REPORT TO THE SUBCOMMITTEE ON MILITARY CONSTRUCTION COMMITTEES ON APPROPRIATIONS UNITED STATES SENATE HOUSE OF REPRESENTATIVES

1

Comparative Costs To Design, Supervise, And Inspect Military Construction Projects

B-133376

Department of Defense

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

JAN. 4, 1973

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

B-133316

Dear Mr. Chairman:

This report is in response to the request of November 10, 1971, by the committee of conference on fiscal year 1972 military construction appropriations. The committee asked us to investigate the efficiency of construction management and the fairness of charges by Department of Defense construction agencies for supervision, inspection, and overhead.

Also as requested, we compared charges by the Army Corps of Engineers and the Naval Facilities Engineering Command for design and for construction supervision with charges for similar services by the General Services Administration and by private architect-engineer firms. Three prominent architectural and engineering societies provided information on the latter charges, and we have expressed our appreciation to them.

We have not requested written comments from any of the organizations included in our study, but, as agreed with our representatives, we are sending copies of the report today to the Secretary of Defense.

We plan no further distribution of this report unless copies are specifically requested and then only after your agreement has been obtained or you have publicly announced its contents.

Sincerely yours,

Comptroller General
of the United States

The Honorable Michael J. Mansfield
Chairman, Subcommittee on Military
Construction
Committee on Appropriations
United States Senate

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ABBREVIATIONS

ASCE	American Society of Civil Engineers
DOD	Department of Defense
GAO	General Accounting Office
GSA	General Services Administration

COMPTROLLER GENERAL'S REPORT TO
THE SUBCOMMITTEES ON
MILITARY CONSTRUCTION
COMMITTEES ON APPROPRIATIONS
UNITED STATES SENATE
HOUSE OF REPRESENTATIVES

COMPARATIVE COSTS TO DESIGN, SUPERVISE, AND INSPECT MILITARY CONSTRUCTION PROJECTS
Department of Defense
B-133316

D I G E S T

WHY THE STUDY WAS MADE

The committee of conference (of the Senate and House) on fiscal year 1972 military construction appropriations asked the General Accounting Office (GAO) to investigate the efficiency of construction management and the fairness of charges by Department of Defense (DOD) construction agencies for supervision, inspection, and overhead. GAO was also asked to compare charges for similar work in private industry with charges by the DOD agencies. (See app. I.)

Background

Design and supervision of military construction projects completed in the United States in fiscal year 1971 cost about $58 million. The Army Corps of Engineers and the Naval Facilities Engineering Command supervise most military construction projects, but the Air Force may supervise its projects with approval by the Secretary of Defense.

Authorization acts before 1970 required the Corps or the Command to supervise all military construction unless the Secretary of Defense determined this was wholly impractical. Beginning in fiscal year 1970, authorization acts have given the Secretary more flexibility in selecting an agency to supervise construction in the United States.

To compare construction efforts, Congress requires military departments to report the value of construction completed each year and the related design, supervision, and overhead charges. After DOD submitted the first report, covering projects completed by the agencies in fiscal year 1970, the Congress questioned their relative efficiency. (See pp. 5 and 6.)

GAO agreed to compare

- --the DOD agencies' costs for design and for construction supervision, inspection, and overhead for military projects completed in fiscal year 1971,
- --the DOD agencies' charges with private firms' charges for similar services and,
- --the DOD agencies' charges with General Services Administration (GSA's) charges for similar services. (See p. 22.)

GAO gave an interim oral report to the Subcommittees on Military Construction of the Senate Committee on Appropriations and Armed Services in May 1972. As requested, GAO did not obtain written comments on this report from DOD.

FINDINGS AND CONCLUSIONS

Costs reported May 1973

Costs reported to the Congress by

the DOD agencies for design and for construction supervision, inspection, and overhead were not suitable for measuring or comparing the agencies' management efficiency because

--the agencies used different procedures and practices to record, estimate, and report these costs and

--the effects of the quality, size, and complexity of construction projects on the agencies' costs were unknown. (See p. 8.)

GAO informed DOD of the differences in estimating and reporting costs for use in its study of the military construction cost accounting systems of the three departments. DOD is making the study to determine the comparability of the costs under the individual systems and the desirability and feasibility of revising current systems. (See p. 9.)

For design, supervision, inspection, and overhead costs reported on projects completed in fiscal year 1971, the Corps averaged 14.1 percent of construction costs, the Command averaged 11.7 percent, and the Air Force averaged 13.2 percent. (See p. 8.)

Charges reported by private firms

A comparison of private firms' reported charges with DOD agencies' charges may not be meaningful because of insufficient information on the firms' charges and on factors which influence them, such as quality, size, and complexity of projects.

Private firms reported their charges in response to questionnaires from three architectural and engineering societies which volunteered to furnish this data for the GAO study. GAO could not verify whether

--charges by the firms that responded were representative of all private firms' charges,

--the firms' charges covered the same services as the DOD agencies' charges, or

--the firms' projects were comparable to the DOD agencies' project in quality, size, and complexity.

Charges reported by private firms ranged from 6.2 percent of project construction costs of $10 million or over to 9.3 percent of project construction costs of less than $1 million. These charges were considerably lower than the 12.4 and 11.4 percent that the Corps and the Command charged for projects completed in fiscal year 1971 at an average construction cost of $500,000 and $1 million, respectively. (See p. 14.)

Charges reported by GSA

A comparison of the DOD agencies' charges for design and construction supervision with GSA's charges may not be meaningful because of differences in the nature and location of construction projects. Charges furnished by GSA as typical for projects were based on a combination of charges for new construction projects and for repair and improvement projects.

It is not known whether such projects are comparable to new construction, alteration, and rehabilitation projects on which the DOD agencies' charges were based. The GSA charges were based on projects in the United States; the Corps and Command charge

were based on projects worldwide. Most GSA construction projects are in cities; most DOD domestic projects are at military installations.

Average charges cited by GSA for construction and repair projects were 22 percent of the project construction cost category of $500,000, 15.3 percent of the $2 million category, and 12.5 percent of the $5 million category. (See p. 19.)

MATTERS FOR CONSIDERATION BY THE SUBCOMMITTEES

A number of factors which influence the DOD reported costs of design and construction supervision must be considered in measuring and comparing the management efficiency of the DOD construction agencies. Such factors include the organizational structures established to manage constructio projects, the management techniques used in the design and con struction supervision process, th nature and location of construction projects, and the quality of construction attained for the tot project cost.

GAO suggests that the Subcommitte defer further studies of the DOD agencies' management efficiency u til they have considered any chan affecting the comparability of re ported costs that may result from DOD study of the military departm construction accounting systems. After considering any such change the Subcommittees could consider whether additional information on specific factors influencing reported costs is needed from the Secretary of Defense to provide t Subcommittees with better visibil of the DOD agencies' management e ficiency.

CHAPTER 1

MILITARY CONSTRUCTION SUPERVISION

JURISDICTION AMONG MILITARY AGENCIES

The Army Corps of Engineers and the Naval Facilities Engineering Command usually provide design and construction supervision services for military projects in the United States and its possessions. Although the military departments can select either of the two agencies to provide such services, the Departments of the Army and Navy have primarily used the services of their own construction agencies. The Corps, and at times the Command, have provided the services for most Air Force projects. In addition, the Air Force has supervised the design and construction of its own research and test facilities, its own family housing projects, and other projects with the approval of the Secretary of Defense.

The design of more than 80 percent of the dollar value of military projects was contracted out in recent years, but most construction supervision was done in-house, according to Department of Defense (DOD) officials.

Military construction authorization acts before 1970 required either the Corps or the Command to supervise all design and construction, unless the Secretary of Defense or his designee determined that this was wholly impractical. The 1970 and subsequent authorization acts modified this requirement; they specified that other Government agencies could supervise construction at the Secretaries of the military departments' request and with the Secretary of Defense's approval, to insure the most efficient, expeditious, and cost-effective construction.

The modified requirement stated that the military departments must send the Congress an annual report on the value of the contracts that the construction agencies completed and on the design, supervision, and overhead charges that the departments incurred. The stated purpose of the report is to compare the construction efforts of the three military departments.

After DOD submitted the first report, covering projects completed in fiscal year 1970, congressional hearings questioned whether the most efficient construction agencies were being selected for design and supervision services. The reported costs of these services in relation to construction costs indicated that the Air Force could design and supervise the construction of its own projects cheaper than could the Corps, which was its usual construction agency.

We used the second report, which covered projects completed in fiscal year 1971 and which was submitted in February 1972, to compare the design and supervision costs of the Corps, the Command, and the Air Force.

ORGANIZATIONAL DIFFERENCES IN CONSTRUCTION AGENTS

The Corps has a headquarters, 11 operating divisions, and 36 district offices within the continental United States. The headquarters, eight divisions, and 11 district offices supervise military construction. The district offices award contracts and supervise and inspect projects under construction, and the divisions review and control those activities. The headquarters implements approved construction programs and reviews design work on all projects. About 5,000 people worked on the Corps' military construction program in fiscal year 1971, according to DOD.

Within the continental United States, the Command has a headquarters and five engineering field divisions responsible for supervising military construction. The headquarters' functions are similar to those of the Corps' headquarters. The field divisions are responsible for projects under construction, as are the Corps' district offices. The Command has no separate level similar to the Corps' divisions. About 2,300 people worked on the Command's military construction program in fiscal year 1971, according to DOD.

The Air Force does not have an organizational structure similar to those of the Corps or the Command for supervising construction. Its military construction program is the responsibility of the Directorate of Civil

Engineering, a 600-man organization. The regional civil engineers, members of the Directorate, supervise the design and award the contracts. The major command having jurisdiction over the base where the project is being constructed is assigned supervision responsibilities. In certain instances, the major command may also be assigned the responsibilities of the regional engineer. Once construction starts the base civil engineer supervises and inspects the project. He must rely on the other base-level activities for such support services as procurement, supply, accounting, and legal assistance.

This contrasts with the Corps and Command procedures because the military installation where the Corps or the Command supervises construction is not responsible for the project until it is completed.

CHAPTER 2

REPORTED DESIGN AND SUPERVISION COSTS AS MEASURES OF EFFICIENCY

The costs reported to the Congress by the DOD construction agencies for design and for construction supervision, inspection, and overhead were not suitable for measuring or comparing the agencies' management efficiency because

--the agencies used different procedures and practices to record, estimate, and report these costs and

--the effects of the quality, size, and complexity of construction projects on the agencies' costs were unknown.

The following table contains data from the DOD report to the Congress on projects completed by the agencies in fiscal year 1971 on which the agencies were responsible for both design and construction supervision. (See app. II for more detailed data.)

Agent	Number of projects	Construction costs (note a) Total	Construction costs (note a) Average	Design and supervision, inspection, and overhead Costs	Design and supervision, inspection, and overhead Percent	Design percent	Supervision, inspection, and overhead percent
		(millions)					
Corps	446	$221.5	$0.497	$31.2	14.1	7.2	6.9
Command	220	232.2	1.055	27.1	11.7	5.4	6.3
Air Force	13	.9	.070	.1	13.2	8.3	4.9
Total	679	$454.6		$58.4			

[a]Excludes design and supervision, inspection, and overhead costs.

DIFFERENCES IN RECORDING, ESTIMATING, AND REPORTING COSTS

The costs for design and for supervision, inspection, and overhead in the report to the Congress were paid from several appropriations and were accounted for differently by the three agencies. We informed the Assistant Secretary of Defense (Comptroller) of the differences we found in estimating and reporting costs for use in his study of the military construction cost accounting systems of the military departments. He is making the study to determine the comparability of costs under the individual systems and the desirability and feasibility of revising the current systems

All three agencies recorded as costs of the facilities in their property records (i.e., capitalized) design and construction supervision costs paid out of military construction appropriations. However, except for certain actual cost data kept by the Air Force specifically for reporting, the amounts paid from other appropriations for design and construction supervision had to be estimated by the agencies

Costs paid out of military construction appropriations and capitalized represented about 12.4 of the Corps' reported 14.1 percent, about 11.4 of the Command's reported 11.7 percent, and about 7.2 of the Air Force's reported 13.2 percent. In accordance with DOD policy, the three agencies charged their military customers only for those costs paid out of military construction appropriations.

We did not verify recorded costs or evaluate the methods used to estimate costs.

Recording costs

In accordance with DOD instructions, the Corps' headquarters- and division-level construction supervision costs are paid from military personnel or operations and maintenance appropriations and are not capitalized in the accounting records. The Corps' district-level supervision costs are paid from military construction appropriations and are capitalized.

The Command pays its headquarters- and division-level construction supervision costs (except for military personn

costs) from military construction appropriations and capitalizes such costs in accordance with DOD instructions. Military construction appropriation acts authorize such appropriations to be used to pay Command headquarters personnel but not Corps headquarters personnel.

DOD instructions do not contain similar special guidance on Air Force supervision costs. The Air Force pays it in-house design and construction supervision costs from either operations and maintenance appropriations or militar personnel appropriations and does not capitalize such costs

Costs for contract services are paid from military construction appropriations and are capitalized by all thre agencies.

Estimating costs

The Corps used formulas to estimate the civilian and military personnel and related overhead costs paid out of operations and maintenance and military personnel appropriations at its headquarters, divisions, and districts for both design and supervision services.

The Command estimated military personnel costs for its headquarters and field offices for both design and supervision services at a fixed 0.3 percent of construction costs. These were the costs paid from the military personnel appropriations.

The Air Force used formulas to estimate the overhead costs incurred at its bases for both design and supervision services. It reported at actual costs the direct man-hours that could be identified as applying to specific projects.

Reporting costs

The three agencies differed in reporting certain types of design and supervision costs.

Costs reported by the Corps did not include any factor for depreciation or rent. The Corps told us that it also did not include any base-level support costs. (Base-level support includes office space and utilities.) The Command also did not include any factor for depreciation or rent or

any base-level support costs unless the base specifically charged it for such support. In addition, the Command omitted design overhead on non-Navy projects.

The Air Force reported base-level costs, including factors for depreciation and utilities, but did not report any costs for headquarters or major commands except for salaries of certain major command personnel who had been specifically assigned to construction projects. (The Air Force said that it would consider its higher level costs in the next report.)

The report to the Congress included domestic projects--those completed in the United States and its possessions. The Corps, the Command, and the Air Force reported supervision, inspection, and overhead costs as 6.9, 6.3, and 4.9 percent, respectively (see table on page 8), of the construction costs. The Corps and Command rates were based primarily on worldwide supervision, inspection, and overhead costs as a percentage of worldwide construction costs, whereas the Air Force rate was based on domestic supervision inspection, and overhead costs as a percentage of domestic construction costs. We did not determine the effect of overseas costs on the Corps and Command rates.

EFFECTS OF NATURE AND QUALITY OF CONSTRUCTION ON DESIGN AND SUPERVISION COSTS

The construction industry recognizes that the size, complexity, and location of projects generally affect design and supervision costs. Because such costs are usually highe for small or complex projects than they are for large or uncomplicated projects, any meaningful cost comparison should consider the size and nature of projects. To show relative management efficiency, a cost comparison also should consider the quality of construction.

We did not analyze the effect that such factors as size complexity, and quality of construction had on the design and supervision costs reported by the DOD agencies.

We did note that the reported design percentages declined as the average project construction costs increased. The design costs of the Corps and the Command averaged 7.2 and 5.4 percent of construction costs, respectively. The Corps and the Command completed hundreds of projects

at average costs of $500,000 and $1 million a l
respectively. The Air Force's design costs avc
cent of construction costs; however, the Air Fc
only 13 projects with an average construction c
$70,000 a project.

CHAPTER 3

COMPARISON OF DOD AGENCIES' CHARGES WITH PRIVATE FIRMS' CHARGES

A comparison of private firms' reported design and construction supervision charges with the DOD agencies' charges may not be meaningful because of the lack of sufficient information on private firms' charges and on factors which influence them, such as quality, size, and complexity of projects. Private firms reported their charges in response to questionnaires. We could not verify whether

--the charges by the firms that responded were representative of all private firms' charges,

--the firms' charges covered the same services as the DOD agencies' charges, or

--the firms' projects were comparable to the DOD agencies' projects in quality, size, and complexity.

CHARGES REPORTED BY PRIVATE FIRMS

We obtained information on private firms' charges for design and construction services from three architectural and engineering societies--the Consulting Engineers Council, the National Society of Professional Engineers, and the American Institute of Architects. The societies had sent questionnaires to 60 firms and had tabulated and analyzed the 30 responses they received. (See app. III.)

A breakdown of the reported charges by project construction cost is shown in the following table.

Project construction cost	Number of projects	Total value of construction	Average project construction cost	Percentages for architect-engineer services		
				Design	During construction	Co bi
		(millions)				
$10 million or over	8	$125.70	$15.72	4.9	1.3	6
$ 5 million to $10 million	19	138.51	7.29	4.4	1.9	6
$ 2 million to $ 5 million	49	153.59	3.13	4.6	2.5	7
$ 1 million to $ 2 million	38	54.48	1.43	5.0	3.2	8
Less than $1 million	40	19.66	.49	5.9	3.4	9
All projects	154	$491.93	$ 3.19	4.7	2.1	6

These charges were considerably lower than the 12.4 an 11.4 percent that the Corps and the Command charged for pro ects completed in fiscal year 1971 at an average constructi cost of $500,000 and $1 million, respectively.

Representativeness of data on private firms

Although the projects on which the firms' reported charges were based appear to include a variety of architect engineer work, we could not determine whether the charges were representative of all architect-engineer firms' charge We could not verify the reported charges because

--we had agreed with the societies to keep the partici pating firms anonymous and

--the firms had chosen the projects included in their responses.

Private versus DOD agencies' services

The descriptions of the design and construction services in the questionnaires were not specific enough to compare them with the DOD agencies' services. Design services were described as architectural, electrical, mechanical, structural, and other. Construction services were describe

as preparing bid documents; analyzing bids; and making surveys, observations, and inspections. These descriptions seemed to exclude a number of the services provided by the DOD agencies for the costs of design and construction supervision.

Examples of such services are:

1. Selecting and negotiating architect-engineer contracts

2. Providing accounting, legal, and security services required for military customers.

3. Awarding and administering contracts for design and construction in accordance with Federal procurement regulations.

Although we could not estimate the costs that the DOD agencies incur for such services, they are apparently included in the agencies' charges but not in the private firms' charges. We could not determine whether the private firms' charges were based on providing any services not provided by the DOD agencies. Even for apparently similar services, e.g., preparing bid documents and inspecting construction, comparisons may not be meaningful because the scope and intensity of the services may differ materially between private firms and the DOD agencies.

Comparability of projects

Design and supervision charges are influenced by such factors as size, complexity, and location of the projects. We could not evaluate the similarity between private and DOD projects in terms of these factors.

The data submitted by the societies showed that the average charge by private firms increased from 5.9 to 9.3 percent as the related average project construction cost decreased from $15.7 million to $500,000. About half the private firms' projects, compared with 93 percent of the DOD agencies' projects, cost less than $2 million. Other than noting that DOD design charges declined as project sizes increased (see p. 11), we do not know the effect that the predominance of low-value projects had on the DOD agencies' charges.

Complexity of a project also affects the cost of design and construction services. Although the projects reported by private firms can be generally classified into the same facility categories (such as administrative or medical facilities) as those of the DOD projects, we believe that each project would need to be analyzed individually to ascertain the effect of project complexity on design and construction charges.

Although the DOD reports covered domestic projects, the Corps and Command charges for supervision, inspection, and overhead were based on both domestic and overseas construction. We could not determine whether any of the private projects were located outside the United States from the responses to the questionnaires.

In addition, the actual or estimated completion dates of the projects included in the questionnaires ranged from 1967 to 1974. The projects in the DOD agencies' report were completed in fiscal year 1971. This difference may have a bearing on both construction costs and design and construction services charges.

ADDITIONAL INFORMATION ON CHARGES FOR SERVICES OF PRIVATE FIRMS

The American Society of Civil Engineers (ASCE) has published a manual entitled "Consulting Engineering--A Guide for the Engagement of Engineering Services," which includes suggested compensation curves for various engineering services related to construction. This manual outlines the functions of consulting engineers, the types of services they usually offer, the various bases on which they are compensated, and the general range of charges for their services. According to ASCE officials, the manual was intended to be used as an aid in initiating discussions and negotiating agreements between clients and engineers and in helping the public, clients, and engineers to establish reasonable compensation for engineering services.

In general, the manual illustrates that many factors influence the compensation for engineering services. One principal factor is the scope and nature of the services, which are referred to in the manual as basic or special services. Basic services include the following sequential phases.

1. Preliminary or design report phase--make preliminary studies, layouts, and cost estimates.

2. Design phase--prepare drawings, specifications, and contract documents.

3. Construction phase--act as owner's representative during construction.

Special services include special studies, tests, surveys, and/or investigations; technical observations of construction by full-time representatives or resident inspectors; special designs to meet unique criteria; and many other services not common to basic design. The manual notes that special services may add substantially to the total engineering cost of a project. DOD guidance requires that the costs reported to the Congress for design and construction supervision, inspection, and overhead include costs for surveying and mapping and other special tests, project management and administration, and other special services necessary for military construction.

The manual points out also that such factors as the type, size, complexity, and location of the projects influence the charges for engineering services.

The manual contains two curves which represent median compensation computed as a percentage of construction costs. These curves, which supposedly reflect the experience and judgment of consulting engineers throughout the United States, were developed from responses to detailed questionnaires sent out by ASCE in 1971. Noting that the compensation for a given assignment may vary above or below the curves depending on various factors, the curves illustrate that median compensation for basic services ranges from about 9 percent on a $100,000 project to 4.6 percent on a $100 million project of average complexity and from 11.6 percent on a $100,000 project to 5.6 percent on a $100 million project of above-average complexity.

The manual does not define "average complexity" or "above average complexity" projects, but it gives examples of the types of projects in these two categories. Examples of average-complexity projects include railways, roads and streets, storm sewers and drains, industrial buildings, warehouses, and garages. Examples of the above-average-

complexity projects are water and industrial waste treatm plants, public and office buildings, powerplants, foundations, and complicated waterfront facilities. The DOD agencies supervise the design and construction of both average complexity and above-average-complexity projects.

CHAPTER 4

COMPARISON OF DOD AND GSA CHARGES

A comparison of the DOD agencies' and the General Services Administration's (GSA's) charges for design and construction supervision may not be meaningful because of differences in the nature and location of their projects.

The following table shows GSA's average charges by selected project construction costs, as furnished by GSA.

Estimated construction costs	Average charge for design and design review	Average charge for construction supervision, inspection, and overhead	Average combined charge
$ 500,000	11.0%	11.0%	22.0%
2,000,000	9.1	6.2	15.3
5,000,000	7.5	5.0	12.5

GSA's charges are higher than the Corps' average charg of 12.4 percent and the Command's average charge of 11.4 pe cent. (See p. 14.) However, the construction programs of GSA and the DOD agencies differ in that GSA's programs are smaller in cost and do not appear to contain as wide a vari ety of facilities.

GSA said that the charges it furnished are average charges for all types of projects in the given cost categories and are based on services for projects financed by repair and improvement appropriations as well as by construction appropriations. Projects financed by repair and improvement appropriations include repairs, remodeling, alter ations, conversions, and extensions. Construction appropriations finance new construction as well as certain exten sions and conversions. The DOD agencies' charges were base on projects financed by military construction appropriation for new construction, alterations, expansions, and rehabili tation. We did not attempt to compare the nature of the projects to which GSA's and the agencies' charges for desig and construction supervision relate.

The Corps' and the Command's charges for construction supervision, inspection, and overhead are based on both domestic and overseas projects, whereas GSA's charges are based on only domestic projects. In addition, it appears that most of GSA's projects are in cities, whereas most of the DOD agencies' domestic projects are at military installations.

The design and supervision services of GSA and the DOD agencies appear to be similar; however, we were advised of certain differences which may affect their comparison. For example, the DOD agencies administer a contractor quality control program as a part of their supervision services, whereas GSA does not.

Also, GSA and the DOD agencies categorize costs of certain services differently. For example, GSA considers that the cost of soliciting bids on construction is related to design and design review; the DOD agencies consider that it is related to construction supervision and inspection.

CHAPTER 5

MATTERS FOR CONSIDERATION BY THE SUBCOMMITTEES

A number of factors which influence the DOD reported costs of design and construction supervision must be considered in measuring and comparing the management efficiency of the DOD construction agencies. Such factors include the organizational structures established to manage construction projects, the management techniques used in the design and construction supervision process, the nature and location of projects, and the quality of construction attained for the total project cost.

We suggest that the Subcommittees defer further studies of the DOD agencies' management efficiency until they have considered any changes affecting the comparability of reported costs that may result from the DOD study of the military departments' construction accounting systems. After considering any such changes, the Subcommittees could consider whether additional information on any of the specific factors influencing reported costs is needed from the Secretary of Defense to provide the Subcommittees with better visibility of the DOD agencies' management efficiency.

CHAPTER 6

SCOPE OF STUDY

The committee of conference (of the Senate and House) on fiscal year 1972 military construction appropriations asked us to investigate the efficiency of construction management and the fairness of charges by the DOD agencies for construction supervision, inspection, and overhead. The committee directed us to investigate the charges for similar work in private industry and to compare them with the DOD agencies' charges. (See app. I.)

We evaluated the use o design and supervision costs as measures of the construction management efficiency of the Corps, the Command, and the Air Force. As agreed with representatives of the conferees, we compared these costs among the DOD agencies and compared the agencies' charges for design and supervision with architect-engineer firms' charges. Also as agreed, we compared the DOD agencies' charges with GSA's charges for similar services. We also considered information in an engineering publication on services and charges by private engineers.

We based our comparison of the DOD agencies' costs on a review of their accounting policies and procedures for accumulating costs and on their report to the Congress on construction projects completed in fiscal year 1971. We held interviews with officials of DOD and GSA and with representatives of five architectural and engineering societies.

We made our review at the Office of the Assistant Secretary of Defense (Installations and Logistics), the Office of the Chief of Engineers, the Naval Facilities Engineering Command, and the Air Force Directorate of Civil Engineering. We also visited the Army Engineer District in Baltimore, Maryland, and the Command's Chesapeake Division in Washington, D.C.

EXTRACT FROM THE CONFERENCE REPORT ON
FISCAL YEAR 1972 MILITARY CONSTRUCTION APPROPRIATIONS
(H. Rept. 92-664, Nov. 10, 1971)

* * * * *

"Amendment No. 9 - General Provisions: The conferees have not included in the general provisions Section 111 whi was added by the Senate. However, both the House and the Senate conferees agree with the intent of this provision to reduce the cost of construction and to encourage more efficient management of construction within the Department of Defense.

"The conferees feel that a complete and unbiased investigation of the efficiency of construction management an the equitableness of charges by construction agencies for construction supervision, inspection, and overhead, as specified in Department of Defense Directive 7040.2, be conducted by the General Accounting Office and that a repor to the conferees be made within 10 months, with an interim report to be provided within 6 months. In conducting this study, the conferees direct the General Accounting Office to investigate the rates charged for similar work in privat industry and to compare them with those charged by Departme of Defense construction agencies."

* * * * *

APPENDIX II

DATA EXTRACTED FROM DOD'S REPORT SUBMITTED TO THE CONGRESS IN FEBRUARY 1972 IN COMPLY WITH THE REQUIREMENTS OF SECTION 604 OF PUBLIC LAW 91-511

Agent	Customer	Number and construction costs of projects completed in fiscal year 1971 (note a) Number	Construction costs	Average costs	Related design and supervision, inspection, and overhead (SIOH) costs Design costs	Percent of construction costs	SIOH costs (millions)	Percent of construction costs	Combined design and SIOH costs (millions)
			(millions)						
Corps	Army	220	$126.7	$0.576	$ 8.20	6.5	$ 8.70	6.9	$16.90
	Air Force	224	94.0	.419	7.60	8.3	6.40	6.8	14.20
	Defense agencies	2	.8	.400	.02	3.0	.06	7.0	.08
Corps' total (note b)	--	446	221.5	.497	16.02	7.2	15.16	6.9	31.18
Command	Navy	186	202.7	1,090	11.00	5.4	$12.70	6.3	23.70
	Army	1	5.4	5,400	.16	3.0	.34	6.3	.50
	Air Force	30	19.7	657	1.15	5.9	1.23	6.3	2.38
	Defense agencies	3	4.4	1,467	.24	5.5	.27	6.2	.51
Command's total (note b)		220	232.2	1,055	12.55	5.4	14.54	6.3	27.09
Air Force	Air Force	13	.9	.070	.08	8.3	.05	4.9	.13
Grand total		779	$454.6		$28.65		$29.75		$58.40

[a] Does not include costs of design and construction supervision, inspection, and overhead. Includes only those projects in which construction agents were responsible for both design and construction supervision.

[b] Average construction costs and percents of construction costs are weighted.

Consulting Engineers Council
of the United States

National Office
Madison Building
1155 15th Street N.W.
Washington D.C. 20005
Area Code 202 Phone 296 1780
Reply to

October 6, 1972

Mr. Robert G. Rothwell
Deputy Director
Logistics and Communications Division
United States General Accounting Office
Washington, D. C. 20548

Dear Mr. Rothwell:

The American Institute of Architects, the National Society of Professional Engineers and the Consulting Engineers Council of the United States appreciate the opportunity to assist the General Accounting Office in developing cost data on architectural and engineering services in private industry for use in your study of the management cost of the Department of Defense's construction program.

As has been pointed out previously in discussions with your staff, the purpose of the involvement of our three organizations was to ensure that representative and accurate data was obtained on private industry cost. From an analysis of the data, we are confident that this has been achieved.

This letter and the enclosed "Report on A-E Services Cost Survey" is intended to serve as a record of the manner in which the information was acquired and as a formal submission of the data which has been provided to your organization during the past several months.

We are pleased to have had the opportunity to assist the General Accounting Office in this study and would welcome the opportunity to assist in any further studies relating to architectural and engineering services.

Very truly yours,

James C. Donald
Administrator, Department of Government Affairs
American Institute of Architects

Milton F. Lunch
General Counsel
National Society of Professional Engineers

Bruce E. Vogelsinger
Assistant Director of Governmental Affairs
Consulting Engineers Council

APPENDIX [illegible]

REPORT ON A-E SERVICES COST SURVEY

Prepared by

The American Institute of Architects

The National Society of Professional Engineers

Consulting Engineers Council of the United States

For

The United States General Accounting Office

Introduction

In the Conference Report on H.R.22248, Military Construction Appropriations, 1972, the Congress directed the General Accounting Office to conduct a complete and detailed investigation of the efficiency and the equity aspects of charges by Department of Defense construction agencies for construction supervision, inspection and overhead. In the conduct of this study, the General Accounting Office was also asked to investigate the rates charged for similar work in private industry and to compare the rates with those charged by Department of Defense construction agencies. To ensure that reliable and accurate information was obtained on the cost for the private sector, AIA, NSPE and CEC contacted the General Accounting Office and offered their assistance. GAO accepted the offer and it was agreed that CEC would coordinate the effort on behalf of the three organizations. During the course of the study, each step was reviewed with GAO personnel and data, as it was developed, was provided to them for their use and comments. Although the Congress was primarily interested in the cost of services during construction and DoD overhead costs, it was later agreed, that to obtain a meaningful comparison, the total cost of all A-E services should be included. Consequently, the survey was planned to obtain the cost of all services from the predesign and conceptual stage through services during construction. The cost reported herein reflect total cost to the owner for A-E services necessary for the design and construction of facilities, and include salaries, direct and indirect overhead, profit, and taxes. Because of the complexity of establishing and making any meaningful

comparison of direct and overhead cost between the private sector and the government, no effort was made to accumulate such data. The survey was designed to accumulate only actual cost to the owner for A-E services.

Survey of A-E Firms

A random selection of 60 firms was made from Engineering News-Record's listing of the top 500 design firms in 1971. The firms included some of the largest and smallest on the listing. Those selected represented a mix of architectural and engineering firms and were chosen on the basis of those who would normally have the prime responsibility from preliminary design through services during construction. Since the survey was designed to obtain full cost for total services, firms limited to interprofessional practice were not included. A survey form was developed to obtain cost in the three categories of (1) predesign, (2) design services and (3) services during construction. Each of the selected firms was sent a letter asking them to submit cost data on ten individual projects for which they provided full services. The letter included a list of typical projects in the Military Construction Program and survey forms. A copy of the letter and survey form are attached to this report as enclosure (1).

Survey Responses

Of the 60 firms invited to participate in the survey, 30 responded and provided cost data on 245 individual projects. Each individual project was reviewed for completeness and consistency and 23 projects were rejected, including some performed for federal agencies. Each project was classified as architectural or engineering based on the classification of the New York State Association of Architects and the American Society of Civil Engineers. Architectural type projects represented 60% and the remaining 30% of the projects were classified as primarily engineering.

The services and cost reported for the predesign category varied considerably depending on the specific project, and in many cases were not reported because they were performed by the owner, not required, or the costs were included as part of the design services. For this reason, and since most predesign costs reported were considerably less than 1% of the construction cost, this data was not summarized. Additionally, it is our understanding that the costs for

[1] GAO note: A society representative advised us that these percentages should be corrected to read 70% and 30%, respectively.

preliminary services are not included in the figures reported by the Department of Defense, and therefore not needed for comparison purposes.

The cost for design services were reported separately on 214 projects. Some of the reports included the cost for services during construction in the design services category. These projects were excluded from the A-E paper summaries. The costs reported for design services include payment for work related to design changes requested by the owner and changes which may be necessary during construction.

Services during construction were reported to be performed on 198 projects. On 44 of the projects, the owner employed a clerk-of-the-works (resident inspector) to inspect construction. These were excluded from the summary which reports on 154 projects where complete design and services during construction were performed by the A-E firm. Full time resident inspection by the A-E was provided on 72 of these projects. For the remainder, these services were provided by periodic visits to the construction site.

Data Processing

The data on each project used in this report was keypunched and coded for type of project (architectural and engineering), owner description (state and local governments, industrial, private, etc.), and complexity of project (new, rehabilitation, unusual). A computer program was written to accumulate the average cost, as a percentage of construction, for design services, and services during construction. Services during construction were further classified as those for which (1) resident inspection was performed, (2) services during construction was accomplished by periodic site visits, and (3) the owner provided inspection services. These costs were tabulated for all projects and for a classification of projects based on construction volume. A program was also written to accumulate cost based on the type of project (architectural or engineering). Other programs can readily be written to accumulate average cost by owner classification or by complexity of projects should this be required by GAO.

Summary of A-E Cost

Table I summarizes the cost of design services, as a percentage of construction costs, for 214 projects having an average construction cost of $4.13 million. These projects are further classified by construction cost for individual projects.

Table II contains the cost of design services, services during construction and the total cost of complete A-E services on 154 projects. Again, these costs are designated as a percentage of construction and further classified by the construction cost for each project.

TABLE I

DESIGN SERVICES

Classification of Projects by Construction Value	Number of Projects	Total Value Construction ($ billions)	Average Project Construction Cost ($ millions)	Design Cost as % of Construction
All Projects	214	$883.03	$4.13	4.2
Less than $1 million	51	$ 24.84	$0.49	5.8
$1 to $2 million	55	$ 77.55	$1.41	5.1
$2 to $5 million	64	$199.51	$3.11	4.6
$5 to $10 million	27	$197.30	$7.31	4.4
$10 million and over	17	$383.63	$22.57	3.7

TABLE II

DESIGN AND SERVICES DURING CONSTRUCTION

Classification of Projects by Construction Value	Number of Projects	Total Value Construction ($ million)	Average Project Const. Cost ($ million)	Design Cost as % of Construction	Cost of Services During Construction % of Cost	Total A-E Cost of Const.
All Projects	154*	$491.93	$ 3.19	4.7	2.1	6.9
Less than $1 million	40	$ 19.06	$ 0.49	5.9	3.4	9.3
$1 to $2 million	38	$ 54.48	$ 1.43	5.0	3.2	8.2
$2 to $5 million	49	$153.59	$ 3.13	4.6	2.5	7.2
$5 to $10 million	19	$138.51	$ 7.29	4.4	1.9	6.3
$10 million and over	8	$125.70	$15.72	4.9	1.3	6.2

*Does not include projects which reported design services only, a single total for design and services during construction, or projects on which the owner performed a portion of the services during construction.

Conclusions

As could be expected, the cost of A-E services [illegible] with an increase in the average construction cost of a project. The only exception to this was the cost of design services for projects of $10 million and over in Table II. Design services for these projects were 1% higher than those in the $5 to $10 million category. This may be explained by the fact that only 8 projects were included in the $10 million and over category and one project could have a significant effect on the average.

The range of cost for A-E services was quite significant. Design services of 16.43% for a $143,000 communications building was the highest reported. The low was 1.35% for designing a $3.0 million warehouse. Design services for 33 projects exceeded 6.0% and these were predominately for small projects although a cost of 6.8% was reported for an $8.5 million industrial plant used to house sensative machine tools. These ranges indicate how unrealistic the statutory fee limitation of 6% is for design services on federal projects.

The intensity of services during construction was greater on engineering type projects than on architectural. On 82 of the projects where observation and inspection of construction was performed by periodic visits to the site, 84% were architectural. On the other hand, 64% of the 72 projects using resident inspectors were classified as engineering. This is understandable since the nature of civil engineering type projects frequently require the use of natural materials, constructed under variable conditions and covered after construction necessitating more constant surveillance of the construction. Whereas, architectural projects predominately utilize manufactured materials where the quality is controlled in the manufacturing process and these projects generally remain visable after construction.

It should be emphasized that the cost reported in this survey reflect total cost to the owner for the A-E services necessary to design and construct the facility. For the A-E firms, the compensation reported for their services must cover their total cost of doing business. These costs include wages and salaries, health benefits and retirement programs, rent, utilities, depreciation, insurance, interest on borrowed capital, local, state and federal taxes as well as profit and dues payments to professional societies and organizations such as the three that financed the cost of this report.

Gentlemen:

The United States Congress, through its Military Construction Appropriations Subcommittees, has directed the General Accounting Office to make an unbiased investigation of the efficiency and costs charged by Department of Defense construction agencies (Corps of Engineers and Navy Facilities Engineering Command) for the design and execution of the Military Construction Program. The Congress further directed the GAO to investigate the rates charged for similar work in private industry and compare them with those charged by Department of Defense construction agencies. To determine private industry costs the General Accounting Office has asked CEC, AIA and NSPE for assistance, hence the purpose of this letter.

Your firm is one of [illegible] architectural and/or engineering firms being asked to participate in a selective survey. The purpose of the survey is to determine the percent of construction cost for A/E and other related services for 1) pre-design, 2) design and 3) services during construction on individual projects for which construction was completed and your services were completed or substantially completed within the past year.

Projects to be included in this survey are those for which your firm had the responsibility for providing or contracting for all or substantially all of the services from feasibility report/design concepts through construction supervision/inspection. The type of projects selected should be somewhat similar to those in the Military Construction Program. A listing of these type projects is enclosed.

We would like each firm participating in the survey to provide information on ten individual projects and for this purpose we have enclosed ten survey forms. Although we would like information on ten projects for which construction was completed within the past year, this is not a firm requirement to participate in the survey. Any number that you can provide will be most helpful.

APPENDIX III

We trust the survey form is self-explanatory. As you will note from the for we are interested only in the amount you were paid for your services includi those which you may have subcontracted. We are not interested in any overhe or profit (loss) data. The Consulting Engineers Council is coordinating the work of the three organizations. The forms should be returned to CEC and sh you have any questions please feel free to contact

Mr. Bruce E. Vogelsinger
Consulting Engineers Council
Room 713
1155 15th Street, N.W.
Washington, D. C. 20005
Phone: (Area 202) 296-1720

Although we do not feel that we are asking for any information which is nec sarily confidential, we will tabulate the data in such a manner so as not to relate the firm with their specific projects. Upon completion of the tabula and summarizing the data all firms who participate in the survey will be pro with a copy of the report.

Should you for some reason not desire to participate in the survey, please l us know in order that we may select another firm.

GAO has asked us to provide the information to them by April 1, in order tha they may make a preliminary report to the Congress by May 1. Consequently, need to receive your information no later than March 27.

In anticipation of your willingness to participate in this survey, we wish t express our sincere appreciation for your effort and cooperation.

Very truly yours,

TYPICAL PROJECTS INCLUDED IN THE MILITARY CONSTRUCTION PROGRAM

Airfield pavements
Communications buildings (radio, telephone, etc.)
Antenna systems, towers, beacons, etc.
Waterfront facilities (piers, wharfs, etc.)
Harbor and coastal facilities
Educational facilities (schools, classrooms)
Maintenance shops
Production or factory-type buildings
Laboratories or research buildings
Warehouses
Hospitals
Medical facilities other than hospitals
Office buildings
Dormitories
Apartments
Housing
Electrical, water, gas, or heat plants
Sewage treatment facilities
Roads, streets, sidewalks, or parking lots
Community-type buildings (fire and police stations, jails, laundries, bakeries, dry cleaning plants, indoor recreational buildings, libraries, banks, restaurants, bus stations, stores, etc.)

APPENDIX III

A/E SERVICES COST SURVEY

DESCRIPTION OF PROJECT (describe end use, size/capacity of facility)

OWNER (name not required) describe owner - such as private developer, state agency, local government, etc.

CONSTRUCTION COSTS.....$
(total construction cost of facility excluding A/E services)

Duration of Construction ____ months; Year Construction Completed ____

PREDESIGN		
Services	Service Performed (Yes or No)	Dollar Amount Paid for Services
Economic Studies		
Feasibility Report		
Test Borings		
Soil Tests		
Property Survey		
Topographic Survey		
SUBTOTAL PREDESIGN SERVICES.....		$
PERCENT OF CONSTRUCTION COST.....		%

DESIGN SERVICES		
Design	Service Performed (Yes or No)	Dollar Amount Paid for Services
Architectural		
Electrical		
Mechanical		
Structural		
Other _____		
SUBTOTAL DESIGN SERVICES.....		$
PERCENT OF CONSTRUCTION COST.....		%

PLEASE TURN P

A/E SERVICES COST SURVEY Page 2

SERVICES DURING CONSTRUCTION		
Services During Construction	Service Performed (Yes or No)	Dollar Amount Paid for Services
Preparation of Bid Documents		
Analysis of Bids and Award		
Construction Surveys and Stake Out		
Observation (Supervision)		
Resident Inspection		
SUBTOTAL SERVICES DURING CONSTRUCTION.....		$
PERCENT OF CONSTRUCTION COST.....		%

SUMMARY		
SUMMARY	Dollar Amount Paid for Services	% of Construction Cost
Predesign		
Design		
Services During Construction		
TOTAL		

SUPPLEMENTAL INFORMATION

Intensity of Observation and Inspection:

A. If you performed periodic observation services, what was the average frequency of visits to the construction site _____/month?

B. If you provided resident inspection services what was the average number of full time inspectors on the job through the duration of construction _____?

C. Was a clerk-of-the-works employed by the owner to inspect construction on this project? Yes _____ No _____

Distance of Construction Site from Your Project Office..._____ miles

Unusual Factors Effecting Costs. Were there any unusual factors on this project which caused the costs of your services to vary significantly from cost you consider to be normal for this type of project? Yes___ No___. If yes, please specify

_____

_____

_____

_____

PLEASE RETURN BEFORE MARCH 27, 1972