W. N. H.

The Chief of Engineers receives many requests from Congress for information. When a letter is received, if the information is not available, it is referred to the Division Engineer, who refers it to the District Engineer.

A letter from a Member of Congress should be answered promptly. If the information for a complete answer is not available, a preliminary report should be submitted with a statement of the circumstances that prevent the submission of the complete report.

After the data have been assembled and checked, the report should be prepared. The first statement of the report should refer to the letter of inquiry. Next there should be presented sufficient descriptive, historical, or explanatory information to provide a clear understanding of the subject of inquiry. Published charts may be referred to for clarifying the description. Previous correspondence should not be referred to. The report should be complete in itself.

The questions should be answered in the order in which they appear in the inquiry. Facts essential to a complete report should be presented. Supporting data and figures should be presented in order. All facts should be stated in simple and concise terms.

The conclusions or views should be stated usually in the last paragraph. They should be based on the information and data given in the report and should leave no doubt that the proper conclusions have been reached.

Finally, the report should be checked for accuracy, completeness, and clearness before forwarding, through channels, to the Chief of Engineers.

### MANUALS

The Corps of Engineers issues various types of operation and maintenance manuals.

*Navigation.* (4219.03) District Engineers will prepare an operation manual for each Government-owned navigation lock and dam, bridge, and other installation requiring operation. The manual will describe the operating parts, their purposes,

and the technique of operation in sufficient detail to insure against faulty operation, undue breakage, and wear. The manual will include manufacturers' standards for lubrication and other care of machinery and equipment at the installation.

*Reservoirs.* (4220.03) For each reservoir under his supervision, the District Engineer will prepare a manual establishing maintenance standards and procedures as a guide for operating personnel. The manual will cover normal maintenance, and so far as practicable, will present a long-range policy governing replacements and repairs. The manual will serve as a guide in the preparation of annual estimates for maintenance.

*Flood Emergency Manuals.* (4223.06) Division and District Engineers will prepare and distribute within their organizations and to any affected agencies (See par. 4223.02—Army commanders, Civil Defense Administration, Red Cross, etc.), a manual containing Standing Operating Procedures for Flood Emergencies. This manual will be in loose-leaf form and will be kept current. . . .

In general, the emergency manual will contain a description of the functions of the Corps of Engineers and of other agencies concerned with major floods and flood disasters, such as the Weather Bureau, Coast Guard, Red Cross, Federal Civil Defense Administration, the military services of the States, and other local agencies; and definitions of the channels of liaison, including the listing of telephone numbers to be called in emergency.

Basic data, forms, adequate maps; a tabulation of local flood protection projects, listing any important weaknesses or inadequacies likely to cause failure during flood periods, the date of last inspection, and a brief evaluation of quality or maintenance.

Data on sources of sandbags available for flood fighting, together with such information on sandbag procurement and procurement of other

material and equipment as will be needed in flood emergency.

Data on transportation and communication facilities; technical liaison procedure; and appendices.

*Local Flood Protection Projects—Operation Manuals* (4221.05). Sometimes the Corps of Engineers builds flood protection projects with the cooperation of local authorities, and, upon completion of the projects, transfers them to the local interests for operation.

. . . District Engineers will prepare and furnish to the operating and maintaining agencies an operation and maintenance manual for each project or separate useful part thereof. . . . Where applicable, definite provisions regarding arrangements for flood warning and prediction services will be prescribed. Photographs and sketches will be used to illustrate features of the project and methods of maintenance and operation. A minimum number of applicable maps, plans, and manufacturers' bulletins and instructions should be included. Sample copies of proposed check sheets and logs which the superintendent will be required to submit to District Engineers under the regulations will be included. Instructions on emergency flood-fighting operations and emergency repair together with sketches and photographs will also be provided. . . . (See typical outline, 4221.06.)

*Engineering Manual. The Engineering Manual for Civil Works* and those portions of the *Engineering Manual for Military Construction* series that are labeled "for Military and Civil Works Construction" are the basic technical guides for design and construction of all civil works as distinguished from military works, undertaken by or under the jurisdiction of the Corps of Engineers. The subjects covered in these manuals include: planning; surveys and mapping; cost estimating; hydrologic and hydraulic analysis; geological investigations; soil mechanics; concrete, hydraulic, electrical, mechanical, and structural design and design criteria applicable to the various types of related civil works modified or revised as necessary to keep abreast of changing techniques and procedures. . . . (4214.05)

Material from *Civil Works Engineer Bulletins*, in most cases, will eventually be incorporated into the *Engineering Manual for Civil Works*, but subjects outside the scope of the manual also may be covered.

## INFORMATION PAMPHLETS

District Engineers will prepare information pamphlets for each major river and harbor and flood control project under their jurisdiction at which public or technical interest or use is expected to be extensive. These pamphlets will be for the information of persons so interested. One or both of two general types of pamphlet will be adopted for these purposes as the anticipated demand requires. (4216.21)

One of these pamphlets will be prepared for free distribution to casual visitors and to inquirers whose interest is non-technical or is limited to reservoir management phases, such as recreation. This pamphlet will be of simple type, usually in the form of a road-map type folder containing an appropriate map of the project area and vicinity, with highway net shown; photographs or sketches of features of the project; a brief summary of the history of the project and its relation to other projects of the Corps of Engineers and of other Government agencies; a brief illustrated description of how the project was constructed and how it works, written for the understanding of non-technical personnel; information of facilities available for the accommodation of visitors, including, when applicable, recreational features of the project; and reference to principal area signs. . . .

The second pamphlet will be published for the information of persons interested in the technical details of the project, such as other offices of the Corps of Engineers and other State and Federal Government agencies, local water use or drainage agencies or companies, etc., and will be published only when the need therefor is clearly evident. . . .

## STATE PAMPHLETS

Division Engineers will prepare separate pamphlets for each State on the scope and program of the civil works activities of the Corps of Engineers. The title of the pamphlet will be: "Water Resources Development by the Corps of Engineers in (State)." These pamphlets will be revised as of 1 January 1955 and each succeeding biennium. (4216.21½)

Since several districts have interests in the same States and often States are situated in two or more Divisions, the District Engineers in such cases will prepare the information required for their respective States and forward it to the Division Engineers responsible for the preparation of the pamphlet.

*Body of Text.* The pamphlets should be informative to the average layman and present a brief description of the work of the Corps in each State. The use of pictures (especially the "before-and-after" type), illustrations, simple charts, and artists' conceptions is very effective for such a presentation and is encouraged. The verbal descriptions should emphasize the reasons for and the desirable results to be achieved from the water resources development program. . . .

*Format.* In addition to the title, the cover will bear a map or distinctive outline of the State, date of publication, the insignia of the Corps, and the designation of the responsible Division office. The pamphlets will be approximately 8 x 10½ inches in size, bound at the left margin with staples. The covers will be of weight and quality consistent with anticipated use, preferably a different color for each State.

## **PUBLICATION OF TECHNICAL PAPERS**

(4216.22)

Division and District Engineers will participate and encourage participation by their assistants in preparation and publication of papers on features of civil works in technical publications. Articles for publication and formal addresses will be submitted to the Chief of Engineers for approval whenever: (1) The presentation of publication involves wide distribution to the public or to prominent organizations such as national engineering societies; (2) matters of Corps of Engineers policy are discussed; and (3) controversial subjects on matters of litigation are discussed.

The provisions of AR 310-10 and AR 360-5 will be complied with so far as applicable to civil works functions.

## **IDENTIFICATION OF PERSONNEL IN REPORTS AND PAPERS (4216.23)**

In general, it is desired that the personnel responsible for investigations, reports, plans, and engineering studies be identified and their names recorded in an appropriate portion of the documents concerned. Such identification will not normally be part of official letters or of that portion of reports prepared for submission to Congress, but will be included in the form of organization charts or other references in appendices to reports, in title blocks of drawings, and in other appropriate portions of technical papers.

## **OUTLINE FORM**

The same order of Roman numerals, Arabic figures, and alphabet should be followed consistently to mark paragraphs and subparagraphs. Example:

- I. . . . .
- A. . . . .
- 1. . . . .
- a. . . . .
- (1) . . . . .
- (a) . . . . .

## **CRITICISM, REVISION, AND PREPARATION OF THE FINAL COPY**

The following outline, which may be used as a checklist for manuscripts of technical reports being prepared for publication, is a lesson outline of a 20-hour course on Report Writing given at the Engineer Research and Development Laboratory, The Engineer Center, Fort Belvoir, Virginia.

- A. Examination and editing of the text.
  1. Unconfused objectives and limits of the report.
  2. Proper points of emphasis made.
  3. Subordination of less important to important ideas.
  4. Clarity and restraint of language.
  5. Correctness of grammar, readability of sentences, coherence of paragraph structure, and adequacy of punctuation.
  6. Conciseness and adequate use of graphic time savers and appendix inclusions.
- B. Examination of the report as a whole.
  1. Balance and proportion of parts.
  2. Consistent use of headings.
  3. Essential agreement of title, table of contents, introduction, and abstract.
  4. Essential agreement carried out and promise fulfilled between the terminal section and the introduction.
  5. Uniform treatment of numbers, tables, graphs, and the like in conformance with local style procedure.
- C. Layout, typing, and arrangement of the manuscript.
  1. Margins and spacing.
  2. Order of parts.
  3. Pagination and binding.
  4. Preparation for reproduction.

- D. Clearance and publication procedure.
1. Security classification.
  2. Review and approval.
  3. Assignment of series number.
  4. Reproduction processes.
  5. Distribution policy.

### LAST-MINUTE REVIEW

Here are some last-minute questions to ask yourself before you forward your finished report:

1. Is all the information listed in your "Contents" actually included in the report?
2. Are all the charts and table titles or labels included in a "List of Illustrations" or "List of Tables"?
3. Are chart values correctly plotted?
4. Do percentages in the supporting tables check with the graphs?
5. Has the report been checked for incorrect spelling, typographical errors, circumlocutions, unessential phrases?
6. Does material in one part of the report seem to contradict material in another part?
7. Has a different person from the author reviewed and checked the report?
8. Is there documentary proof for every statement of fact that might be questioned by an expert in the field? (Costs, measurements, on which estimates are based; engineering methods and practices, etc.)
9. Has the manuscript been checked for contradictions, duplications, incomplete statements, and page numbers?
10. Has it received the proper clearance in regard to security and Corps of Engineer policy?

### PRINTED PUBLICATIONS

The U. S. Government Printing Office Style Manual (pp. 10-11) states that, unless otherwise

indicated by the publishing Agency, Government publications will be made up in the following order:

**FRONTISPIECE**—Faces title page.

**FALSE TITLE**—On back of frontispiece, if any.

**TITLE PAGE**—Follows cover if no frontispiece is used.

**BACK OF TITLE**—Blank, but frequently carries such useful bibliographic information as list of board members, congressional resolution authorizing publication, etc.

**LETTER OF TRANSMITTAL**—New odd (right-hand) page.

**FOREWORD\***—Differs from preface in that it is an introductory note written as an endorsement by a person other than the author. (New odd page).

**PREFACE\***—By author. New odd page.

**CONTENTS**—New odd page, immediately followed by list of illustrations and list of tables, as part of contents.

Use small-cap Roman numerals for pages preceding text.

**TEXT**—Begins with page 1, on right hand side; if half title is used, begins with page 3.

**BIBLIOGRAPHY**—At end of main text. New odd page.

**APPENDIX**—New odd page.

**INDEX**—New odd page.

**COVER**—A separate cover should not be used on booklets of 32 pages or fewer. Page 1 should be a self-cover or should carry a displayed title heading followed by table of contents, if any, and the text.

The *dates* of the original edition and of reprint or revision should be supplied by the author on the title page or in some other suitable place.

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\*An *introduction* differs from a foreword or a preface in that it is the initial part of the text; if the book is divided into chapters, it should be the first chapter.