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ms. Gunter

**DECISION**



**THE COMPTROLLER GENERAL  
OF THE UNITED STATES**  
WASHINGTON, D. C. 20548

FILE: B-199022

DATE: June 19, 1980

MATTER OF: Neal & Company, Inc.

DLG04839

*[Protest of Procurement Award]*

DIGEST:

Procurement by Kodiak Electric Association using funds borrowed from Rural Electrification Administration is neither Federal procurement nor procurement involving Federal grant funds and, therefore, will not be reviewed by GAO.

DLG04839

Neal & company, Inc. protests the award of a contract by the Kodiak (Alaska) Electric Association to Kenai Industrial Mechanical Company in connection with a rural electrification project.

We understand that the procurement is funded by a loan from the Rural Electrification Administration (REA), and that the loan is repayable to REA. We do not review such procurements since we view them as being neither procurements by or for an agency of the Federal Government nor procurements by a Federal grantee. See Donovan Construction Co., B-191721, May 12, 1978, 78-1 CPD 371, and cases cited therein.

The protest is dismissed.

*for* Harry R. Van Cleave  
Milton J. Socolar  
General Counsel

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2<sup>nd</sup> CONF. ON COMPUTING IN CIVIL  
ENGINEERING. BALTIMORE MD.  
JUNE 10-13, 1980

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A/E Use of Computer Aids on Federal Projects

By Ronald L. King, C.P.A.<sup>1</sup>

The General Accounting Office (GAO) has made a survey to determine the extent that architectural and engineering firms providing design services to Federal agencies use computer-aided techniques in the design process. While the 800 firms we surveyed were not selected on a statistical sampling basis and the results of the survey should not be projected over the entire architect-engineer (A/E) community or even those providing services to Federal agencies, the response--nearly 94 percent (750 of 800)--was very good and we believe that even the raw data will be of interest to Federal agencies, the A/E community, and others.

In this paper we present the results of our survey. The reason for making the survey and its scope are discussed. The survey results presented provide some insight into the use of computer methods in the design process, how computer services are provided, why computers are used, which applications are currently being used, and which applications firms are planning to use in the near future.

BACKGROUND AND DEFINITIONS

GAO has been looking at the use of computer technology in building design since early 1976. Our initial effort explored the benefits of computer-aided building design (CABD), the problems and inhibitors slowing development, and the avenues for promoting the beneficial applications of computer techniques. Our findings were presented in a Staff Study, "Computer-Aided Building Design," LCD-78-300, July 11, 1978. Our current work in this area concerns the problems experienced by A/E firms using computer-aided techniques on Federal projects. This paper discusses just one aspect of this current work--the results of our survey of A/E firms. The findings of the entire project will be presented in a GAO report (anticipated issue date - June 1980).

In our survey we defined computer use as any and all applications of computers to the design process. We excluded all accounting, fiscal and personnel management uses. We used the term "design process" in its broadest sense defining it as all functions or operations from programming and architectural conception through the preparation of working drawings and construction specifications. For the purposes of our survey, we also included computer applications in the construction management area, although we recognized that most firms would not normally consider such uses to be part of the "design process."

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## WHY WAS THE SURVEY MADE?

In our 1978 staff study we commented on several factors which practicing A/E's and experts in the field identified as having inhibited the development and use of CABD technology in the United States. One of these factors was Federal contracting policies and procedures. In view of our findings that Federal agencies, as building owners, could benefit from the use of computers by A/E's performing work for them, we felt this factor should be looked into to determine whether or not Federal policies and procedures do, in fact, inhibit the beneficial use of computer-aided methods by A/E firms working for Federal agencies. Our first step was to get a handle on the size and complexity of the problem, and its significance.

Very little information was available on who was using computer aids and whether computers were being used more or less on Federal work. Using normal auditing techniques, the collection of such data would have been very costly and time consuming, making such an effort infeasible. The only viable alternative appeared to be a questionnaire survey with selective interviews to identify specific problems being experienced by firms working for Federal agencies.

## SCOPE OF SURVEY

How many firms should be surveyed? We felt that we needed at least 200 responses to be able to draw any conclusions from the data. We were aware that architects and engineers, as a group, are not prone to responding to questionnaires. Assuming a 25 percent response rate, we decided to send out 800 questionnaires.

Probably the most difficult task regarding the use of the questionnaire was the development of the mailing list. We recognized from the beginning that we would be unable to make a statistical sample. We did not know exactly how many A/E firms actually did work for Federal agencies each year. Using information available in GAO files for the Department of Defense, and information provided by nine other agencies, we developed a list of 1,000 firms that had done work for Federal agencies during 1976, 1977 and 1978. The problems with the list at this point was it included very few addresses, as this information was not shown on the records we were using. Using telephone books from the library, various books listing architectural and engineering firms, professional society/association rosters, advertisements in trade journals, and personal contacts, we were able to obtain addresses for 800 of the firms on our list. Since this was the number of questionnaires we wanted to send out, we decided that it would be unproductive to continue the search for more addresses.

## DESIGNING THE QUESTIONNAIRE

Our main objective was to get a response that would provide us sufficient information to use for programming our review of problems experienced by A/E's using computers on Federal projects. Our secondary objective was to keep the questionnaire short and to the point in order to facilitate the accomplishment of our primary objective--an adequate response.

The questions were developed in close coordination between the audit staff (accountants), our technical consultants (an architect and an engineer), our systems analysis staff (computer specialists), and a GAO psychologist. A concerted effort was made to make sure that the questions were written so that architects and engineers responding to the questionnaire could understand what we were asking. Before sending the questionnaire out, we tested it on four design firms located in Washington, D.C. These tests indicated some minor wording changes were needed, and more importantly, that we could increase our response rate with a little better format. With the help of the psychologist, we reformatted the questionnaire before mailing it out.

The results far exceeded our greatest expectations and hopes. Of the 800 questionnaires mailed, 749 were returned completed, 1 firm returned the questionnaire stating they did not have time to respond, and 4 questionnaires were returned undeliverable. That is about a 94 percent response.

### RESULTS OF SURVEY

All the questionnaire responses were keypunched and placed into a data base. We tabulated the responses and analyzed the data in a variety of ways. Four of the responses were received too late to be included in the analysis. Therefore, most of the data below is based on responses from 745 firms.

#### General Questions

The questionnaire had two parts. The first section asked questions about the firm's general use of computers in the design process. In the second section, questions were asked about the firm's use of computers on a specific Federal project.

#### Classification of firms

While a wide variety of firms responded, we grouped them under four categories to facilitate analysis. Firms were classified as either architect, engineer, architect-engineer or other, as shown in Figure 1.

Figure 1. Classification of Firms  
Responding to Questionnaire

<u>Type of firm</u>	<u>Number</u>	<u>Percentage</u>
Architects	186	25.0
Engineers	200	26.8
Architect-Engineers	318	42.7
Other	<u>41</u>	<u>5.5</u>
Total	<u>745</u>	<u>100.0</u>

Use of Computers  
in General Practice

We asked firms whether or not they used computers in the design process, either through their own use or through their consultants. The responses show that 567 firms or 76.2 percent indicated they did use computers in the design process.

Areas Where Computers Are Being  
Used During the Design Process

Firms were asked what applications are currently used and those they plan to use by December 1980. The responses to these questions revealed no surprises. The results show a heavy use in the engineering areas and very little for architectural applications. (See figure 2.)

Figure 2. Areas Where Firms are Using  
and Where they Plan to Use  
Computers in the Design Process

	<u>Number of Firms</u>	
	<u>Using (1/79)</u>	<u>Additional Planned Use (12/80)</u>
1. Structural engineering	322	30
2. Civil engineering	281	24
3. Mechanical engineering	276	33
4. Energy analysis	222	55
5. Electrical engineering	180	50
6. Life-cycle costing	166	61
7. Specifications	140	100
8. Cost estimating	137	71
9. Lighting analysis	130	48
10. Construction management	119	29
11. Functional programming	76	38
12. Soil analysis	69	7
13. Drafting	64	47
14. Perspective drawing	29	24
15. Other areas	75	2

Why are computers used

We asked firms to indicate the primary reason they used computers in the design process. The results show that by far the primary reason is to carry out tasks not practical using manual methods--242 firms listed this reason. To improve the quality of designs produced was a distant second--115 firms indicated this as their primary reason. (See figure 3.)

How are computer services provided

Responses indicate that firms generally provide computer services by utilizing either commercial time-sharing service (266 firms) or their

own computer (252 firms). Other methods used are commercial service bureaus (170 firms), leased computer (68 firms), through consultants (117 firms) and miscellaneous other methods (26 firms).

Figure 3. Primary Reasons Computers Are Used In Design

<u>Reason</u>	<u>Total Number of Firms</u>	<u>Type of Firm</u>			
		<u>Architect</u>	<u>Engineer</u>	<u>Architect-Engineer</u>	<u>Other</u>
To carry out tasks not practical using manual methods	242	21	95	111	15
To improve the quality of designs produced	115	12	34	66	3
To reduce costs of design	73	7	25	37	4
To speed up the design process	72	10	22	37	3
To reduce the number of design errors	10	1	1	8	0
To standardize methods	6	3	2	1	0
In order to comply with building codes or project requirements	4	0	2	2	0
Other <u>1/</u>	18	5	6	5	2

1/All 18 responses checking the other box listed two or more of the specific reasons shown in the chart. No new reasons were introduced.

Use on Federal Projects

The questionnaire responses showed that computers were used in some way on 65 percent of the 745 projects included in the survey. The projects included various types as shown in Figure 4.

Figure 4. Breakdown of Federal Projects Done by Firms Responding to Questionnaire

<u>Type of Project</u>	<u>Number of Projects</u>	<u>Type of Firm</u>			
		<u>Architect</u>	<u>Engineer</u>	<u>Architect-Engineer</u>	<u>Other</u>
Office and general purpose building	128	51	11	62	4
Facility renovation	92	29	22	41	0
Special studies/services	75	13	27	21	14
Storage/maintenance facility	69	12	20	35	2
Hospital/medical facility	63	18	10	32	3
Laboratory/educational facility	55	23	2	27	3
Pollution control	43	1	26	13	3
Housing	36	19	3	14	0
Civil engineering	35	11	24	10	0
Utilities	29	1	15	9	4
Energy conservation	27	3	11	12	1
Production plants	24	0	7	14	3
Misc. small buildings	21	8	4	7	2
Water	18	0	10	7	1
Security	7	1	2	4	0
Aerospace	5	0	2	2	1
Detention centers	3	2	0	1	0
Other	<u>10</u>	<u>1</u>	<u>3</u>	<u>6</u>	<u>0</u>
Totals	<u>740</u>	<u>183</u>	<u>199</u>	<u>317</u>	<u>41</u>

The computer was used on better than half the projects in each category except for facility renovations. The category with the highest use was office buildings and general purpose buildings as was expected. See figure 5 for complete breakdown.

Figure 5. Use of Computer Methods  
on Selected Federal Projects

<u>Type</u>	<u>Number</u>	<u>Computer Methods</u>	
		<u>Used</u>	<u>Not Used</u>
Office and General Purpose Buildings	128	95	33
Facilities renovations	92	39	53
Special studies and services	75	38	37
Storage and maintenance facilities	69	41	28
Hospitals and medical facilities	63	44	19
Laboratories and educational facilities	55	38	17
Pollution control	43	24	19
Housing	36	27	9
Civil engineering projects	35	25	10
Utilities	29	19	10
Energy conservation	27	15	12
Production plants	24	18	6
Misc. Small buildings	21	20	1
Water projects	18	16	2
Security projects	7	6	1
Aerospace and Air Defense facilities	5	5	0
Detention centers	3	2	1
Other	10	5	5

Use of Available Computer  
Methods on Federal Projects

We compared the computer methods available to firms with the computer methods used on Federal projects. We found that available computer capability was not always used on the Federal projects included in the survey. For example, 177 of firms indicated they had capability in computer-aided specifications, yet only 55 firms used this capability on Federal projects. Other applications we looked at showed similar usage experience. (See figure 6.)

Figure 6. Comparison of Computer Applications Available to A/E's Awarded Federal Contracts and the Applications they Actually Used.

<u>Computer Application</u>	<u>Number of Firms</u>	
	<u>Available</u>	<u>Used</u>
Specifications	177	55
Cost Estimating	198	67
Drafting	73	18
Life-Cycle Costing	281	105
Functional Programming	81	11
Perspective Drawing	36	5

Reasons Computers Not Used

On those projects where computers were not used we asked for the firm to indicate the reason. Computers were not used on 266 projects. Figure 7 shows the reasons broken down by type of firm.

Figure 7. Reasons Why Computers Were Not Used on Federal Projects

<u>Reason</u>	<u>Total Number of Projects</u>	<u>Type of Firm</u>			
		<u>Architect</u>	<u>Engineer</u>	<u>Architect-Engineer</u>	<u>Other</u>
Firm does not ordinarily use computers	52	20	6	17	9
Work did not involve aspects where computer is normally used	88	17	35	30	6
Work not sufficiently extensive or complex to require computer	97	18	32	43	4
Use of computer would have created difficulty in recovering costs under the contract	4	1	2	1	0
Other	16	2	6	8	0
No reason given	<u>9</u>	<u>2</u>	<u>2</u>	<u>4</u>	<u>1</u>
Number of projects on which computers were not used	<u>266</u>	<u>60</u>	<u>83</u>	<u>103</u>	<u>20</u>

How Computer Costs Were Listed in Fee Proposal

On those projects where computers were used we asked the firm to indicate how they listed computer costs in their fee proposal. The results show that frequently computer costs are buried in either overhead or labor figures. Only 172 of 474 firms listed their computer costs as a direct costs. An additional 24 firms had these costs listed as direct costs, but identified the cost by some label other than computer services costs. (See figure 8.)

Figure 8. Listing of Computer Costs  
in Fee Proposals

<u>Method Used</u>	<u>Total Number of Firms</u>	<u>Type of Firm</u>			
		<u>Architect</u>	<u>Engineer</u>	<u>Architect- Engineer</u>	<u>Other</u>
Listed as a direct cost identified as computer ser- vices cost	172	43	45	75	9
Listed as a direct cost identified in another way, e.g. energy analysis	24	8	9	7	0
Buried in labor figures	94	24	18	50	2
Buried in over- head	219	62	50	98	9
Other	37	7	11	18	1

Number of firms responding to this question: 474 firms.

Note: This was a "check all that apply" question. More than one method is often used in fee proposals.