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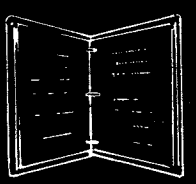

What Bugs Engineers About Report Writing

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WHAT BUGS ENGINEERS MOST ABOUT REPORT WRITING

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EDITOR'S NOTE

Mr. Terry C. Smith has over 20 years experience in technical writing and editing. He joined Westinghouse in 1954 and has held progressively responsible assignments to his present position as Manager of Communications. This article analyzes the results of a survey made by Mr. Smith on technical writing and provides some helpful suggestions on report writing.

As part of a series of seminars given throughout the United States and Canada, over 1,000 engineers, scientists, and technicians were asked to identify their biggest single problem in writing technical reports. Although their career fields varied from electronics to nuclear power to organic chemicals, the respondents cited 12 principal stumbling blocks (see table 1, page 2).

These categories may seem somewhat arbitrary, and they are. My purpose in asking the question "What is your biggest single problem in report writing?" was not as a basis for this article. If that were the case, I would probably have started with a well-structured questionnaire. Instead, I used 3- by 5-inch index cards to obtain completely spontaneous answers. Then I used the answers to tailor individual seminar sessions to particular groups. Group size varied from 20 to 80, with attendees representing more than 200 firms. Seminars were held in 36 States, plus Montreal and Toronto. With this broad a cross section, I felt an article on the resulting discussions of the common problems should have wide interest. Here are some of the suggestions offered.

Table 1. Most significant problems of authors of engineering reports

Problem	Percent	Number of respondents
1. Organization and outlining	28	293
2. Lack on conciseness	19	194
3. Interpersonal difficulties	9	94
4. Writing	8	83
5. Lack of time	7	77
6. Audience	7	67
7. Grammar (spelling, punctuation, sentence structure)	6	57
8. Insufficient clarity	5	52
9. Poor continuity	4	45
10. Emphasis	3	26
11. Editing (review of one's own material)	2	25
12. Technical accuracy	1	9
Miscellaneous	1	11
Totals	100	1,033

ORGANIZATION AND OUTLINING

With the importance the engineering profession places on planning, it's not surprising that organization and outlining pose the biggest problem in writing. However, organization and outlining do not constitute the first step in the prewriting process. Before beginning work on the outline the writer should spend some time determining his objective, analyzing his audience, and determining the best approach. Preferably, this analysis is followed by a discussion of these points with his supervisor.

As part of the discussion of objective, audience, and approach with the supervisor, the writer should also attempt to agree on a thesis sentence for the report. The thesis sentence provides a capsule comment on what the report is all about. For example:

Purchase of an IBM 999 computer will permit combination of our numerous semi-automated data handling systems into an integrated fully automated system that will supply more complete data usable by all departments and will save approximately $35,000 per year through reduced manpower and equipment rentals.

Quite a mouthful, I agree, but this thesis sentence would never find its way into the report. Instead, it serves as a cornerstone or "contract."

Having accomplished these preliminaries, the writer can move on to organizing and outlining. Here he may have an "established format" to follow. The answer cards listed this as both a blessing and a curse. That is, a number of respondents cited the lack of an established format as their biggest problem, while an equal number complained about the established format they were forced to write to. Oh well . . . .

Certainly formats that are too rigid cause many needless problems. And countless poor reports have been written because the writer began his effort with a trip to the files to "see how it was done the last time."

Many writers follow established formats blindly, depriving themselves of the thought processes which structuring an outline would provide. Other writers, lacking an established format to follow, succumb to temptation and plunge ahead without an outline. Considering the multiple benefits an outline provides, both approaches are downright foolish. A good outline will:

- Supply a solid foundation to build on.
- Assure direction.
- Provide a checklist of important items.
- Help maintain proper emphasis.
- Ensure the report doesn't become a runaway.

One of the reasons outlining is a problem is that many writers start by putting the Roman numeral I down on their paper and expect the outline to follow in apple-pie order. A better method is to merely start a random list of items to be included without worrying about which should come first or second. Even better than a random listing is the use of index cards which can be easily shuffled into the proper order to segregate, coordinate, and subordinate.

When outlining, many of us take the easy way out and settle on a chronological sequence. We write about what happened first, and then what happened next, and so forth. The result is a historical arrangement. (Remember how much you liked history in your school days.) While this

arrangement may be easier on the writer, it's tough on the reader who's probably not as interested in what happened first as he is in what had the biggest impact on the program. As an analogy, imagine you're interested in modern France, and the report starts with "All of Gaul is divided into three parts" and continues by reciting the remainder of *Caesar's Gallic Wars*.

Instead, the best organization is usually an informational approach in which you tell the reader the most important item first (your thesis) and then add more and more mutually supporting and interwoven information. Graphically, this organization resembles a pyramid with the point at the top (the beginning) supported by layers of corraborating information below (that which follows). Newspapers use this format, principally because it reduces their makeup or layout problems. But, it also proves a great convenience for their busy readers who may not have the time to turn to page C4, column 1 for the continuation. Busy readers . . . there's a term that fits most managers I know who are deluged with reports.

Other organizations or expository techniques that might prove useful include:

- Appearance
- Installation procedure
- Operational sequence
- Division by principal parts
- Spatial
- Generic classification

Which one to use is best determined by asking yourself, "Which will be of most value to my readers?"

One last word on outlines. Outlines are just made in clay, not bronze. They're a working tool subject to change or modification much like the prototype model before the production run. It's a lot easier to spot errors in organization and make changes there than it will be after the draft copy is typed.

CONCISENESS

In the "place" position we find our runner-up problem--conciseness. A lot of the smart money (including some of mine) was bet on conciseness to win going away. After all, the problem has certainly been around a long time. Wasn't it Pliny the Younger (A.D. 61-105) who said, "I apologize for the

length of this letter; I didn't have time to write a shorter one." Pliny knew that conciseness helps maintain interest, whether in a letter or a report.

Before plunging ahead, let's recapitulate for a moment. Some of the things we've already discussed can also help us with conciseness. Remember, we said to analyze your audience as part of the prewriting planning process. Having a better definition of audience needs should allow us to be more concise in our writing. And don't forget that outline we spent all that time preparing. Sticking to it should help prevent those tangents that add bulk to our writing.

Authorities on effective writing have devoted considerable space to conciseness. There's Rudolph Flesch and his Readability Nomograph, Robert Gunning and his Fog Count, the KISS formula (Keep It Simple Stupid), numerous catchy phrases such as "Write to express, not to impress," and the golden rule of writing, "Write unto others as you would have them write unto you."

All of these offer good advice, but I believe that too much conscious effort on conciseness during the writing process can actually cause problems. It's like the golfer who reminds himself before and during each shot--"Keep your head down, slow take-away, left arm stiff, shift your weight, cock those wrists, accelerate through the ball . . . ." As any 22 handicapper knows, the result is usually disastrous. We'll have a lot more to say about this danger later.

There are a few things you should be doing as a conscious part of your writing. For one, if you're writing a sentence and you find yourself becoming entangled in the punctuation, the sentence is probably too long. Also, keep in mind that old saying that a picture is worth 1,000 words. For some reason, many engineers overlook the built-in conciseness and interest that illustrations add to writing.

While we're on the subject of conciseness, some battle-scarred writer is sure to point out that many reports are judged by the pound, and attempts at conciseness may be self-defeating. Unfortunately, this is often true. If you're faced with this problem, remember that certain sections *are* read carefully and put extra effort on the Summary, Introduction, Recommendations, and Conclusions.

INTERPERSONAL DIFFICULTIES

To add a little humor while the seminar attendees were filling out their cards, I often commented, "If your biggest problem is your boss, put that down." Perhaps this facetious suggestion generated a Pavlovian response and resulted in more cards in this category than would otherwise have been the case. At any rate, quite a few cards dealt with what might best be called "interpersonal difficulties"--with most of these listing the boss.

A few of these were laced with bitterness, but most were constructive. Vague assignments and lack of Management direction were often cited.

To my way of thinking, this lack of communication is as much the writer's fault as the supervisor's. Be sure you know your supervisor's views and he knows what you're doing. Discuss the audience and objective with him. Get his approval on the thesis and the outline. The more he feels he has been a part of creating the report, the fewer earth-shaking changes he's likely to make later. Don't be afraid to ask your boss for advice; chances are he will appreciate the chance to help.

Aside from listing the boss, many cards cited lack of cooperation from co-workers charged with supplying inputs. You might try a multifaceted approach including questionnaires, interviews, and pressure from above. The most successful approach I've ever heard involved a writer who once published a progress report with the statement "Not Available At Time of Publication" beneath those paragraph headings where delinquent contributors owed him information. According to the story, no one was ever late again.

The final type of problem in this category involved dealing with secretaries. Here the writers were more critical of their own faults (changing their minds, unreadable handwriting, etc.) than secretarial shortcomings. In fact, one respondent commented:

> "The biggest single problem I have encountered in my writing is the inability of the secretary to transpose poor writing and spelling into flawless and effective English."

WRITING

Although this category might seem a catchall, one problem kept recurring--getting started. From the number of these cards one couldn't help but visualize the over-worked TV and movie scene in which the aspiring writer crumples up page after page in attempting to get underway.

Here are three good ways to avoid this pitfall. First, if you've already spent considerable time on the prewriting planning process, you should be itching to start the writing itself. So there's another good reason for not shortchanging the planning process. Secondly, discussing what you're planning to write with a friend often helps start the words flowing. Then write it as though you were telling it to yet another person. Finally, don't feel you have to start writing your report at the beginning. Start anywhere you feel most comfortable, you can always rearrange the pieces. Why start with the all-important Summary? Many authorities suggest writing the beginning last.

One other way to stimulate the writing flow is the synoptic outline. The synoptic outline takes the topical outline and carries it a step further.

It not only lists the topics but, as the name suggests, it also provides a synopsis (key words, phrases, etc.) of what you plan to say about each topic. Thus the synoptic outline provides a good bridge between the topical outline and the first draft.

These are just a few tips to help you start that writing flow. Most important, once it does start, be careful not to risk turning it off. In the words of Isaac Newton, "A body in motion tends to remain in motion; a body at rest tends to remain at rest." The writer who pauses after each sentence or paragraph to inspect his writing for ways to improve it is taking a serious risk. The time to do this is during the self-review or editing process.

One other problem that received a large number of cards was writing a good Summary. It's easy to see why an engineer who had trouble condensing a report into, say, 250 pages would have trouble writing a good 250-word Summary. My approach is to start by listing the principal sections from your report. For example:

- Background
- Statement of the Problem
- Solution
- Conclusions
- Recommendations

If you limit yourself to two sentences on each of these topics, and your sentences average 20 words, you'll have a good, informative Summary with room to spare.

LACK OF TIME

Another contender for the biggest problem award was lack of time. The pressure of the handwriting on some of the cards written in pencil no doubt reflected the pressure of "deadline brain-cramp" experienced by some of the writers. Perhaps this is one of your biggest problems too. If so, here are a few ideas on how to cope.

One way to avoid the agonies of last-minute crunch is to use concurrent writing. Concurrent writing simply means that you attempt to write bits and pieces of your report throughout the period the project entails. Thus you are doing part of the writing while things are still fresh in your mind. Yes, you will have to make a lot of adjustments and corrections later, but have you ever noticed how easy it is to correct someone else's work? The elapsed time could make this true on your own writing.

Another way to beat the last-minute rush is to set yourself a step-by-step realistic schedule. Sure, you'll probably fall behind anyway, but it's much better to fall behind a realistic schedule (and be aware of it) than to be working to an unrealistic one or--even worse--none at all.

Many of the respondents complained of lost time due to interruptions by co-workers, explaining why some engineering areas are referred to as bull-pens. In this case, maybe a sign would work--"Quite Please, Report Being Rewritten."

Again, another source of help is your boss. There may be an unused office nearby that he could arrange for you to use. Or he might suggest your using the plant library to get away from your desk, or even permit you to write the report at home on company time. Or he might be able to provide a technical assistant to help perform your routine tasks so that you can concentrate on the report.

While we're discussing interruptions, I should point out that many are self-induced. There's the stopping-to-edit difficulty that we mentioned earlier. Also, there are interruptions caused by not having background material at hand that, with a little forethought, could have been gathered earlier.

One time saver is the recorder, such as Dictaphones and Stenocords. These can save a lot of time in the writing process, but their savings must be compensated by extra effort in the planning and editing stages. Also, using these devices effectively is like riding a motorcycle. You may know how to run one, but you better get a lot of practice before you attempt to go downtown during the rush hour.

One final comment on this problem of lack of time. Writing is hard work. There may be a few shortcuts; but there's really no easy way to meet those deadlines. As a sign I once saw read:

The Only Man to Get His Work Done by Friday was Robinson Crusoe.

AUDIENCE

The audience is the writer's most important consideration. Hopefully, the relatively low number of replies in this category reflect a lack of problems and not a lack of concern.

Audiences have different backgrounds, different educational levels, different fields of interest--but they all have one thing in common. They appreciate reading material that is interesting and easy to understand.

Commercial magazines, such as *Fortune*, are masters at the technique of writing interesting, easy-to-read articles. Rightly so, for them it's a life-and-death matter. They have to keep those subscription renewals

coming in to stay in business. Pick up any issue of *Fortune*, turn to the Table of Contents, and select the most complicated topic you can find. Regardless of how complex the subject, you'll discover *Fortune* discusses it in a straightforward easy-to-read style.

Chances are the same level of higher management that we write our reports to also reads *Fortune*. And although our writing may never become quite as polished as *Fortune*, we can use some of their techniques. The place to start is by looking on our readers not merely as readers, but as *Fortune* does--as customers!

When dealing with customers, we bend over backwards in an attempt to be helpful. The same is true of readers.

We can start by realizing that different parts of a report have different readers. Everyone reads the Summary, and some read only that. This is particularly true of top management. Therefore, if you have a message for top management, make sure it's in the Summary. Make that message as straightforward as possible. (The details can go in the Technical Discussion or Appendices.) Also, don't forget to stress the business and financial impact along with the technical and production information. Above all, make sure your Summary has a message. Don't let it read like a Table of Contents, telling the reader what he will find elsewhere--if he has the perserverance.

Some people confuse the Introduction with the Summary. Just as the name implies, the Introduction introduces the reader to the subject. It brings him up to speed for the technical discussion that will follow. The way to write a good Introduction is to ask, "What did I need to know when I came on-board this project?" (Or, "What would a new man need to know?")

One final point in making things easier for your readers. A report that "looks" hard to read, is hard to read. Avoid those single-spaced formats with typing that runs from one side of the paper to the other. Instead, use space-and-a-half or double-space typing with ample margins. Break the text with frequent paragraphs and paragraph headings. Use blocked indentions of enumerated items. And as we said before, use illustrations where possible.

Fortune uses all of these techniques, admittedly with a rather lavish production budget, but the techniques themselves cost next to nothing. Other techniques *Fortune* uses, such as using simpler words wherever possible and shorter sentences (on the average) are covered elsewhere in this article and in countless others.

GRAMMAR

English instructors who happen to read this article may be appalled at the low percentage accorded grammar (5 percent). My own feelings are mixed.

Mostly, however, I am pleased by the self-confidence reflected by this low percentage. My experience has been that many engineers who are quite competent in this area subject themselves to needless worry over minor points that only a grammarian would question. Furthermore, that grammarian would probably be at odds with the more enlightened authorities on the subject.

Another point of view would state that at least eight of the categories into which the answers were grouped touch upon grammar, and thus its percentage should have been much higher. While this is true, the cards show that most engineers think of grammar strictly in terms of spelling, punctuation, vocabulary, sentence structure, etc.

One suggestion I would make in this area is that each engineer include a book on grammar, a thesaurus, or at least a dictionary among the reference books on their desks. Many a time I've reached for a dictionary while working at an engineer's desk and found that the "section copy" was kept by the secretary.

CLARITY

Its hard to answer this particular problem. For the most part, my suggestions encompass a review of what we've already discussed, plus a review of that which remains.

We've talked about the importance of knowing as much as possible about your audience. We've seen how organizing and outlines can help chart a clear course for both the writer and the reader. The technique of "talking out" your report with a friend before writing it can provide instant feedback on clarity. Conciseness and coming to the point quickly certainly help. Conversely, repetition of key ideas may add a little bulk, but is usually worth it. We've touched on illustrations a few times; they're another winner. We'll be talking about how continuity can tie all your ideas together.

Saying "you'll find it all under the other topics in this article" may seem like a cop-out, but what else can I say? There are, however, a few tips that probably fit better here than elsewhere.

A good vocabulary can increase clarity. Not the type of vocabulary that will encourage you to write *deleterious* instead of *harmful*, but one that will help you write in specific terms (e.g., *conduit* instead of *electrical equipment*).

Not counting examples originating in the District of Columbia, the best (worst) examples of clarity's chief enemy obfuscation are usually found in the protective report. In such a report the writer spends most of his time writing long explanations of why a particular course of action was taken--just in case anything goes wrong later.

I hope you never find yourself using this approach. If you do, you can forget about clarity.

CONTINUITY

You can call it continuity, paragraphing, thought flow, transition--whatever you like. They all mean that your writing should be smooth as silk. You can make your writing smooth by building "bridges" that will help your reader cross from sentence to sentence or from thought to thought. Here are four bridges you can use:

1. Orderly arrangement
2. Connecting words
3. Repeated words or ideas
4. Enumeration

To build the first bridge, make sure that your sentences are arranged properly. The best arrangement is usually in the order of importance--a busy executive may not read your entire report.

The connecting words that make up the second bridge are really just stepping stones that help your reader from one sentence to the next. Connecting words, such as *furthermore, however, therefore, this*, and *these*, tell your reader immediately how your next sentence is going to tie in with what has come before.

The third bridge is the easiest to build. Repeating words or ideas from previous sentences will show your reader that he is still on the right track, and will smooth out some of the bumps. For example, if your first sentence starts, "The space capsule instrumentation provides . . . ", your next sentence might begin "This instrumentation consists of . . .". Following sentences would then cover the various items in more detail.

The last bridge is also easy. We used it in the preceding paragraphs when we said there are four bridges that will improve your continuity. If you have a number of points to make, enumerate them. Enumeration furnishes continuity and makes your ideas easier to remember.

Your biggest ally in achieving continuity is your ear, i.e., how does your writing sound? Write in a conversational person-to-person style if at all possible. If that's too informal, picture yourself giving a presentation or lecture.

The speaker has many advantages over the writer; gestures and enunciation, for example. Unfortunately, the printed page can neither smile nor gesture, but proper punctuation can reduce this handicap and help your

continuity. You can find the rules, plus examples, in any book on grammar or even in your office dictionary. The examples are worth more than the rules. Certainly, they're more interesting. (Now if we could harness the energy created by all the grammar teachers spinning in their graves, we might solve the power crisis.)

EMPHASIS

A look in the dictionary tells us a lot about emphasis. The word derives from "to show." The definition that follows talks about being "forceful" and "stressing the importance." So in our reports we want to forcefully show our readers the importance of what we are trying to tell them.

Get the reader's attention by stating features of your design and how these features will benefit him. If the information is "buried" in illustrations or tables, make sure the text calls it to his attention.

Remember that thesis you derived during the prewriting planning phase? It emphasized your main point. Make sure that same emphasis is reflected in your Summary. (Why not also consider a mini-summary at the beginning of each major section of your report?) To help you keep your thesis in mind, you could write it on a large sheet of paper with a marker pen and place it in a prominent position. Remember, virtually everything in your report should be aimed at supporting that thesis.

Deletion of unnecessary detail will automatically add emphasis to the material that remains, which leads us to our next topic--editing.

EDITING

The low percentage of replies in this category (2 percent) is a real surprise.* My guess is that many engineers don't realize the value of self-review (or editing) as an aid not only to improving their writing but to making the writing process easier. Let me explain.

Many engineers think of writing as a single task to be accomplished, if at all possible, in a single effort. My advice, however, is to divide the effort into three separate tasks: organizing and outlining, the writing itself, and self-review (or editing). This division not only reduces what must be accomplished at any given stage, but also helps focus the writer's attention.† Thus editing is recognized as a distinct process rather than

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**Although conciseness was cited on 19 percent of the cards, the respondents' cards clearly showed they thought of conciseness as part of the writing process rather than as part of editing.*

†We have already seen how considering editing as a separate effort can avoid cutting off the writing flow.

part of writing. A simplistic example of the value of this would be to compare editing with the opportunity to review an exam after it had been completed and thus raise one's grade from a B to an A.

How can you get the most out of the time you spend editing? An entire book could be written on the subject. I'll try to restrain myself to a few paragraphs. First, put the material aside for a few days before starting, if possible. Also, have a draft copy typed. Both of these steps are aimed at encouraging editing by making the material less personal--less "yours." Secondly, when you do start editing, read the material with your ear--how will it sound to the reader. Don't make the mistake some people do of poking through the text, looking at each individual word and asking themselves, "Should I change this?" Instead, proceed in the same fashion as you would driving on an expressway. That is, move at a brisk pace, but be ready to slow down and take appropriate action when you see a danger signal. Two danger signals that become apparent and correctable during editing are inclusion of unnecessary material and lack of continuity.

The editing process provides an excellent opportunity to eliminate any "gobbledygook" that might have sprouted from your pen during the heat of writing. Even more important, watch out for those tangents or detailed derivations you originally thought interesting enough to include, even though there was no direct impact on your theme. (If you *must* include such items, you should at least consider demoting them to appendices.)

As stated earlier, good original organization helps achieve good continuity, but the editing process provides another opportunity to reposition words, phrases, sentences, paragraphs, and even entire sections that now seem out of place. Reading by ear can indicate how well subsequent sentences in a paragraph support the topic sentences and suggest connecting words to smooth out the flow.

TECHNICAL ACCURACY

Most of the concern here was over the accuracy of the inputs used in constructing the report, with additional concern for the validity of the conclusions drawn. Some writers seem unsure of their own technical competence, as though the readers would know more about the subject than they did. Obviously some readers will, but most won't. To most readers, you're the expert.

One has to sympathize, however, with a writer from one company who confessed to writing sections of a report on a project he hadn't worked on. Apparently his department wrote its reports using the "Let's see, who isn't busy?" approach.

CONCLUSION

Well, that does it. There were a few cards that fell into the miscellaneous category, but none seemed of enough interest to warrant discussion.

For the sake of review, let's look at those top 12 problems again:

1. Organization and outlining
2. Lack of conciseness
3. Interpersonal difficulties
4. Writing
5. Lack of time
6. Audience
7. Grammar
8. Insufficient clarity
9. Poor continuity
10. Emphasis
11. Editing
12. Technical accuracy

I hope some of what I've said will help others with their writing problems (but watch out for number 3) or, perhaps, even help you with your biggest single problem. If nothing else, everyone should now know that . . . whatever your problem, you're not alone.

WASHINGTON OFFICE NEWS

CONSULTATION AND STANDARDS

Charles R. Weller
Assistant Director

RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

The first major piece of waste management legislation in 6 years, the Resource Conservation and Recovery Act of 1976 (PL 94-580), was signed by President Ford October 21. The new law substantially amends the Solid Waste Disposal Act of 1965 (PL 89-272) to provide: Federal regulation of hazardous waste; financial assistance to States for solid waste management planning; and funding for research, development, and demonstration of new technology for garbage reduction and disposal and resource recovery. The legislation strengthens and broadens the authority of the Environmental Protection Agency (EPA) to regulate solid waste and creates an Office of Solid Waste in EPA, headed by a new Deputy Director.

The new legislation is certain to have an impact on most National Forests, specifically in these highlighted areas:

Hazardous Waste Regulation.

EPA must promulgate hazardous waste regulations within 18 months of the enactment of the new law. EPA will first establish criteria for identifying hazardous waste, taking into account: toxicity, persistence, and degradability in nature; potential for accumulation in tissue; and other related factors such as flammability, corrosiveness, and other characteristics. Using those criteria, EPA then will list specific substances deemed hazardous and subject to regulation under law. These regulations will set standards for the handling of hazardous waste from the point of generation to the point of disposal. Owners and operators of hazardous waste treatment, storage, or disposal facilities will be required to obtain permits to insure that the wastes are being handled in an environmentally safe manner. Violators of the hazardous waste provisions of the Act are subject to a fine of $25,000 a day. The new law pertains only to those wastes that are deposited on the ground. The legislation specifies that the States may take over hazardous waste regulations as long as their standards meet Federal requirements. These hazardous waste regulations may significantly affect the treatment and disposal of certain types of wastes generated at Forest Service facilities such as sludge from sewage treatment plants, pumping from septic tanks and vault toilets, and discarded chemicals.

Changes in landfill special use permit issuance and administration requirements will certainly be required.

State Solid Waste Management Plans.

New law directs EPA to set guidelines for State solid waste management plans within 18 months. To obtain funding for development of these plans, States must comply with the standards to be established that will include a phase-out of open dumps within 5 years. Within 12 months of the enactment of the law, EPA will promulgate regulations containing criteria for classifying sanitary landfills and open dumps. These regulations may provide for the classification of types of sanitary landfills. Regional and State plans are also required to address the issue of appropriate resource conservation and recovery methodology. The planning process for solid waste will resemble that established under Section 208 of the Water Pollution Control Act (PL 92-500). The new law directs EPA, where feasible, to designate existing 208 agencies to include solid waste management planning.

Special Funding for Construction or Improvement of Solid Waste Disposal Facilities.

The law provides special funding for small communities and rural areas. Communities with fewer than 25,000 population will be eligible for $2.5 million in grants in each of fiscal years 1978 and 1979 for construction or improvement of solid waste disposal facilities. Rural areas lacking access to solid waste facilities may be granted $25 million in each of fiscal years 1978 and 1979 to help build their own facilities. This provision may be a boon to some of the existing landfill special use permittee's that are encountering financial difficulties in their efforts to upgrade their present substandard facilities.

Federal Responsibilities

Under the previous statute, Federal land management agencies involved in solid waste disposal activities were required to comply with the guidelines developed pursuant to the Act. Executive Order No. 11572 requires Federal agencies to comply with the substantive State and local requirements respecting solid waste disposal and other forms of environmental pollution. The new law requires Federal agencies engaged in solid waste disposal activities, or having jurisdiction over any solid waste management facilities or disposal sites, to be subject to and comply with all Federal, State, interstate, and local requirements, both substantive and procedural, respecting control and abatement of solid waste or hazardous waste disposal; this to be done in the same manner and to the same extent as any person subject to such requirements, including the payment of reasonable service charges. These provisions of the new law include any requirement for permits or reporting, or any injunctive relief and sanctions imposed by a court to enforce such relief. The new law also requires that

the Forest Service now seek permits and follow other procedural requirements of States and local governments, may add a significant administrative burden and create delays in the construction of, or the issuing of permits for, solid waste facilities.

OPERATIONS

Harold L. Strickland
Assistant Director

NEW MAPPING PROGRAM AFFECTS FOREST SERVICE

The U.S. Geological Survey (USGS) has started an intermediate scale mapping series to supplement their large scale (1:24,000 - 7 1/2') quad) and small scale (1:250,000 - 1° x 2° quad) programs. The scale of this new series is 1:100,000 and the format is normally 1° x 30' quadrangles. Where State or county cooperative funding is provided, county format editions may be published at either a 1:50,000 or 1:100,000 scale.

There are several features about this series which make it unique with respect to other USGS map publications. It is a metric product, using the Universal Tranverse Mercator (UTM) Projection with a 10,000-meter grid interval. One kilometer is represented by one centimeter at map scale. Contours and spot elevations are shown in meters. All linear features are depicted by solid line symbology, using line weight and colors to distinguish between similar features. For example: both intermittent and perennial water courses are shown as solid blue lines, but the line weights vary significantly to distinguish between the two. This solid line symbology was designed to facilitate automated digitizing techniques for future data bank creation, subsequent plotting, and ease of revision. Another unique feature of this series is that the total USGS program is based on cooperative funding by user agencies. An indicated need for this series must be demonstrated by either matching funds (or production support) to those of the USGS. The Bureau of Land Management, Soil Conservation Service, and several States have active programs with the USGS. Map coverage of approximately 20 percent of the United States is currently under production as a result of these cooperative programs.

Our Washington Office Geometronics Development Group recently completed an Intermediate Scale Mapping Study to evaluate the merits of this 1:100,000 scale program as a support to, or replacement of, the current 1/2 inch = 1 mile (1:126,720) program. Our program currently provides intermediate scale coverage for over 90 percent of the National Forests. With this extensive coverage, and the significant expense required to convert to the 1:100,000 scale format, it was decided that adoption of the USGS format was not feasible for Forest Service use *at this time*.

In an attempt to have this new map series evaluated by prospective Forest Service users, the Wenatchee National Forest in Region 6 has agreed to

cooperate on a pilot study. In lieu of revising their existing 1/2" - 1 mile Secondary Series Map, as originally scheduled for FY 1978, 1:100,000 metric base maps will be constructed to provide total Forest coverage. This will be a cooperative Forest Service-USGS effort. Some items to be evaluated during this study include:

1. Forest vs. quad folio format.

2. Utility of new symbology, including metric contours.

3. Cost of preparing status and other necessary layers needed to enhance the basic product for Forest Service use.

4. Administrative and public user acceptabliity.

5. Utility for single color or special functional maps.

6. Range of enlargement and reduction limits to produce special project maps.

7. Automated cartography applications.

Evaluation of this pilot study, by both mapping specialists and users, will provide a benchmark for recommending future policy on conversion of Secondary Series mapping to the 1:100,000 scale format.

Regional Geometronics Group Leaders are aware of this new USGS map series and can answer any specific questions you may have.

TECHNOLOGICAL IMPROVEMENTS

Heyward T. Taylor
Assistant Director

A PAVEMENT DESIGN AND MANAGEMENT SYSTEM FOR FOREST SERVICE ROADS - A WORKING MODEL

Under the terms of a cooperative agreement, the Forest Service and the University of Texas have been developing a Servicewide systems approach for pavement design and management. Copies of the final report on the conceptual study (Phase I) have been distributed throughout the Service. Phase II of this cooperative work has now been completed and documented in a report, "*A Pavement Design and Management System for Forest Service Roads--A Working Model.*" We plan on distributing copies of the report when they become available from the University in January or February of 1977; the table of contents from the draft version of the report is given in the following pages. Forest Service reviewers have commented favorably on the computer program and systems approach documented in the report. The general consensus was that the system will provide a valuable working tool for the engineer and manager on the ground.

A cooperative agreement and a detailed work plan (Phase III) have been approved. Some of the work to be accomplished in Phase III will involve trial usage of the systems approach on selected National Forests in Regions 6 and 8. We will be reporting more on this in later issues of *Field Notes*.

A workable systems approach to pavement design and management in the Forest Service can result in significant savings. During the implementation phase, the methodology and computer programs will be "debugged" and tried on a limited basis, and the goal will be to refine the systems approach to the point that it will be "on-line" and available for Servicewide use.

A PAVEMENT DESIGN AND MANAGEMENT SYSTEM FOR FOREST SERVICE ROADS - A WORKING MODEL

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INVITATION TO READERS OF *FIELD NOTES*

Every reader is a potential author of an article for *Field Notes.* If you have a news item or short article you would like to share with Service engineers, we invite you to send it for publication in *Field Notes.*

Material submitted to the Washington Office for publication should be reviewed by the respective Regional Office to see that the information is current, timely, technically accurate, informative, and of interest to engineers Service-wide (FSM 7113). The length of material submitted may vary from several short sentences to several typewritten pages; however, short articles or news items are preferred. All material submitted to the Washington Office should be typed double-spaced; all illustrations should be original drawings or glossy black and white photos.

Field Notes is distributed from the Washington Office directly to all Regional, Station, and Area Headquarters, Forests, and Forest Service retirees. If you are not currently on the mailing list ask your Office Manager or the Regional Information Coordinator to increase the number of copies sent to your office. Copies of back issues are also available from the Washington Office.

Each Region has an Information Coordinator to whom field personnel should submit both questions and material for publication. The Coordinators are:

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