

BY THE COMPTROLLER GENERAL

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Report To The Congress

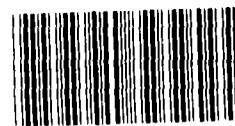
OF THE UNITED STATES

Conventional Design And Construction Methods Are More Applicable For Capitol Hill Construction Projects

Attempts by the Architect of the Capitol to use a phased construction method, under which construction is begun on some segments of a project while others are still being designed, have contributed to cost overruns, completion delays, and management problems on congressional building projects.

GAO's reviews of recent projects show that phased construction does not work well for Capitol Hill construction projects due to the numerous reviews and approvals required at each phase, funding problems, complexity of design and quality of construction required on monumental buildings, and likelihood of numerous design changes.

The Architect might be able to minimize or alleviate some of these problems by trying more conventional design and construction methods. GAO recommends other actions the Architect should take to improve the management of construction activities before undertaking the planned restoration of two Library of Congress buildings.



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

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To the President of the Senate and the
Speaker of the House of Representatives

This report describes the problems encountered by the Architect of the Capitol in trying to construct or renovate buildings on Capitol Hill. It recommends ways for the Architect to improve his construction activities.

Our previous reports in this area were concerned with individual Capitol Hill projects. This report represents our overall evaluation of the Architect's construction activities, including updating the information in our past reports and identifying the underlying causes of the Architect's problems.

We are sending copies of this report to the Director, Office of Management and Budget; the Architect of the Capitol; and the Librarian of Congress.

Charles A. Bowater

Comptroller General
of the United States



D I G E S T

Over the last 12 years, each of the Architect of the Capitol's four major construction projects has experienced significant cost overruns, completion delays, and management problems. The Architect and the Library of Congress are now proposing to restore two Library buildings. Unless care is taken to avoid the types of problems experienced on the other projects, the restoration project could also encounter cost overruns and completion delays. (See app. III.)

Previous GAO reports in this area were concerned with individual Capitol Hill projects. This report represents GAO's overall evaluation of the Architect's construction activities, including updating the information in GAO's past studies of three projects, identifying the underlying causes for the Architect's problems, and informing the Congress of changes needed to help minimize or avoid the pitfalls that have plagued previous Capitol Hill projects.

CONSTRUCTION PROJECTS

Hart Senate Office Building

Although originally conceived as a \$48 million replica of the Dirksen Office Building, by March 1981 a total of \$137,730,400 had been appropriated for the project. Further, even though design work on the project started in 1973, the Architect now estimates that the project will not be completed until 1983. (See pp. 4 to 6.)

Because of the project's increased scope, inflation, and the attempts to design the building as it is being constructed, the \$137,730,400 has proven insufficient to construct the project as designed. In the absence of additional funds, the Architect has

--deleted certain items from the project, such as the basement cafeteria, multimedia room, ninth floor dining room, auxiliary offices, police facility, athletic equipment, security

stations, computer central control system, gym facilities, and wood paneling in the Senators' offices;

--decided not to complete certain portions of the project; and

--reduced the quality of the project by substituting less expensive materials than originally called for in the project's design. (See pp. 7 to 9.)

The Architect proposes to use maintenance funds to do some of the work on the project that had to be deleted because the \$137,730,400 has proven inadequate to construct the project as designed. (See p. 9.)

Library of Congress James Madison Memorial Building

In April 1967 the associate architect that designed the project estimated that it could be built in 42 months at a cost of \$75 million. As of July 1981, the project still was not finished, and appropriations for the project had increased to \$130,675,000. (See pp. 9 to 13.)

The Architect now estimates that the \$130,675,000 will be sufficient to complete the project, exclusive of the interior contractor's \$23.5 million claim for time delays. Although officials from the Architect's Office believe that the claim eventually will be settled for considerably less than \$23.5 million, they acknowledge that additional funds will be needed to pay the claim. (See p. 13.)

House Office Building Annex No. 2

The renovation project started out originally as a \$14.5 million conversion into office space of a Federal building used primarily for storage. (See pp. 13 and 14.) By March 1981 the Architect had spent all \$25.5 million appropriated for the renovation and had suspended work on the project because of the lack of funds. (See pp. 16 and 17.)

The Architect's latest analysis shows that about \$2.2 million will be needed to complete the project. (See p. 16.)

Originally, about 370,000 square feet of the building were to be renovated for use as office space. However, because of the funding difficulties, only about 216,000 square feet--about a 42-percent reduction--have been renovated for office use. (See p. 16.)

From the start, the Architect has attempted to limit the direct renovation costs by reducing the scope of the project. Most of the scope reductions involved refurbishing or remodeling existing equipment and/or systems, as opposed to installing new ones. This could result in higher operation and maintenance costs for the building. (See pp. 14 to 16.)

Capitol Power Plant

Originally planned for completion in mid-1975 at a cost of \$18.6 million, the project to modify and enlarge the Capitol Power Plant is now scheduled for completion in mid-1982 at a cost of \$30.6 million. (See p. 48.)

As of July 31, 1981, about \$27.1 million of the \$30.6 million appropriated for the project had been obligated. However, the actual cost of the project is difficult to determine because at least \$525,000 of the charges against the Capitol Power Plant project's appropriations have been for work done on other Capitol Hill projects. (See pp. 47 and 48.)

Library of Congress buildings

The Architect and the Library of Congress are proposing a major restoration/firesafety project--currently estimated at about \$55.5 million--for the Library's Jefferson and Adams Buildings. (See p. 55.)

An associate architect has developed a presentation--currently under review by the Architect's Office and the Library--that covers the preliminary design of the restoration, plus cost estimates and scheduling plans for the overall restoration/firesafety project. (See pp. 55 and 56.)

This proposed project is already encountering some of the same conditions that caused problems on other Capitol Hill projects. GAO is concerned that

- funding delays have already occurred;
- no realistic cost and work schedule estimates have been developed;
- current plans call for the work to be done in phases while the buildings are occupied; and
- the Architect plans to use his in-house work forces, even though it has not been shown that this is the best approach. (See pp. 56 to 60.)

FACTORS CONTRIBUTING TO PROBLEMS

Design and construction methods

Most Federal agencies generally use what is known as the "conventional method" to design and construct projects; that is, a project is first designed and then a single contract is awarded to construct the project. (See p. 18.)

For the recent additions to Capitol Hill--Madison and Hart Buildings--the Architect has attempted to apply some or all of the principles of a design/construction process known as "phasing." Under the phasing process, the project is divided into phases (construction segments), and construction begins on some phases while others are still being designed. In theory, through overlapping, phasing is supposed to shorten a project's design/construction cycle and thus save time and costs. (See p. 19.)

As far back as its April 1967 report on the Rayburn Building, however, GAO concluded that phasing was not compatible with Capitol Hill construction projects. Then, GAO recommended that the Architect use the conventional method to design and construct his projects. (See p. 19.)

After reviewing the Madison and Hart projects, GAO is convinced that the Architect's attempts to use phasing are primary factors contributing to problems on those projects. Rather than shortening the design/construction cycles and reducing costs, the Architect's various attempts at phasing have contributed to cost escalations, time delays, and management problems experienced on these two projects. (See pp. 19 and 20.)

To be effective, phasing requires that as each segment of a project is designed, it be quickly put out for bid. Accordingly, phasing works best in those situations where the design and construction processes are not subjected to potential delays or problems. (See p. 20.)

To the contrary, the Architect's construction projects are fraught with potential delays and problems. Specifically, GAO believes that phasing is not compatible with Capitol Hill projects because of the

- myriad of reviews and approvals required throughout the planning/design/construction cycle (see pp. 20 to 22),
- funding problems that often prevent the prompt and timely award of multiple construction contracts (see pp. 22 and 23),
- complexity of design and quality of construction required on monumental buildings (see pp. 23 and 24), and
- likelihood of numerous design changes throughout a project's design/construction cycle (see pp. 24 to 26).

Inadequate project control systems

In its report on the Hart project, GAO noted that the Architect did not have adequate systems for controlling time and cost on major construction projects. The Architect subsequently took certain actions on the Hart project that appear to address the project control and management problems cited in GAO's report. However, it is too soon to evaluate the effectiveness of the Architect's actions. (See pp. 32 to 34.)

No standard policies and procedures

The Architect has not developed standard policies and procedures for associate architects commissioned to work on Capitol Hill projects. This increases the time and cost incurred by the associate architects in familiarizing themselves with such things as general design criteria, performance standards, preparation of drawings and claims, and general operating procedures. (See p. 34.)

Inadequate inventory controls

The Architect's inventory control system does not provide adequate controls over materials dispatched to job sites. As a result, it is difficult to verify that materials were delivered to and used on a particular job site for a particular project. (See pp. 34 to 36.)

Use of in-house work forces

The Architect plans to use his in-house work forces to restore the two Library buildings. Until the restoration plan is developed, however, GAO does not believe it is feasible to determine which type of approach--in-house, contracted-out (contracting with a general contractor), or some combination thereof--is best suited for restoring the Library buildings.

Because of the size of the Library restoration project and the artistic considerations involved, GAO is concerned that the Architect may be unable to recruit and retain the necessary in-house work forces, in terms of numbers and artistic expertise, to effectively and efficiently restore the Library buildings. (See p. 36.)

Occupancy and phased restoration

GAO's report on House Office Building Annex No. 2 demonstrated how partial occupancy of the building and phasing the renovation work have been the primary factors contributing to the delays in completing the project. It now appears that the Library buildings also will be restored in phases while they are partially occupied.

GAO recognizes that it may be necessary to keep the Library buildings operating while they are being restored. If this proves to be the situation, GAO believes that the Architect and the Library should try to minimize the number of phases and the amount of occupancy to try to avoid or lessen the problems that have occurred on House Annex No. 2. (See p. 37.)

RECOMMENDATIONS

To minimize or alleviate some of the problems that have plagued Capitol Hill projects designed and constructed using the phasing process, GAO recommends that the Architect of the Capitol try

more conventional planning/design/construction methods for major projects. (See p. 31.)

GAO also recommends that the Architect:

- Develop standard policies and procedures for associate architects regarding general design criteria, performance standards, and general operating procedures.
- Improve inventory controls over construction materials to ensure that the materials are properly used.
- Thoroughly study which type of approach-- in-house, contracted-out, or some combination thereof--is best suited for effectively and efficiently restoring the Library buildings.
- Minimize the number of phases and amount of occupancy during the restoration of the Library buildings. (See p. 39.)

AGENCY COMMENTS

Architect of the Capitol

The Architect disagreed with GAO's conclusions and recommendation regarding the incompatibility of phasing and Capitol Hill construction projects, maintaining that GAO's findings were "conclusory in nature" and based on an insufficient analysis of all the factors involved. The Architect continues to support the use of phasing on certain projects, depending on the circumstances.

Because all recent Architect of the Capitol projects have been constructed using the phasing process, it was not feasible to make a comparative analysis of phasing versus the conventional method for Capitol Hill projects. However, considering the problems encountered on the Hart and Madison projects and the inherent factors--multiple reviews, funding delays, complexity of design and quality of construction, and design changes--on Capitol Hill that are contrary to the effective use of phasing, GAO believes that the Architect should try the conventional method to see if it can help minimize or alleviate the problems on future projects. (See pp. 28 to 31.)

Regarding GAO's conclusions and recommendations on other aspects of the Architect's construction activities, the Architect said that the other

suggestions contained in the report are creditable, provided that appropriate recognition be given to the special circumstances which the Architect sometimes encounters. (See pp. 39 to 42.)

Library of Congress

In commenting on GAO's draft report, the Library of Congress stated that the report accurately described the situations relative to the design and construction of the Madison Building and the proposed project to restore the two Library buildings. (See p. 42.)

C o n t e n t s

		<u>Page</u>
DIGEST		i
CHAPTER		
1	INTRODUCTION	1
	Architect of the Capitol	1
	Objectives, scope, and methodology	2
2	AOC CONSTRUCTION PROJECTS	4
	Hart Senate Office Building	4
	James Madison Memorial Building	9
	House Office Building Annex No. 2	13
3	CONVENTIONAL DESIGN AND CONSTRUCTION METHODS SHOULD BE TRIED FOR CAPITOL HILL PROJECTS	18
	Phasing principles not compatible with Capitol Hill projects	18
	Conclusions	27
	Agency comments and our evaluation	28
	Recommendation	31
4	AOC SHOULD CONSIDER OTHER FACTORS TO MINIMIZE OR ALLEVIATE CONSTRUCTION PROBLEMS	32
	Inadequate project control systems	32
	No standard policies and procedures for associate architects	34
	Inadequate inventory controls	34
	Use of in-house work forces	36
	Occupancy and phased restoration	37
	Conclusions	37
	Recommendations	39
	Agency comments and our evaluation	39
APPENDIX		
I	GAO reports on AOC construction projects	43
II	Modifications and enlargement of the Capitol Power Plant	44
III	Restoration of Library of Congress buildings	50
IV	Letter dated July 28, 1981, from the Architect of the Capitol	61

ABBREVIATIONS

A/E architect/engineer
AOC Architect of the Capitol
GAO General Accounting Office
GSA General Services Administration

CHAPTER 1

INTRODUCTION

Over the past 4 years, at the requests of either a committee or Members of Congress, we have reviewed the major construction projects of the Architect of the Capitol (AOC). These reviews have resulted in the issuance of individual reports on three projects (see app. I), 1/ all containing similar findings that AOC construction projects experience significant cost overruns, completion delays, and management problems. These same conditions are also evident on the latest AOC project nearing completion--the modifications and enlargement of the Capitol Power Plant (see app. II).

The AOC is planning a major restoration project involving two Library of Congress buildings (see app. III). Unless care is taken to avoid the types of problems experienced on the other projects, the proposed restoration project could also encounter cost overruns and completion delays.

Our previous reports were concerned primarily with cost overruns and completion delays. In accordance with the intent of the requesters, the reports contained no recommendations concerning the way AOC projects are approved, funded, designed, constructed, and managed. This report updates our previous studies of three Capitol Hill projects, identifies the underlying causes for the AOC's problems, and informs the Congress of changes needed to help minimize or alleviate the pitfalls that have plagued previous Capitol Hill projects.

ARCHITECT OF THE CAPITOL

The Office of the AOC has been in existence since 1851. Originally, the AOC was responsible for planning, constructing, and maintaining the Capitol Building. Currently, the AOC is responsible to the Congress for the (1) structural and mechanical care, maintenance, and operation of the Capitol Building, the Senate and House office buildings, the Supreme Court Building, the Library of Congress buildings, and related facilities, (2) care and improvement of the Capitol grounds, (3) operation of the Senate and House restaurants, and (4) planning and construction of such buildings as the Congress may assign to him. These additional responsibilities resulted primarily from the Act of August 15, 1876, as amended (40 U.S.C. 162).

Since the mid-1950s, the AOC has supervised or is supervising the design and construction of three major additions to Capitol Hill--the Rayburn House Office Building, the Hart Senate

1/Also, on April 7, 1967, we reported on the construction and related costs of the Rayburn House Office Building (see app. I).

Office Building, and the James Madison Memorial Library Building. Also, the AOC is converting a former Federal building used primarily for storage into office space (House Office Building Annex No. 2) and is modifying and enlarging the Capitol Power Plant. The AOC is also planning to restore two Library of Congress buildings, the Thomas Jefferson Building and the John Adams Building.

OBJECTIVES, SCOPE, AND METHODOLOGY

In 1979, at the request of the Chairman, Subcommittee on Legislative Branch, House Committee on Appropriations, we reviewed the Madison Library, House Annex No. 2, and Capitol Power Plant projects, plus the proposed restoration of the two Library buildings. Our review showed that the three ongoing projects were experiencing the same situations--cost overruns, completion delays, and management problems--found in our previous reviews of the Rayburn and Hart projects. At the same time, we noted that the AOC's planned approach to restoring the two Library buildings involved some of the same processes and procedures that had contributed to problems on other projects.

In July and September 1979, we issued reports to the Chairman on the House Annex No. 2 and Madison Library 1/ projects, respectively, and briefed him on the status of the reviews of the Power Plant and the two Library buildings. At the briefing, we noted that the piecemeal approach of reviewing each AOC project separately was not conducive to correcting the problems so prevalent on all major AOC construction projects. We believed that an overall analysis of the way AOC projects were approved, funded, designed, constructed, and managed was needed. This approach, by looking at the AOC's construction activities in total, would help to identify the underlying factors causing the common problems. Without such an approach, we believed that the two Library buildings, as well as future AOC construction projects, would experience the same problems found on the other Capitol Hill projects.

The Chairman concurred with our suggestions, and an agreement was reached that, for this review, we would

- develop an overall report to the Congress on the AOC's construction activities, including the approval and funding aspects of AOC projects and
- include analyses of the remaining projects (the Power Plant and the two Library buildings) as appendices.

1/We also issued the Madison Library report to the Ranking Minority Member, Subcommittee on Public Buildings and Grounds, House Committee on Public Works and Transportation, pursuant to his Apr. 17, 1979, request.

Our review consisted of three main segments:

- An update of our previous reports on the Hart, Madison, and House Annex No. 2 projects (ch. 2).
- An overall evaluation of the practices and procedures used by the AOC in designing, constructing, and managing major projects (chs. 3 and 4).
- An analysis of the remaining AOC projects--the modifications and enlargement of the Capitol Power Plant and the restoration of the Library's Jefferson and Adams Buildings (apps. II and III, respectively).

We made our review at the offices of the AOC, various architectural/engineering firms commissioned by the AOC to design the projects (referred to as associate architects), and the Library of Congress. We reviewed project records, spoke with appropriate officials, and examined the AOC's contracting techniques.

CHAPTER 2

AOC CONSTRUCTION PROJECTS

Over the last 12 years, the AOC has undertaken four major construction projects. Each project has experienced significant cost overruns, completion delays, and management problems.

For three of the projects--Hart, Madison, and House Annex No. 2--we have issued reports (see app. I). This chapter highlights the findings in those reports and updates the current situations regarding the projects. Appendix II contains an analysis of the fourth project--the modifications and enlargement of the Capitol Power Plant.

HART SENATE OFFICE BUILDING

Public Law 92-607, approved on October 31, 1972, appropriated \$47,925,000 for construction of an extension (eastern half) to the Dirksen Office Building. However, even before the authorizing legislation was signed, the then Senate Committee on Public Works requested the AOC to consider constructing a building that would provide more space and flexibility than the proposed replica of the existing Dirksen Building.

In January 1974 the AOC informed the associate architect that additional funds had been provided to expand the project to include

- a 45-percent increase in use of the authorized building site;
- an extension of the Senate subway system;
- construction of additional floors on the rear center wing of the Dirksen Building;
- changes to the Dirksen and Russell Buildings to provide improved circulation to, in, and through those buildings and the Hart Building; and
- other changes required to properly correlate use of the three buildings.

For designing and constructing the project, the associate architect recommended a process known as "phasing." When properly carried out, phasing, by overlapping the design and construction efforts, is supposed to significantly shorten the overall design/construction cycle of a project. However, the AOC's investigation showed that phasing was too risky for a custom-designed and built structure requiring a flexible design and a lifespan of over 100 years. Instead, the AOC and the associate architect decided that the project would be designed sequentially and built in segments.

Specifically, there were to be six contracts (phases) for the project: (1) construction of a temporary access area to the Dirksen Building, (2) excavation and foundation, (3) procurement of exterior stone, (4) construction of the superstructure, (5) interior and related work, and (6) demolition and renovation of specific areas of the Dirksen and Russell Buildings and the Russell courtyard.

Also, under the original concept, the building would have been comparable to a typical commercial office building in quality of materials and methods of construction. However, as work on the design progressed, the quality of both the construction methods and the materials was continually upgraded so that the Hart Building would conform to the monumental criteria typical of Capitol Hill structures.

To compensate for the increased scope and quality of the project and for inflation, an additional \$37,222,000 was appropriated for the project in 1974. 1/ This increased total appropriations for the project to \$85,147,000, exclusive of funds for furniture and furnishings and the cost of expanding the Capitol Power Plant to service the building.

On January 23, 1978, the AOC asked the Senate Office Building Commission to increase the project's authorized limit to \$122,647,000 by appropriating an additional \$37.5 million. At that time, the first four contracts had been awarded. On February 28, 1978, the Commission unanimously adopted a motion directing us to review the project, including its costs.

Our August 14, 1978, report on the Hart project concluded that the additional \$37.5 million requested by the AOC would be insufficient to complete the project as designed. In September 1978 the House rejected the AOC's \$37.5 million additional funding request.

For fiscal year 1979 the AOC sought an additional \$57,480,200 (total authorization of \$142,627,200) for the project. In September 1979 the Congress raised the project's total authorization to \$137,730,400, by appropriating an additional \$52,583,400 for the building. 2/

In April 1973 the associate architect estimated that once the program for the project was established, the building would be ready for occupancy in 4 years. At the time of our August 1978 report, the AOC was estimating that construction would be completed by June 1, 1981.

1/Public Law 93-245 (Jan. 3, 1974) appropriated \$20,900,000 and Public Law 93-554 (Dec. 27, 1974) appropriated \$16,322,000.

2/Public Law 96-69 (Sept. 25, 1979).

Our report, in questioning the reasonableness of the AOC's June 1981 estimate, noted that a realistic timetable probably was not feasible because of:

- The quality of construction needed to build a project having a lifespan of more than 100 years, which negated using the methods of time estimating prevalent in the construction industry.
- The degree of perfection required in the contract documents, including the review and correction processes.
- The impact of congressional review and approval on project design, construction, and funding.
- The continuing changes to the project's design.

By February 1981 the AOC was estimating that the project would be completed in early 1983.

A major factor cited in our 1978 report as contributing to the project's delays was the lack of preliminary planning and development of a definitive program detailing the Senate's space requirements. Generally, a detailed program is developed before a design firm is selected and frequently before any funds are requested for a project. In this instance, the AOC's preliminary planning was primarily related to supporting the need for the additional space. As a result, the programming effort, which was made part of the associate architect's contract, extended from May 1973 through the preparation of the documents for each contract. In effect, the space requirements program was developed and expanded as the project progressed.

Other factors cited in our 1978 report as contributing to the delays included (1) congressional review and approval of schematic drawings, (2) multiple AOC reviews of contract documents, and (3) changes to the design, sometimes even after final drawings for a contract had been approved and signed by the AOC.

Regarding the decision to design the project sequentially and build in segments, our report noted that this eliminated two of the supposed major benefits of phasing:

- There was no significant overlapping of the design and construction efforts, and thus no shortening of the overall design/construction cycle.
- The use of multiple construction contracts did not reduce the project's exposure to escalating market costs, since the contracts involving the major construction costs of the project (superstructure and interior) were not awarded in the early stages of the design/construction cycle.

Our report also contained findings regarding the AOC's lack of adequate systems for controlling major construction projects and the absence of standard policies and procedures for associate architects. These issues are discussed in detail in chapter 4.

Current status of Hart project

Since we issued our August 1978 report, the AOC has experienced additional cost and delay problems on the Hart project. As discussed below, without additional funds, the AOC will be unable to complete the project as designed.

In August 1978 the AOC invited bids on the phase 5 contract for the interior and related work. However, because the Congress denied the AOC's requested \$37.5 million in additional funds for the project in September 1978, the AOC was unable to award the complete interior and related work contract. By issuing addendums to the bid package, the AOC was able, in effect, to divide the contract into two parts: phase 5a and phase 5b.

In December 1978 the AOC awarded a \$16,898,000 contract for that part of the interior and related work included under phase 5a. Work under that contract is scheduled for completion by July 1982.

After the Congress authorized the additional \$52,583,400 in September 1979, the AOC prepared six separate bid packages--phase 5b and phases 5b1 through 5b5--for most of the remainder of the interior and related work. Three of the six phases were for construction work, with the remaining three involving material procurements. Subsequently, phases 5b and 5b1 were combined into one package, while the interior stone procurement, originally part of phase 5b, was made a separate bid package as phase 5b6.

As of July 1981 the status of the contracts for the interior and related work was as follows:

- Phases 5a, 5b (including the previously separate 5b1), 5b2, and 5b6 (originally part of 5b) had been awarded.
- Phases 5b3, 5b4, and 5b5 had not yet been awarded. (The AOC estimated that the last of these three phases could be awarded as late as October 1981 without adversely affecting the project's estimated completion date of early 1983.)

However, award and completion of all the current contracts under phases 5a and 5b (including 5b2 through 5b6) will result in considerably less interior and related work than originally designed for the project. Because the \$137,730,400 has proven insufficient for constructing the project as designed, the AOC, without additional funds for the project, will delete the

- basement cafeteria;
- multimedia room;
- ninth floor dining room;
- wood paneling in the Senators' offices;
- auxiliary offices;
- police facility;
- athletic equipment;
- automatic materials distribution system above the ground floor;
- vertical blinds;
- security stations;
- computer central control system;
- light dimming system for the Senators' offices;
- dumbwaiter; and
- gym facilities, including toilets and showers.

In addition to the deleted items, certain portions of the project will not be completed, including:

- Restoration of the Dirksen Building to compensate for the temporary access work done under phase 1.
- Renovation work in the existing (Dirksen Building) basement and ground floor print shop.
- Renovation work in the existing (Dirksen Building) ground floor.
- Phase 6--demolition and renovation of specific areas of the Dirksen and Russell Buildings and the Russell courtyard.
- Finishing work for the interior first floor of the Dirksen Building's new central wing.

Reducing the scope of the project by deletions and leaving certain portions of the project unfinished are not the only efforts being made by the AOC to limit project costs. The AOC is also lowering the quality of certain parts of the project by substituting less expensive materials than originally called for in the project's design. Presented below are some typical substitutions that had taken place as of October 1980.

- Use of plaster instead of the original marble requirements for the monumental stairs and the skylight coffers.
- Deletion of plaster ceilings in substantial portions of the building.
- Use of gypsum board instead of plaster for numerous interior finishes.
- Reduction in size of ceiling light fixtures and deletion of some of the propriety fixtures originally specified.
- Substitution of anodized aluminum (later reduced to gypsum in some cases) for bronze for interior metal.
- Substitution of thinner, hollow, metal door frames for wood door frames in the Senators' offices.

Use of maintenance funds

The AOC is now requesting funds beyond those directly appropriated for the Hart project to do work related to the project. For fiscal year 1982 the AOC is requesting \$5 million in no-year funds, as part of the maintenance funds provided under the Senate Office Buildings' appropriation, to do work involving the (1) renovation of existing ground and basement floors in the Dirksen Building, (2) removal of the temporary access area at the Dirksen Building, and (3) relocation of support functions in the Dirksen and Russell Buildings. Most of the work had been within the scope and funding of the Hart project, but, as discussed previously, was deleted by the AOC because the \$137,730,400 has proven insufficient to construct the project as designed.

JAMES MADISON MEMORIAL BUILDING

The Library of Congress James Madison Memorial Building is the result of the need for more Library space and the effort to build a memorial to James Madison. Although the projects started out as separate concepts, they were eventually combined through legislative action. Originally, the Madison Building was to be used primarily for book collection activities, however, over the years, the project evolved into a structure serving mainly office-type functions.

The first legislative acts relating to the project occurred with the passage of Public Law 86-469, approved on May 14, 1960 (2 U.S.C. 141 note), which authorized the AOC to begin preliminary planning for a third Library building, and Public Law 86-628, approved on July 12, 1960 (74 Stat. 446), which appropriated \$75,000 for that purpose. Previously, in April 1960, the James Madison Memorial Commission had been created to develop plans for the design, construction, and location of a permanent memorial to James Madison in Washington, D.C.

From 1961 to 1965 various resolutions seeking approval for a third Library building and/or a memorial to James Madison were introduced in the Congress. The resolutions eventually resulted in Public Law 89-260 (2 U.S.C. 141 note), which authorized the construction of the Library of Congress James Madison Memorial Building, including a Madison Memorial Hall, at a total construction cost not to exceed \$75 million. The Supplemental Appropriations Act of 1966 1/ provided \$500,000 for preliminary planning for the project.

Since the initial authorization of \$75 million in 1965, the project's cost has escalated. As of July 1981 a total of \$130,675,000 had been appropriated for the project. 2/ At the time our September 17, 1979, report was issued, the AOC was requesting an additional \$3.5 million (increasing the total appropriations to \$134,175,000) and estimating that the project would be completed by January 1980.

Our September 1979 report, in discussing the additional \$3.5 million being requested by the AOC, concluded that \$134,175,000 might not be sufficient to complete the project because (1) the AOC probably would not be able to meet his January 1980 estimated completion date and (2) the claims from the phase 4 (interior) contractor would probably exceed the available contingency allowances.

The additional \$3.5 million requested by the AOC was never acted on by the Congress. In July 1980 the AOC estimated that the project could be completed for its authorized limit of \$130,675,000, 3/ exclusive of the cost to settle a claim of \$23.5 million for time delays from the phase 4 (interior) contractor.

The AOC took beneficial occupancy 4/ of most of the building on April 18, 1980. The AOC estimates that he will use the \$130,675,000 in appropriations to pay all bills and settle all

1/Public Law 89-309, approved Oct. 31, 1965 (79 Stat. 1133).

2/The estimated cost of furniture and furnishings for the project has also increased, from \$8 to \$10 million in the 1960s to about \$24.2 million as of October 1980. In October 1980 Library of Congress personnel stated that future requests probably will be made for additional funds for furniture and furnishings for the building.

3/Does not include land acquisition costs (about \$5.7 million), furniture and furnishings (about \$24.2 million as of Oct. 1980), plus certain other indirect costs, such as expansion of the Capitol Power Plant, consultant services, and AOC overhead.

4/Beneficial occupancy allows the AOC's personnel to enter the area to do in-house work but does not connote final acceptance of the contractor's work.

claims related to the project, exclusive of the phase 4 contractor's \$23.5 million claim for time delays. Although AOC officials believe that the claim will eventually be settled for considerably less than \$23.5 million, they acknowledge that additional funds will be needed to pay the claim.

Funding and construction

The major factor contributing to the escalated cost of the project has been inflation resulting from delays in funding, designing, and constructing the building. For example, although the preliminary plans and cost estimates were completed in July 1961, legislation authorizing the project was not approved until October 1965. Subsequently, the project experienced delays that added more than 10 years to the associate architect's original estimated completion date of January 1971.

In 1967, upon approval of the associate architect's preliminary design, the AOC requested \$2.8 million for contract plans and specifications. However, in both 1968 and 1969 the AOC's request was denied by the Congress, primarily for budgetary reasons. In January 1969 the associate architect's estimator, citing increased costs due to inflation, revised his 1967 estimate of \$75 million to \$90 million.

The AOC's \$2.8 million request was included in the 1970 Legislative Branch Appropriations Act, approved on December 12, 1969, contingent upon the project's total authorization being increased to \$90 million. Public Law 91-214, approved on March 16, 1970 (2 U.S.C. 141 note), provided the necessary increase in the project's authorized funding limit.

Another significant delay in funding occurred between July 1975 and March 1976. At that time, the AOC was trying to contract for the phase 4 interior work. However, because of insufficient available funds, the actual award was dependent upon additional funds being appropriated for the project.

Congressional action on the AOC's request was delayed due to a controversy over whether part of the building should be used as additional House office space. The issue was resolved with the passage of Public Law 94-219, approved on February 27, 1976 (2 U.S.C. 141 note), which increased the project's authorized spending limit to \$123 million without amending the prohibition contained in Public Law 91-214 against using the building for general office purposes.

In his 1976 estimate justifying the need to increase the project's authorization from \$90 million to \$123 million, the AOC cited inflation (about \$17 million); additional construction work, including extension of the automated book conveyor system into existing buildings, a more sophisticated security system, and an improved fire protection system (about \$10 million); and increased contingency allowances (about \$6 million).

In 1978 the AOC requested an additional \$10 million for the project. Public Law 95-355, approved on September 8, 1978, appropriated \$7,675,000 of the AOC's request, raising appropriations for the project to the current total of \$130,675,000.

The building was designed and constructed using the phasing process. Originally, the project was to be constructed in three phases: excavation and foundation, exterior stone, and superstructure and interior.

During development of the plans and specifications for the original phase 3, however, it became evident for various reasons, including the need for additional study by the Library, that the space and technical requirements of the Library could not be incorporated into the contract documents without causing a substantial delay in their preparation. The AOC decided to split the original phase 3 into two phases. The AOC anticipated that construction of the superstructure (new phase 3) could proceed while permitting the Library and the associate architect more time to develop the requirements and finalize the documents for the phase 4 (interior) contract.

The contract documents for phase 4, scheduled for completion by December 15, 1972, were not completed until October 15, 1974, 669 days later. Significant changes to some of the internal service systems of the building were the primary causes of the delays.

Once the contract documents were completed, the Invitations for Bids were issued on January 30, 1975, with a scheduled bid opening date of April 16, 1975. The actual bid opening date was delayed until July 23, 1975 (98 days later), because the AOC issued 11 addendums, primarily involving changes in the project's scope, to the contract.

At the bid opening, the AOC found that all the bids exceeded the available funds. The AOC was able to obtain agreement from some of the bidders, including the low bidder, to extend the acceptance date of their bids pending the authorization of additional funds. With the increase in the project's limit in February 1976 to \$123 million and the appropriation of the additional funds on March 6, 1976 (Public Law 94-226), the AOC's funding problems were temporarily resolved. On March 9, 1976 (230 days after the bid opening), the AOC awarded the phase 4 interior contract.

Current status of Madison project

The AOC considered the Madison Building substantially completed as of April 1980. While the Library proceeds with occupying the building, the AOC is supervising (1) completion of work under the phase 4 contract, (2) settlement of the phase 4 contractor's change orders and claims, and (3) correction of problems involving the building's book conveyor, fire detection, and security systems.

According to AOC and Library officials, the book conveyor system is experiencing the major difficulties. AOC officials stated that the phase 4 contractor is testing and replacing, as necessary, the system's hardware and computer software. As of July 31, 1981, Library officials stated that although the book conveyor system was operational, it needed major adjustments for continuous operation and reliable delivery.

By September 1, 1980, 94 percent of the phase 4 contractor's change orders and claims had been settled, exclusive of its \$23.5 million claim for time delays. AOC officials are estimating that (1) all of the project's remaining funds will be needed to complete the phase 4 contract, exclusive of the \$23.5 million claim, and (2) additional funds will be needed for the time delays claim, although they believe it will eventually be settled for considerably less than \$23.5 million.

HOUSE OFFICE BUILDING ANNEX NO. 2

By a motion dated December 12, 1974, the House Office Building Commission authorized and directed the AOC to request the General Services Administration (GSA) to transfer, as soon as practical after January 1, 1975, the building now known as House Office Building Annex No. 2. ^{1/} The building, which was used previously by the Federal Bureau of Investigation primarily for storage, was to be renovated by GSA for use as Federal office space.

The building was officially transferred to the AOC's jurisdiction on April 7, 1975. At the time of the transfer, GSA had already hired an architect/engineer (A/E) to design the renovation of the building. The AOC stated that since GSA's proposed alterations to the building were similar to what he had envisioned, he would adopt GSA's plans for the project, including retaining the A/E hired by GSA.

Because the building would be partially occupied from the start, the AOC decided to renovate the building in two phases--occupy half the building, renovate the other half of the building, move the people into the renovated half, then renovate the remaining half of the building. However, building occupancy increased at such a rate that, in May 1976, the AOC decided to do the renovation in three phases. In November 1977 the AOC, again citing the building's increased occupancy level, decided that four phases would be needed. Each increase in the number of work phases further complicated problems relating to reworking design documents and shop drawings, using work forces, ordering materials and supplies, having access to work areas, and providing adequate storage space.

^{1/}The Commission acted pursuant to Public Law 84-24 (Additional House Office Building Act of 1955), Apr. 22, 1955 (40 U.S.C. 193a note).

Complete renovation of the building while it was unoccupied would have been the most economical and the quickest method to effect renovation. Partial occupancy and phasing the renovation work have been the primary factors contributing to delays in completing the project. However, as discussed below, the impact of these two factors on direct renovation costs has been substantially offset by reductions in the scope of the renovation effort.

Public Law 94-6, dated February 28, 1975 (40 U.S.C. 175 note), appropriated \$15 million for the House Annex No. 2 project: \$14.5 million for renovation and \$500,000 for operation and maintenance costs for the last 4 months of fiscal year 1975. The appropriation was based on the AOC's estimate that about \$11 million would be needed for direct renovation costs, \$2.3 million for contingencies, and about \$1.2 million for A/E fees, supervision, and other related expenses. As of March 1981 a total of \$25.5 million had been appropriated for the project.

At the time our July 19, 1979, report was issued, the AOC was estimating that the total project would cost \$26.5 million and would be completed by January 1981. Our report noted that of the \$26.5 million estimate, about \$6.6 million was for costs unrelated to renovating the building and about \$900,000 was for two items added to the project after the AOC adopted GSA's renovation plan.

Our July 1979 report concluded that the AOC probably would be unable to meet his estimated completion date of January 1981 or be unable to finish the project for the projected \$26.5 million. Our report also found that the AOC had reduced the scope of the project to avoid cost increases and that certain portions of the ground and first floors were not being completely renovated because of the lack of funds.

Reduced scope, deleted items, and incomplete renovation

When the building was transferred to his control in April 1975, the AOC stated that he would renovate Annex No. 2 in accordance with GSA's plans. From the start, however, the AOC emphasized to the A/E that the GSA proposal was too elaborate and, due to limited funds, would have to be reduced in scope. The AOC's attempts to limit the project's direct renovation costs by reducing its scope became the focal point of the renovation effort. This enabled the AOC to offset, to a large degree, cost escalations related to workload increases and time delays resulting from partial occupancy and phased renovation.

Most of the scope reductions involved refurbishing or remodeling existing equipment and/or systems, as opposed to installing new equipment or systems. For example, although the A/E's design provided for replacing the roof, the AOC decided to repair the roof as needed. Other major scope reductions included:

- Refurbishing the existing elevators rather than replacing them with new ones.
- Reglazing the existing windows as opposed to replacing them.
- Revising the design concept to allow for less complicated installations of electrical/transformer equipment.
- Combining the smoke evacuation system with the heating, ventilation, and air-conditioning system.

Numerous other scope reductions, some of a highly technical nature, involved changing the building's electrical, mechanical, plumbing, and air-circulation systems.

In our July 1979 report, we stated that the AOC's scope reductions could negatively affect the quality of the renovation effort. By reducing the initial capital investment (direct renovation costs) in the project, the AOC was, in all probability, increasing the building's operation and maintenance costs. Generally, operation and maintenance costs would be minimized by maximizing the use of new and efficient equipment and systems. The AOC stated that the potential increase in operation and maintenance costs was not a major consideration in his scope reductions.

At the time the AOC took control of the building in 1975, he anticipated that ownership would only be temporary, pending construction of a fourth House office building. Supposedly, Annex No. 2 would be returned to GSA in about 5 to 6 years. Apparently, the decisions to refurbish existing equipment and systems, rather than to replace them, were influenced by the belief that the building would only be under the AOC's control temporarily. The AOC acknowledged that the scope reduction decisions could have been affected by considerations of temporary ownership.

The AOC's efforts to reduce the project's scope were facilitated by the use of his own in-house work forces to do the renovation work. This enabled the AOC and his staff to alter the A/E's design (the A/E was terminated in Aug. 1977) without concerns about change orders or claims from a private contractor.

Our July 1979 report noted that the AOC employed several other means to limit renovation costs. The original A/E design included carpeting and venetian blinds. Now, the funds for these items are being provided by the Clerk of the House. 1/ The

1/At the time our report was issued, the Clerk of the House estimated it would cost \$4.2 million--\$2 million already spent and an additional \$2.2 million--to provide furniture and furnishings (including carpeting and venetian blinds) for the renovated building. In addition, \$1.5 million was spent to purchase new furniture for the Longworth Building, with the old furniture being transferred to House Annex No. 2.

AOC also eliminated certain items from the A/E's design, including a roof garden, skylights, a snack bar, and computer facilities. Also, as a result of the project's appropriations being limited to \$25.5 million instead of the \$26.5 million being sought at the time our report was issued, the AOC decided to omit the smoke control system and the emergency generator from the renovation project.

Our July 1979 report also found that, without additional appropriations, the AOC would not be able to completely renovate the ground and first floors. Although these two floors would contain the basic firesafety, air-circulation, plumbing, and mechanical systems, large amounts of space on these floors would not be finished in accordance with the AOC's renovation plan. As a result, rather than being used as office space or for other specific purposes, the space would either be unoccupied, used for storage, or used by the AOC's construction personnel.

As detailed in our report, as much as 75,000 square feet of occupiable space would be affected in this manner. This reduced the AOC's estimate of net usable space in the building from 370,000 square feet to 295,000 square feet at the time our July 1979 report was issued.

Current status of House Office
Building Annex No. 2 project

Currently, the AOC is experiencing the problems envisioned by our July 1979 report regarding inadequate funds, additional delays, and increased operation and maintenance costs. As of March 1981, the AOC's latest analysis showed that about \$2.2 million, in addition to the \$25.5 million already appropriated, was needed to complete the project. (As of Nov. 1980 the AOC had an unobligated balance of \$17.35 out of the \$25.5 million appropriated for the project.) The AOC is requesting \$1.5 million for fiscal year 1982 to do work on the project.

Because of the lack of funds, the AOC, as of February 1981, discontinued work on phase 4. Due to the funding uncertainties, AOC officials have no completion schedule for the project. AOC officials estimate that, with adequate funding, it will take 9 to 10 months to complete phase 4.

Eliminating phase 4 reduces the building's usable office area by more than one-fourth--about 78,500 square feet out of a total of about 295,000 square feet. This is in addition to the 75,000 square feet on the ground and first floors that will not be completely renovated, as detailed previously and in our July 1979 report. In total, the usable space in the building has declined from about 370,000 square feet to about 216,500 square feet--about a 42-percent reduction.

Our July 1979 report noted that the AOC's decision to reduce the project's scope would probably increase operation and maintenance costs for the building. One of the examples given was repairing the roof, rather than replacing it as provided for in the A/E's design. In October 1980, AOC officials stated that the roof probably would have to be replaced soon. The AOC also projected increased maintenance costs as a result of the decision not to replace the windows and elevators (items also cited in our July 1979 report).

CHAPTER 3

CONVENTIONAL DESIGN AND CONSTRUCTION

METHODS SHOULD BE TRIED FOR

CAPITOL HILL PROJECTS

All four of the AOC's construction projects have been characterized by significant cost overruns, completion delays, and management problems. Our analyses have shown that these problems are directly related to the methods used on Capitol Hill to approve, fund, design, construct, and manage major construction projects.

The AOC is about to restore two Library of Congress buildings (see app. III). The restoration will involve major commitments of personnel and resources. Also, in the future, the AOC will probably be responsible for constructing additional Capitol Hill projects. Unless the Congress and the AOC try different approaches for major construction projects, we believe that the Library restoration and future AOC projects will experience problems similar to those encountered on the projects discussed in this report.

In this chapter, we discuss what we believe is one of the major factors contributing to the problems of Capitol Hill construction projects: the AOC's attempts to apply some or all of the principles of the phasing process (design as you construct, overlapping of design and construction, and multiple construction contracts). In chapter 4 we address the other factors, such as management controls, standard policies and procedures for associate architects, inventory controls, and use of in-house labor, that must be considered if problems on AOC construction projects are to be minimized or alleviated.

PHASING PRINCIPLES NOT COMPATIBLE WITH CAPITOL HILL PROJECTS

Generally, most Federal construction agencies use the conventional method to design and construct projects. The agency first develops the planning concept for the project. After the planning concept is approved by the Congress, the agency seeks authorization and appropriations to design and construct the project. Part of the data provided the Congress includes the estimated cost to construct the project. After funds are appropriated, the agency awards the design contract. Once the design is completed, the agency then awards a lump-sum contract to a general contractor--low competitive bidder--to construct the project.

The conventional method is characterized by two major factors:

--It is a sequential process in that the project is designed before construction begins.

--The construction is done under one contract by a general contractor.

Under the conventional method, because of the finite design and single construction contract, the owner (Federal agency) knows what it is getting and at what price (exclusive of change orders and contractor claims). Also, the conventional method helps affix responsibility in the event of problems--the A/E is responsible for the design and the contractor is responsible for construction.

Over the years, however, the conventional method has been criticized because of the amount of time needed to (1) approve the planning concept and (2) obtain the funds to design and construct the project. In their efforts to shorten the planning/design/construction cycle, certain agencies have tried phased design and construction, a process sometimes used by private industry and commercial builders.

Under phased design and construction, the project is divided into phases (construction contracts). Construction begins on some phases while others are still being designed. The theory behind phasing is that overlapping the planning, design, and construction efforts should shorten the overall design/construction cycle of a project. In an escalating construction market, this would supposedly reduce the project's exposure to inflation since the construction contracts (phases) would be put out for bid earlier than they would if the entire project had to be designed before construction began.

As far back as 1967 we recognized that phasing and Capitol Hill construction projects were not compatible. Our April 1967 report on the Rayburn project, in discussing how the overlapping of design and construction and the use of multiple construction contracts had contributed to the project's problems, recommended that the AOC, in the absence of compelling circumstances, consider (1) completely designing a project before starting construction and (2) awarding a single contract for construction of the project.

The associate architect hired to design the Hart Building recommended that it be designed and constructed using the phasing process. However, the AOC's evaluation of the associate architect's recommendation concluded that phasing was too risky a method for a custom-designed and built structure requiring a life-span of over 100 years.

In our opinion, trying to apply all or some of the principles of phasing to the monumental structures typical of Capitol Hill construction projects invites risks far in excess of any potential benefits that could be realized from such design/construction approaches. The situations that have occurred on the Madison

project and are occurring on the Hart project are graphic examples of the incompatibility of the phasing process and Capitol Hill projects. Rather than shortening the design/construction cycles and reducing costs, the AOC's various attempts at phasing have been major contributing factors to the cost overruns, time delays, and management problems experienced on the projects.

To be effective, phasing requires that as each phase of a project is designed, it be quickly put out for bid. If the design phases and/or construction contracts are delayed, then the potential for shortening the design/construction cycle of the project is reduced or lost. Accordingly, phasing works best in those situations where the design and construction processes are not subjected to potential delays or problems.

As shown in the discussions on the Madison and Hart projects (both in our previous reports and in ch. 2), Capitol Hill projects are fraught with potential delays and problems. Specifically, we believe that phasing is not compatible with AOC construction projects because of the factors discussed below--factors which appear to be an integral part of Capitol Hill projects while, at the same time, being contrary to the effective use of the principles of phasing.

Multiple reviews and approvals

For phasing to be effective on a construction project, it is imperative that the planning/design/construction process proceed as rapidly as possible to minimize the impact of cost escalation due to inflation. A centralized system that enables prompt decisionmaking regarding the design and construction phases is essential if phasing is to be successful. Most Federal agencies theoretically achieve such a system once a project is approved and funded, since at that point, the head of the agency generally assumes design and construction responsibility for the project.

In contrast, AOC construction projects undergo a myriad of reviews and approvals throughout the entire planning/design/construction process. As a result, the rapid decisionmaking system necessary for phasing usually is not available on Capitol Hill construction projects. The following examples illustrate the situations confronting the AOC in his efforts to plan, design, and construct projects.

In June 1971, the Acting AOC, in a letter to the Chairman, Legislative Subcommittee, Senate Appropriations Committee, stated that the procedures necessary for authorizations and appropriations for the Madison Building had required meetings, reports, or hearings involving the Senate and House Office Building Commissions, the Senate and House Appropriations Committees, the Senate and House Public Works Committees, the Joint Committee on the Library, and the James Madison Memorial Commission. In addition, the Acting AOC noted that during the preliminary phase of the project, he was required by the Congress to consult with a

committee of the American Institute of Architects as to the type of building to construct.

In commenting on our 1967 report on the Rayburn project, the AOC (in effect summarizing one of the basic problems confronting attempts to use phasing on Capitol Hill projects) stated:

"* * * Your auditors apparently fail to comprehend fully the essential difference in constructing a building for the use of the House of Representatives, where the opinions or ideas of any one of the 435 members could and sometimes do come into play, and a building for an Executive Agency where there is just one head who makes final important decisions. * * * a building for the Congress draws scrutiny, criticism, and press comment from all over the country; our 'sidewalk superintendents' are nationwide; whereas a building of similar magnitude for another agency of Government in downtown Washington normally goes almost unnoticed.
* * *"

Our reports on the Hart and Madison projects describe how congressional involvement in Capitol Hill projects helped eliminate the possibility of prompt decisionmaking during the planning/design/construction process and affected the AOC's attempts to apply some of the principles of phasing to those projects. For the Hart project, congressional involvement contributed to the decisions that resulted in a project considerably different than that envisioned by the authorizing legislation. Also, concerning the Hart project, our August 1978 report noted that:

--In mid-1973 the AOC informed the associate architect that the Senate Office Building Commission and the Senate Public Works Committee probably would need more than 2 months to review and approve the schematic drawings and at least that amount of time to review and approve the design development. Both the Commission and the Committee exceeded the parameters.

--In 1974, congressional approval of the design and supplemental funding for the project was delayed for 6 months. This delayed the start of contract-drawing preparations, since the AOC maintained he could not authorize the work without sufficient funding to put the documents out for bid.

Our September 17, 1979, report on the Madison project detailed the impact of congressional actions during the planning phase of the project. In that report, we also discussed how the AOC's efforts to award one of the construction contracts was delayed while the Congress resolved the question of whether part of the building would be used for general office purposes.

The congressional interest inherent in Capitol Hill projects and the attendant multiple reviews and approvals such projects experience cause other effects in addition to reducing the potential

for prompt decisionmaking. As discussed in the following sections of this chapter, it also affects the timeliness of funding and sometimes causes changes to a project's design that result in time delays and increased costs.

In our opinion, applying the conventional method to AOC projects would help alleviate the impact of multiple reviews and approvals. Only one planning document and one design package would have to be reviewed, rather than the multiple design segments that occur under the phasing process. Further, once the design package was approved and the construction contract was awarded, the AOC would not face the prospect of having design or construction phases delayed as he now does when he attempts to use phasing on a construction project.

Funding

Under phasing it is essential that funds be readily available for prompt and timely award of construction contracts. Otherwise, as in the case of delays due to multiple reviews and approvals, the benefits of phasing are reduced or lost. As discussed in our previous reports and in chapter 2, funding problems played significant roles in the delays that occurred on the Madison and Hart projects.

In our opinion, two major factors contribute to the funding problems that occur when phasing is applied to a Capitol Hill construction project. First, AOC projects constructed under the phasing process experience such time delays and cost escalations that the original funded amounts are insufficient to complete the projects. As a result, unless the AOC continually seeks and the Congress continually approves additional funding, somewhere during the design/construction process of phasing the AOC is faced with inadequate funds to complete the projects.

Both the Madison and Hart projects provide graphic examples of this situation. For the Madison project, the associate architect was estimating, in April 1967, that it could be built in 42 months at a cost of \$75 million. As discussed in chapter 2, by July 1981 the project had cost over \$130 million and was still not 100-percent complete. Further, the \$130 million does not include the eventual cost of settling the phase 4 contractor's \$23.5 million claim for time delays.

The Hart project has gone from a \$48 million replica of the Dirksen Building to at least a 9-year, \$137,730,400 project. Also, as discussed in chapter 2, the scope and quality of the project has been reduced and the AOC is now proposing to do some of the project using maintenance funds.

Second, because multiple construction contracts are used, when the projects run out of sufficient funds during the design/construction process, the AOC is unable to award one or more of the contracts. This causes delays on the projects, thus

contributing to cost escalations related to inflation and further reducing or eliminating the benefits of phasing.

For both the Madison and Hart projects, the AOC was faced with such situations. On the Madison project, the AOC was unable to promptly award the phase 4 interior contract because all the bids exceeded the available funds. As a result, award of the contract was delayed for an additional 230 days.

Chapter 2 details how insufficient funds have contributed to the AOC's problems in trying to complete phase 5 (interior and related work) of the Hart Building. Initially, in December 1978, the AOC had to divide phase 5 into two parts because of insufficient funds to award the entire contract. Later, he had to divide the second part of phase 5 into six separate contracts. Also, the AOC has had to delete many items from the project, not complete some portions of the project, and reduce the quality of other items. In addition, the AOC is now proposing to do some of the project using maintenance funds.

In our opinion, the conventional design/construction method, as opposed to phasing, would help minimize or eliminate the funding problems described above. After development of the planning concept and the estimated cost to construct the project, the Congress would know the approximate amount of funds needed to complete that project. Further, after award of the one overall construction contract to a general contractor for the project, the AOC would not have to be concerned with the awarding of construction phases versus the availability of funds.

Complexity of design and quality of construction

As stated previously, the associate architect recommended that the Hart Building be designed and constructed using the phasing process. However, the AOC concluded that the recommended approach was too risky for a custom-designed and built structure requiring a flexible design and a lifespan of over 100 years. In our opinion, the complexity of design and quality of construction required for the monumental buildings on Capitol Hill works against any attempts to apply some or all of the principles of phasing to such projects.

Capitol Hill buildings are not constructed under the same criteria as other Federal or commercial buildings. Whereas most buildings are constructed to last 30 to 50 years, the monumental buildings of Capitol Hill are constructed to last 100 years or more. This requires a complexity of design and quality of construction and materials beyond that which is normally found in the construction marketplace.

The design complexity and the construction and materials quality needed on AOC projects (1) negates using the methods of time estimating prevalent in the construction industry and (2) requires an unusual degree of perfection in the contract documents, including numerous review and correction processes. When these two factors are combined with the multiple reviews and approvals and the funding issues discussed previously and with the design changes discussed below, it is understandable why the Hart and Madison projects have experienced problems in awarding, completing, and coordinating construction phases.

In our opinion, the use of the conventional design/construction method on Capitol Hill projects would lessen some of these problems, as follows.

- Only one set of contract documents (drawings and specifications) would have to be reviewed. In our report on the Hart project, we detailed the amount of time it took the AOC to review and the associate architect to correct the contract documents for each of the phases.
- With only one construction contract to award, there would not be the problems of coordination prevalent on phased projects. This would eliminate situations where the AOC has to pay one contractor for delays resulting from a previous contractor's failure to finish his phase on time. 1/ It would also eliminate delays in one phase of the project causing a ripple effect on subsequent phases.
- Contract changes resulting from the use of multiple construction contracts and the awarding of some of the contracts before a project's design was completed would be lessened or eliminated. 1/
- A single construction contract should also (1) eliminate inter-contract conflicts between contractors, (2) help affix responsibility for problems, and (3) help reduce administrative costs and problems related to coordinating contract phases.

Design changes

In our previous reports and in chapter 2, we discussed how changes in the Madison and Hart designs contributed to cost escalations and completion delays. For the Hart project, the AOC related many of the design changes to the need to maintain flexibility in the structure. We believe, however, that flexibility in design is incompatible with phasing.

As stated previously, phasing works best when the design/construction process is not subjected to potential delays or

1/This situation was also detailed in our Apr. 7, 1967, report on the Rayburn project.

problems. Accordingly, phasing is less tolerant of design changes than is the conventional method.

Under the conventional method, there is only one design package and one construction contract. Thus, the effect of any design changes on the entire project can be readily identified. Further, only one contractor is involved in any change orders and/or claims resulting from changes to the project's design.

On a phased project, however, design changes on one phase can cause repercussions on the design and the work done under other phases. As detailed in our April 7, 1967, report on the Rayburn project, design changes resulted in (1) work already in place having to be removed or modified, (2) payments to contractors to compensate for delays due to additional time needed to complete previously awarded construction contracts, and (3) added administrative burden because of the increased coordination needed between the various contractors.

Further, we believe that phasing, in and by itself, may contribute to design changes. Under the conventional method, there is only one design package to be reviewed, corrected, and approved. Thus, the opportunities for changing the project's design are limited, particularly once the overall construction contract is awarded. With phasing, however, the opportunities to make changes to a project's design during the review/correction/approval process would appear to be directly proportional to the number of phases.

We believe that the Hart project highlights the types of situations that can occur on a Capitol Hill project when one tries to combine flexibility in design with some of the principles of phasing. From the start, as detailed below, the design program for the Hart Building has been subjected to changes that have added costs, delayed completion, and contributed to the current situation facing the AOC of being unable to complete the project as designed because of insufficient funds.

--A definitive program detailing the Senate's space requirements had not been developed at the time the associate architect was selected. The detailed programing effort was made part of the associate architect's contract. In effect, the space requirements program was developed and expanded as the project progressed.

--Even before the authorizing legislation was signed, the project's scope was greatly expanded. This required an increase in the project's authorization from \$47,925,000 to \$85,147,000.

--Under the original concept, the building was to have been comparable to a typical commercial office building in materials and methods of construction. However, as work on the design progressed, the quality of both construction

methods and materials was continually upgraded so that the Hart Building would conform to the monumental criteria typical of Capitol Hill structures.

- The project has been designed as the contract documents for the segments are developed. This has resulted in delays while the AOC reviews options and provides direction to the associate architect. Throughout the project's development, the design has been changed, sometimes even after the final drawings for a contract have been approved and signed by the AOC. (Our report on the Hart project contains specific examples of design changes, including the length of time it took the associate architect to incorporate them into the design packages for the phases.)
- In January 1978 the AOC asked the Congress to raise the project's authorization to \$122,647,000, an increase of \$37,500,000. The requested increase included about \$11 million for design, quality, and value improvements and about \$15.5 million for inflation.
- Originally, there were to be six construction and material procurement phases for the project. However, the original phase 6 was deleted from the project because of a lack of funds. Also, because of funding difficulties, phase 5 was split into seven separate contracts.
- Because the total authorization of \$137,730,400 has proven insufficient to construct the project as designed, the AOC has deleted numerous items from the project, decided not to complete certain portions of the project, and reduced the quality of other parts of the project.
- Currently, the AOC is proposing to the Congress that maintenance funds (\$5 million requested for fiscal year 1982) be used to construct some of the project.

The Hart and Madison projects have been significantly affected due to design changes, either by direct increases in cost or by inflation resulting from the delays caused by the changes. We believe that some of these costs might have been lessened or eliminated if the AOC had used the conventional planning/design/construction process for the project.

At the least, under the conventional process, once the cost to construct estimate was completed, the Congress would know what the approximate cost to construct a project would be. At that time, any decisions regarding changing a project's scope and/or quality because of funding considerations could be made and then incorporated into the project's design. This would help avoid the current situation on the Hart project of the Congress eventually having a building considerably reduced in scope and quality from that which it approved.

CONCLUSIONS

Phasing and Capitol Hill construction projects generally are not compatible. Because of such factors as multiple reviews and approvals, delays in funding, complexity of design and quality of construction, and design changes, we believe that any attempt to apply some or all of the principles of phasing to an AOC construction project will inevitably lead to cost escalation and completion delays. The situations surrounding the Madison and Hart projects are testimony to such probabilities.

Phasing works best in those situations where the planning/design/construction process is not subjected to potential delays. To the contrary, Capitol Hill projects travel a path that is fraught with the kinds of problems that work against the successful application of phasing. As shown with the Madison and Hart projects, saving time and reducing cost escalation due to inflation by overlapping design and construction are not realistic probabilities on Capitol Hill projects.

For example, on the Hart project we found that the major supposed benefits of phasing were not realized because:

- There was no significant overlapping of the design and construction efforts, and thus no shortening of the overall design/construction cycle.
- The use of multiple construction contracts did not reduce the project's exposure to escalating market costs, since the contracts involving the major construction costs of the project were not awarded in the early stages of the design/construction cycle.

We believe that many of the problems encountered on Capitol Hill construction projects might be lessened or alleviated if the AOC would try the conventional design/construction process. Some of the benefits that would be derived from using the conventional process include:

- Only one design package would have to be reviewed and approved as opposed to the multiple design segments that have to be reviewed and approved under the phasing process.
- Once the cost-to-construct estimate was developed, the approximate cost to complete the project would be known. Any necessary decisions regarding changing a project's scope or quality because of funding considerations could be made at that time. Further, the AOC would not be faced with delaying award of a phase of a project because of insufficient funds.
- The AOC could maintain the complexity of design and quality of construction and materials required on Capitol Hill projects, while reducing or eliminating some of the problems

associated with phasing, including (1) time lost in multiple reviews and corrections of contract documents for each phase, (2) time and cost of coordination among the various contractors, (3) contract changes due to the use of multiple construction contracts and the award of some phases before the design of the project was completed, (4) inter-contract conflicts between contractors, (5) attempts to affix responsibility for problems, and (6) increased administrative costs related to coordinating the phases.

--Design changes would be reduced because opportunities to make such changes would be reduced. Also, the impact of design changes would be lessened since only one design package and one contractor would be involved.

AGENCY COMMENTS AND OUR EVALUATION

In commenting on our draft report, the AOC, in a letter dated July 28, 1981 (see app. IV), disagreed with our conclusions and recommendation regarding the incompatibility of phasing and Capitol Hill construction projects. In defending his use of phasing, the AOC maintained that our findings were "conclusory in nature" and based on an insufficient analysis of all the factors involved. In support of his position, the AOC cited only one example: an in-house analysis showing that use of the conventional method would have added from \$2.5 million to \$11 million to the cost of the \$137.7 million Hart Building.

We reviewed the AOC's analysis and found it contained inaccurate figures, incorrect calculations, and improper assumptions. For example, the AOC did not uniformly escalate his cost figures to account for economic factors, such as inflation. Also, the AOC ignored available cost indices for some figures, while for other figures, he arbitrarily used adjusted cost indices.

In redoing the analysis, based on methodology accepted by other Federal agencies for calculating the cost of construction projects (such as the Department of Defense and GSA), we found that the AOC would have saved at least \$1.7 million by using the conventional method of design and construction. Further, our evaluation did not consider various additional costs associated with the use of phasing on the Hart project, such as increased overhead to handle multiple contracts and coordination among contractors, increased A/E costs, increased design review costs, and costs resulting from change orders and contractor disputes and related time delays.

The AOC also states or implies that, in our report, we take such positions as:

--No construction should begin until all information needed for decisionmaking is known (see p. 62).

- After the major design and funding choices are made, construction should proceed without reconsideration or further policy guidance (see p. 62).
- The complex authorization, appropriation, and oversight procedures inherent in any Capitol Hill project are problems per se (see p. 62).
- Single phase (conventional) construction methods will always be less costly than multiphased construction under all circumstances (see p. 63).
- Deviations in costs from the original estimates for the projects could be attributed largely, if not solely, to phasing (see pp. 63 and 69).
- Other factors causing cost increases, such as scope changes, more severe inflationary pressures, funding delays, design changes, and inadequate contractor performance should not be considered. (see p. 63).

None of the above statements accurately reflect the positions we take in our report. Nowhere in the report do we advocate the concepts contained in the AOC's first two statements. Rather, as discussed in this chapter, we support development of the design package before starting construction. This does not mean that construction should not begin until all information needed for decisionmaking is known. Rather, we believe that no large commitments of construction funds should be made until a proposal (design package) and estimate (cost to construct) have been developed.

Regarding the AOC's second statement, we believe that evaluation (reconsideration) and policy guidance are integral parts of all construction projects, from their inception through completion of construction. Accordingly, we would anticipate that these factors would be applied to any Capitol Hill project, regardless of what method was used for designing and constructing that project.

Like the AOC, we also believe that the complex authorization and oversight procedures inherent in any Capitol Hill project are "facts of life." However, it is these facts of life that make Capitol Hill projects and phasing incompatible. Because of the realities of congressional involvement in AOC projects, the AOC should use design/construction methods that are least affected by delays and changes. As discussed in this chapter, the phasing process is much less tolerant of delays and changes than is the conventional design/construction process.

Two other related points we would like to make. First, contrary to the AOC's statement on page 63, we are not opposed to the Congress retaining its central role in authorizing and funding projects for the Legislative Branch and in overseeing the projects' progress. Using the conventional design/construction

process does not mean an automatic lessening of the Congress role. Rather, we believe it will simply lessen the problems inherent in using phasing in light of the realities of Capitol Hill projects.

Second, we recognize, as the AOC states on page 63, that changes in congressional membership and leadership can affect a project during the design/construction process. However, what the AOC fails to acknowledge is that nothing prevents the use of options in the conventional process. Design changes, change orders, and even bid packages containing various options are factors as applicable to the conventional process as they are to any other design/construction process. Further, as discussed in this chapter, such factors have less negative impact on the conventional process than they do on the phasing process.

Also, in this regard, on page 70, the AOC states that phasing allows the staggering of appropriations for a major project over several years rather than requiring the full amount to be appropriated before construction begins. It should be noted that conventional design/construction projects can also be funded in this manner. Since contractors are paid on the basis of work completed, for certain large projects, certain agencies, such as GSA, fund the projects annually (based on the work to be completed by a contractor in a given year), rather than all at once.

Contrary to the AOC's statement on page 63, our report does not state that conventional construction methods are always less costly than multiphased methods. Our report, as discussed in this chapter, simply details how, with respect to Capitol Hill projects, conventional design/construction methods appear to be more appropriate than phasing methods.

In his last two statements listed above and on pages 62 and 64, the AOC states that we (1) are overly concerned about the differences between the original estimated cost of the projects and their current cost, (2) do not consider such other factors as scope changes, inflationary pressures, funding delays, and design changes, and (3) attribute all of the increased costs to phasing.

In chapter 2, in this chapter, and in our previous reports, we discuss, in considerable detail, all the factors that caused increases in the cost of the projects, including those factors that the AOC says we ignore. For example, on pages 9 to 13, we detail what factors increased the cost of the Madison project from \$75 million to \$130,675,000, including inflation, design changes, congressional actions, contingency allowances, and delays in developing and awarding the phases. Similar data on the Hart project is provided on pages 4 to 9.

We recognize that on the two projects, especially the Hart project, the initial cost estimates bear little relationship to the current projects. That is one reason why we advocate the conventional method. Under this method, once the design package

and cost to construct were completed, the Congress would have much more realistic data regarding the design and cost of a Capitol Hill project.

As stated previously, we detail all the factors that have increased the cost of AOC projects from their original estimates. Our report does not attribute all of these increases to phasing. Rather, it discusses how phasing has been one of the major contributing factors to cost increases and delays during the design/construction process.

In summary, because all recent AOC projects have been constructed using the phasing process, it was not feasible to make a comparative analysis of phasing versus the conventional process for Capitol Hill projects. However, in light of the problems encountered on the Hart and Madison projects, and considering the inherent factors--multiple reviews, funding delays, complexity of design and quality of construction, and design changes--on Capitol Hill that are contrary to the effective use of phasing, we believe that the AOC should try the conventional method to see if it can help minimize or alleviate the problems on future projects.

RECOMMENDATION

To minimize or alleviate some of the problems that have plagued Capitol Hill construction projects designed and constructed using the phasing process, we recommend that the AOC try more conventional planning/design/construction methods for major construction projects.

CHAPTER 4

AOC SHOULD CONSIDER OTHER FACTORS

TO MINIMIZE OR ALLEVIATE CONSTRUCTION PROBLEMS

In chapter 3 we detailed how the AOC's attempts to apply phasing to the design and construction of Capitol Hill buildings have been primary factors contributing to cost escalations and completion delays on the projects. Presented below are some of the other contributing factors that, we believe, have to be considered if the problems associated with AOC construction projects are to be minimized or alleviated.

INADEQUATE PROJECT CONTROL SYSTEMS

In our August 14, 1978, report on the Hart project, we noted that the AOC did not have adequate systems for controlling major construction projects. The lack of a disciplined approach to the design and construction process is a barrier to the effective control of time and cost on construction projects. A disciplined approach, properly implemented, provides total visibility of the decision processes during all phases of a project. Any approach used should provide three types of information: schedule and progress data, actual cost data, and budgetary data.

At the time of our review of the Hart project, the AOC did not have an adequate system for monitoring the progress of the project. Although the AOC did have limited in-house capability to adequately track certain items, namely shop drawings, most schedule and progress reports were either prepared manually by the AOC or produced monthly by the contractors. For example, the AOC had no viable, detailed, schedule/progress mechanism on the Hart project to relate the impact of the progress of phase 4 on phase 5.

Regarding cost control, the AOC's system was based on the associate architect's prepared estimates for the Hart project. The AOC rarely altered or adjusted these estimates, and there was no cost control module to provide project participants with the project's current cost/estimate status versus the budget. The lack of such a module contributed to the AOC's reliance on outdated estimates.

Neither the AOC nor the associate architect had a formal, centralized, active system for updating Hart project estimates as the scope or quality of the project was increased or as delays were encountered. In fact, project estimates were not formally updated until funding situations became critical.

Also, the AOC did not maintain a detailed project operating budget, responsive to experience and to periodic revisions as estimates were updated, for the Hart project. Funds appropriated for the project were lump sums, and the AOC did not allocate the

funds to detailed budget categories. Fund control resided solely at the appropriation level. This contributed to critical management decisions on project funding being postponed until available funds were inadequate to proceed as planned.

Project management

During our reviews of the Madison, Hart, House Annex No. 2, and Capitol Power Plant projects, we found that the officials directly in charge of the projects had only limited authority over the project for which they were supposedly responsible. We noted instances where AOC officials started actions directly affecting the projects without seeking the approval or informing the responsible project directors. In several instances, until we brought it to their attention, the project directors were unaware of the actions taken by the other AOC officials.

For example, our April 13, 1981, report, "Improper Accounting for Costs of Architect of the Capitol Projects" (PLRD 81-4), demonstrated how appropriations for the project to modify and enlarge the Capitol Power Plant were improperly charged for costs directly related to work on other AOC projects. The purchase orders accompanying the work were prepared by officials from the Construction Division and approved by the Director of Engineering. The director of the Power Plant project was often bypassed and, in some instances, was unaware of the charges being made against his project's appropriations.

On House Annex No. 2, we found that the official responsible for the renovation project also exercised limited control over charges to the project's appropriations. The official stated that, without performing a detailed analysis, he could not say what costs had been charged to the project by other AOC officials.

Actions taken by AOC on Hart project

Since our report on the Hart project was issued, the AOC, with the assistance of a construction management consulting firm, has developed and implemented the following actions regarding phase 5 of the project:

- A project budgeting system designed to alert the AOC's staff to problems on a more timely basis.
- A scheduling capability to enable analysis of contractor data by AOC personnel.
- Monthly reports to monitor the financial exposure of each portion of the project.
- Monthly narrative reports to AOC top management.
- Monthly progress meetings with AOC top management.

--A strengthening of the project director's role so that he has increased management control over work and charges involving the project.

Members of the AOC's staff for the Hart project stated that the new actions have helped to improve interoffice communications and the timeliness of decisionmaking.

On the surface, the AOC's actions appear to address many of the project control and management problems cited in our August 1978 report. However, because of the recent nature of the actions (in use for about 1 year) and their application to a project that was already substantially underway, we do not believe a meaningful evaluation of their effectiveness can be made now.

In our opinion, a realistic evaluation of the AOC's new project controls will have to await their application to a new, major project, from its inception through completion. In this regard, the Administrative Assistant to the AOC stated that the new project controls and strengthened project director concept will be used on the restoration of the Library buildings.

NO STANDARD POLICIES AND PROCEDURES FOR ASSOCIATE ARCHITECTS

Under normal Federal A/E procurement policies, most Federal agencies provide A/Es commissioned to do work with detailed programs, manuals, and procedures for the design and construction of new buildings. This material covers such matters as general design criteria, A/E performance standards, instructions on how to prepare drawings and claims, and general operating procedures. The AOC does not have a similar policy and, therefore, A/Es (associate architects) commissioned to do work on Capitol Hill projects must familiarize themselves with how the AOC's office operates through discussions with the AOC's staff.

In our opinion, developing standard policies and procedures would reduce the amount of time and cost associate architects must now spend familiarizing themselves with AOC operations. Further, it would provide continuity and standardization among associate architects relative to design criteria, performance standards, preparation of drawings and claims, and general operating procedures.

As of February 1981 the AOC had not developed any detailed programs, manuals, or procedures for associate architects. Further, AOC officials stated that, at present, there were no plans to develop such materials.

INADEQUATE INVENTORY CONTROLS

Our reviews of the projects to renovate House Annex No. 2 and to modify and enlarge the Capitol Power Plant revealed inadequacies in the AOC's inventory control system for construction

materials. Although the AOC's system allows for recording receipt of the materials upon their delivery to the AOC, the system does not provide adequate controls over the materials once they are dispatched to job sites.

For example, we found that some materials purchased as part of the Capitol Power Plant modifications and enlargement project were delivered to Annex No. 2. In response to our inquiries, AOC officials stated that the materials were used to replace items that had previously been drawn from the annex's storerooms for use on the Power Plant project. When we attempted to verify the amounts of the previously removed materials, we found that the AOC's system involving dispatch tickets prevented us from readily identifying materials, including quantities, dispatched to particular job sites. The dispatch tickets were not filed either by job codes or by work order numbers but were stored together in boxes by their chronological date of issuance.

To verify the officials' statements that materials purchased with Power Plant funds had been used to replenish Annex No. 2 materials previously used on the Power Plant project, we would have had to

- sort through all the dispatch tickets stored in the boxes,
- obtain copies of the receipts for all the materials purchased with Power Plant funds that had been delivered to Annex No. 2, and
- attempt to match the dispatch tickets with the receipts.

However, even if this complicated, time-consuming process could be accomplished, it would still not confirm that the items previously drawn from Annex No. 2 had actually been used on the Power Plant project. The AOC's inventory control system does not generate documentation verifying that materials have been delivered to and used on a particular job site for a particular project.

We also found that dispatch tickets were prepared only for materials supposedly removed from Annex No. 2. For materials supposedly used on the renovation of Annex No. 2 itself, no dispatch tickets were prepared.

An effective inventory control system must be able to trace large dollar items, groups of items, or items designated for specific purposes, to their final destination and use. The AOC's inventory system does not do this. We did find some efforts by individual AOC units to establish inventory controls. However, these efforts emanated from the individual managers responsible for the units, not from high-level AOC management.

In our opinion, the AOC needs to develop an effective inventory control system for use by all AOC personnel involved in the

purchase, receipt, dispatch, and use of materials. Such a system would provide AOC management with better tools for controlling inventories, including providing assurances that materials were being properly used on the projects for which they were purchased.

USE OF IN-HOUSE WORK FORCES

In our report on the Annex No. 2 renovation and in chapter 2, we discussed how the work on the project was being done primarily by the AOC's in-house work forces. In appendix III we note that, under his current plan, the AOC proposes to also restore the two Library buildings using his own in-house work forces.

The renovation of Annex No. 2, like the Madison and Hart projects, has experienced significant cost escalations, completion delays, and management problems. Further, because of funding difficulties, the scope and quality of the Annex No. 2 project have been consistently reduced since the start of the renovation effort. As of March 1981, work on the renovation of Annex No. 2 had been discontinued because all appropriated funds for the project had been obligated. As a result, large portions of the building--about 42 percent--are unfinished and, therefore, cannot be used as originally intended.

Use of the AOC's in-house work forces to do the renovation effort has not prevented the Annex No. 2 project from experiencing the same types of cost, delay, and management problems that plagued those Capitol Hill construction projects done under outside contracts. Further, it should be noted that use of his own in-house work forces helped the AOC reduce the scope and quality of the renovation project.

As noted in our report on Annex No. 2, this is the largest project ever done in-house by the AOC. From the standpoint of potential cost, however, the renovation of the Library buildings (currently estimated by the AOC to cost about \$55.5 million) will be a much larger project. Further, because of the ornate art work and architecture that has to be restored in the Jefferson Building (see app. III), the work will require considerable artistic expertise.

Until the restoration plan is developed, we do not believe it is feasible to determine what type of approach--in-house, contracted-out (contracting with a general contractor), or some combination thereof--is best suited for restoring the buildings. Specifically, because of the size of the Library restoration project and the artistic considerations involved, we are concerned that the AOC will be unable to recruit and retain the necessary in-house work forces, in terms of numbers and artistic expertise, to effectively and efficiently restore the Library buildings. Accordingly, we believe that the AOC should thoroughly study the type of approach that will be best suited for restoring the Library buildings in accordance with whatever restoration plan is adopted.

OCCUPANCY AND PHASED RESTORATION

In our report on House Annex No. 2 and in chapter 2, we discussed how partial occupancy of the building and phasing the renovation work had been the primary factors contributing to the delays in completing the project. Both have been constant and integral factors in the project since its inception and have affected all aspects of the renovation effort.

The end result of the escalating occupancy rate of Annex No. 2 was an increase in the work phases from 2 to 3 to 4. Each increase in the number of work phases further complicated problems relating to reworking design documents and shop drawings, using work forces, ordering materials and supplies, having access to work areas, and providing adequate storage space.

Under the original two-phase renovation plan developed in the fall of 1975 by the A/E and the AOC's staff, completion of Annex No. 2 was scheduled for May 1978. Currently, as discussed in chapter 2, work on phase 4 of the project has been suspended for lack of funds.

Regarding the restoration of the Library buildings, it appears that the work also will be done in phases while the buildings are partially occupied. As discussed in appendix III, this approach could provide the foundation for problems similar to those that have occurred and are occurring on House Annex No. 2.

We recognize that it may be necessary to keep the Library buildings operating while they are being restored. If this proves to be the situation, we believe that the number of phases and the amount of occupancy should be minimized to try to avoid or lessen the problems that have occurred on House Annex No. 2.

CONCLUSIONS

Our previous report on the Hart project detailed the AOC's inadequate systems for controlling and managing major construction projects. Since then, the AOC has taken certain actions regarding the Hart project that, on the surface, appear to address many of the deficiencies cited in our report. However, because of the recent nature of the actions and their application to a project that is substantially underway, we do not believe that a meaningful evaluation of the effectiveness of the actions can be made now.

We do, however, commend the AOC for taking the actions, including his decision to use the new project and management controls on the restoration of the Library buildings. In our opinion, a realistic evaluation of the new controls will be feasible once they are applied to this major project, from its inception through completion.

There are, however, certain other aspects of the AOC's construction related activities that we believe need additional attention at this time.

Unlike most Federal agencies, the AOC has not developed standard policies and procedures for the associate architects commissioned to do work on Capitol Hill projects. As a result, associate architects must familiarize themselves with how the AOC's office operates through the AOC's staff. Developing standard policies and procedures for associate architects regarding general design criteria, performance standards, and general operating procedures would save time, reduce costs, and provide continuity.

We found a need for improvement in the AOC's inventory controls for construction materials. Although the present system records receipt of the materials upon their delivery to the AOC, it does not provide adequate controls over the materials once they are dispatched to job sites. The AOC's inventory system does not produce documentation verifying that the materials were actually delivered to and used at particular job sites for particular projects.

The renovation of Annex No. 2 is being done by the AOC's own in-house work forces. The project, however, is experiencing the same types of problems encountered on those projects done by outside contractors. Further, the use of the AOC's own work forces helped to reduce the scope and quality of the renovation project.

The AOC plans to restore the Library buildings using his in-house work forces. Considering the size and complexity of the restoration project, we are concerned that the AOC will be unable to recruit and retain the necessary in-house work forces, in terms of numbers and artistic expertise, to effectively and efficiently restore the Library buildings.

Any decisions on who should do the work should be postponed until the restoration plan is developed. At that point, the AOC should thoroughly study which type of approach--in-house, contracted-out, or some combination thereof--is best suited for effectively and efficiently carrying out the restoration work.

The problems encountered on Annex No. 2 demonstrate that trying to renovate a partially occupied building in phases is inefficient and costly. We are concerned that using the same approach to restore the Library buildings will produce the same results.

We recognize that it may be necessary to keep the Library buildings operating while they are being restored. If this proves to be the situation, we believe that the AOC and the Library should try to minimize the number of phases and the amount of occupancy to try to avoid or lessen the problems that have occurred on House Annex No. 2.

RECOMMENDATIONS

To minimize or alleviate problems that have occurred and are occurring on Capitol Hill construction projects, we recommend that the AOC:

--Develop standard policies and procedures for associate architects regarding general design criteria, performance standards, and general operating procedures.

--Improve inventory controls over construction materials to ensure that the materials are properly used.

--Thoroughly study the types of workers--in-house, contracted-out, or some combination thereof--that will be best suited to effectively and efficiently carry out the restoration of the Library buildings.

--Minimize the number of phases and amount of occupancy during restoration of the Library buildings.

AGENCY COMMENTS AND OUR EVALUATION

Architect of the Capitol

In commenting on our conclusions and recommendations concerning the other aspects of his construction activities, the AOC stated that the "other suggestions contained in the report are meritorious, provided, of course, that appropriate recognition is given to the special circumstances which we sometimes encounter." While generally agreeing with us, the AOC made some observations and comments that we feel need to be addressed, as discussed below.

Standard policies and procedures for associate architects

In his July 28, 1981, comments (see pp. 65 to 67), the AOC indicated that we were advocating the development of detailed, finite instructions that could possibly limit his freedom to deal with associate architects. However, our report (see p. 34) shows that all we are recommending are generalized policies and procedures for associate architects. Specifically, we are advocating that the AOC develop general guidelines to avoid having associate architects spend unnecessary time and money familiarizing themselves with how the AOC's office operates.

The types of policies and procedures we recommend--design criteria, performance standards, preparation of drawings and claims, and general operating procedures--are items that would be required from all associate architects and would not vary from project to project. Further, such policies and procedures would aid the AOC by reducing the time and cost incurred by

associate architects in familiarizing themselves with AOC operating procedures.

Inadequate inventory controls

The AOC agrees with our observation concerning the need for better inventory controls. However, according to the testimony the AOC cites in his comments (see p. 68), he is still developing the necessary improvements. The AOC hopes to use the new inventory control system he is developing on the Library restoration/firesafety project.

In-house work forces

The AOC's comments (see pp. 67 and 68) suggest, quite strongly, that he believes he will be able to recruit the necessary personnel to do the Library restoration/firesafety project. Before citing several examples of previous projects on which in-house labor was used, the AOC states that a study will be made on the specific mix of services to be rendered by in-house personnel versus those under contract.

While the AOC's comments discuss whether he should hire additional personnel under contract, our report (see p. 36) is concerned with a study on whether the project should be done in-house, contracted out to a general contractor, or some combination thereof. We believe that any decisions on who should do the work should be postponed until the restoration plan is developed. At that point, the AOC should study which type of approach--in-house, contracted-out, or some combination thereof--is best suited to most effectively and efficiently carry out the restoration of the Library buildings.

Occupancy and phased restoration

On pages 64 and 65 of his comments, the AOC, in discussing occupancy and phased restoration, agreed that restoring an occupied building was more complex and costly than restoring an unoccupied one. He then pointed out, however, that other criteria, such as business flow and providing temporary space, needed to be considered.

Our report (see p. 37) also recognizes the importance of these other criteria. That is why our recommendation (see p. 39), in noting that it may be necessary to keep the Library buildings operating and partially occupied while they are being restored, is concerned with minimizing the number of phases and amount of occupancy.

Other issues

We believe two other issues in the AOC's comments should be addressed. Our report, in discussing the inadequacy of the available funds to complete the Hart project as designed, details

how the scope of the project has been reduced through deletions, leaving certain portions of the project unfinished, and lowering the quality by substituting less expensive materials (see pp. 7 to 9).

In his comments (see pp. 68 and 69), the AOC believes we should be more explicit in noting that certain modifications resulted from changes directed by the Senate and that the Senate Office Building Commission approved the changes to the original design that have been incorporated in the construction contracts. Further, the AOC believes that we have omitted references to funding delays and other difficulties outside the construction process that have affected the Hart project.

Our report does not imply that the deletions, unfinished portions, and reductions in quality involving the Hart project have not been approved by the proper authorities. Rather, the report simply notes the effects of insufficient funds on the original design of the Hart project. Further, our previous report and chapter 2 of this report discuss, in detail, the effect of funding delays and other factors on the Hart project.

The second issue concerns the use of maintenance funds to do work relating to the Hart project. In our report (see p. 9), we discuss how the AOC, for fiscal year 1982, is requesting \$5 million in no-year funds, as part of the maintenance funds provided under the Senate Office Buildings' appropriation, to do work on the Hart Building that had been within the scope and funding of the construction project.

In his comments, the AOC stated that portions of the \$5 million being requested were required to move certain support offices in accordance with a study made in connection with the West Central Front project and authorized by Public Law 95-94. Also, the AOC stated that our report gave the incorrect impression that his office intended to make these renovations with funds appropriated for maintenance purposes.

Originally, the AOC estimated that \$6.6 million of work could be done with funds appropriated under the Senate Office Buildings' appropriation: \$1.5 million for moving the support offices pursuant to Public Law 95-94 and \$5.1 million for work originally included as part of the Hart project. However, the AOC sought only \$5 million in funds, with no indication of how much of the funds would be used for the support offices and how much for the Hart project. Accordingly, using the AOC's own figures, at least \$3.5 million of the \$5 million being sought for fiscal year 1982 is for items that were originally within the scope and funding of the Hart project.

Also, we disagree with the AOC's statement that our report gives an incorrect impression. The funds the AOC is seeking are under the appropriation used for operation and maintenance of the Senate buildings. The point our report is making is that

the AOC is seeking other sources of funds, beyond those funds directly appropriated for the project, to do work relating to the Hart project.

Library of Congress

In commenting on our draft report, the Library of Congress stated that the report accurately described the situations relative to the design and construction of the Madison Building and the proposed project to restore the two Library buildings (see app. III).

GAO REPORTS ON
AOC CONSTRUCTION PROJECTS

<u>Date report issued</u>	<u>Report title</u>	<u>Report No.</u>
4/07/67	Examination of Construction and Related Costs Rayburn House Office Building	B-145899
8/14/78	New Senate Office Building: Escalated Costs and Delayed Completion	(LCD-78-333)
7/19/79	Renovation of House Office Building Annex No. 2 By The Architect of the Capitol	(LCD-79-319)
9/17/79	The Library of Congress' New Madison Building: Reasons For, And Effects Of, Delays and Escalating Costs	(LCD-79-330)

MODIFICATIONS AND ENLARGEMENT
OF THE CAPITOL POWER PLANT

BACKGROUND

Before the turn of the century, the central part of the Capitol Building was heated by warm air furnaces, Franklin stoves, and wood burning fireplaces. The Senate and House wings had separate heating plants, with electricity for the building generated by a small plant located on what is now the site of the Rayburn House Office Building. The Library of Congress Building, 1/ completed in 1897, also had its own heating plant.

In 1904 the Congress authorized a central power plant for Capitol Hill. Located about one-half mile south of the Capitol Building, the Capitol Power Plant was put into operation in 1910.

Since 1910 many changes and improvements have been made to the Capitol Power Plant. The original steam boilers were removed in 1923 and replaced by a second generation of steam boilers. In 1938 a one-story extension was constructed at the east end of the turbogenerator room to house six refrigeration machines and associated auxiliary equipment.

In 1950 both the steam generators and refrigeration machines were replaced, and arrangements were made to obtain electricity from the Potomac Electric Power Company. In 1958 the Congress, recognizing the increased power needs that would result from extension of the East Front of the Capitol Building, construction of the Rayburn Building and a cafeteria in the Longworth courtyard, and air-conditioning of the Library's Jefferson Building, authorized a major expansion of the Capitol Power Plant. The project was completed before 1970.

Because of the distance between the buildings served and the source of supply, there is an extensive system of underground tunnels leading from the Power Plant with piping systems having branch connections to supply steam and/or chilled water to the buildings. Also, a steam pipe tunnel from the plant extends beyond Union Station Plaza to provide the City Post Office and the Government Printing Office with steam for heating and other purposes.

EVOLUTION OF MODIFICATIONS
AND ENLARGEMENT PROJECT

In August 1969 the National Air Pollution Control Administration filed a report containing certain recommendations for

1/Later called the Main Library Building and now named the Thomas Jefferson Building.

improving the combustion situation at the Capitol Power Plant. In November 1969 a citizens' group filed a petition complaining about air and noise pollution at the plant. Early in 1970 President Nixon issued Executive Order 11507 requiring compliance by Federal agencies with prescribed air and water quality standards.

On March 19, 1970, on the basis of a resolution by the House Office Building Commission, the AOC requested \$150,000 to study all the short- and long-range aspects of the Capitol Power Plant's services. The funds were provided in the Legislative Branch Appropriation Act of 1971. 1/ The contract for the study was awarded in February 1971, and the professional engineers forwarded their report, which included both a short- and long-range program, to the AOC on October 1, 1971.

Project funding

The Supplemental Appropriations Act of 1972 2/ appropriated \$1.2 million for the professional engineering services necessary to prepare contract plans and specifications for the modifications and enlargement of the Capitol Power Plant and for the AOC to administer the project. The Second Supplemental Appropriations Act of 1973 3/ appropriated \$17,400,000 to enable the AOC to proceed, under the direction of the House Office Building Commission, with the short-range program for modifying and enlarging the plant.

In 1975 and 1976 the AOC informed the appropriate congressional committees that, because of increased costs, additional funds would probably be needed to complete the short-range program for the plant. Subsequently, the Legislative Branch Appropriation Act of 1977 4/ authorized an additional \$12 million, raising total authorizations for the project to \$30.6 million, exclusive of the \$150,000 originally approved for the study.

Project scope

As described in specific detail in the enabling legislation (Public Law 93-50), the modifications and enlargement of the Capitol Power Plant consists of

- demolishing the two-story annex building;
- constructing a new refrigeration plant;

1/Public Law 91-382, approved Aug. 18, 1970 (84 Stat. 820).

2/Public Law 92-184, approved Dec. 15, 1971 (85 Stat. 637).

3/Public Law 93-50, approved July 1, 1973 (87 Stat. 109-110).

4/Public Law 94-440, approved Oct. 1, 1976 (90 Stat. 1454).

- installing four or more centrifugal refrigeration machines having a capacity of 24,000 tons, together with necessary cooling towers, chilled water and condenser water pumps and piping, equipment controls, electrical load center and other auxiliary equipment;
- installing a new electrical substation and distribution system;
- constructing a new operations building, controlling both the new and existing refrigeration plants and the entire Capitol Power Plant;
- installing a new chilled water "headering" system to connect the new and existing refrigeration plants with existing and future distribution systems;
- installing supply and return mains to connect the James Madison Memorial and Hart Senate Office Buildings to the steam and chilled water systems;
- installing sectionalizing valves in the existing chilled water system;
- reactivating, replacing, and installing chilled water flow devices in buildings supplied by the plant;
- installing new dust collectors and other equipment in the existing oil-fired boilers;
- installing new acoustical enclosures to minimize noise from fans and compressors; and
- including other sound control measures.

PROJECT CONSTRUCTION

Work to modify and enlarge the Capitol Power Plant is being done in phases. Basically, phasing is being used on the project to permit the procurement of long lead-time components while the buildings are constructed. The project's five phases consist of:

- Phase 1 - manufacture and installation of four refrigeration machines, four pump-down units and receivers, and cooling towers; fabrication and delivery of structural steel and procurement of substation equipment, piping components, motor-operated valves, and chilled water and condenser pumps.
- Phase 2 - demolition of the annex building and clearing, excavation, and maintenance of the site before construction.

- Phase 3 - construction of the refrigeration plant, the operations plant, and a tunnel across the north portion of the power plant site.
- Phase 4 - procurement and installation of mechanical and electrical equipment in the new refrigeration and header tunnel.
- Phase 5 - procurement of dust collectors, central controls for the operations building, noise abatement equipment, and other miscellaneous items needed to complete the project.

PROJECT STATUS AND COSTS

As of July 31, 1981, the AOC had awarded multiple contracts for procurement, installation, and construction work under the project's phases, plus several contracts for engineering services.

The first four phases of the project were substantially complete as of January 1, 1981. Under phase 5, the AOC still has to complete the central controls for the distribution system and various environmental control projects. The AOC estimates this work will be completed by mid-1982.

As of July 31, 1981, about \$27.1 million of the \$30.6 million appropriated for the project had been obligated. The remaining \$3.5 million in unobligated funds is earmarked for completion of the phase 5 work.

IMPROPER CHARGES

Although most of the construction costs for the modifications and enlargement of the Capitol Power Plant through July 1981 were for contracted-out work, costs for in-house labor, materials, and equipment have also been charged against the project's appropriations. Of the \$27.1 million obligated, about \$24.4 million was for contracted-out work, about \$2.0 million was for administrative charges, and about \$700,000 was for in-house charges.

On April 13, 1981, we reported 1/ to the Architect that the appropriations for the modifications and enlargement of the Capitol Power Plant were being charged for work done on other projects, primarily the project to install a sophisticated security system on Capitol Hill. Although we did not completely analyze all the charges related to the modifications project, we did identify over \$525,000 in improper charges to the project's appropriations, primarily involving the in-house and administrative charges.

1/"Improper Accounting For Costs of Architect of the Capitol Projects" (PLRD-81-4).

The use of appropriations for projects and activities for which they are not intended is a violation of 31 U.S.C. 628, which states, in part, that appropriations "shall be applied solely to the objects for which they are respectively made, and for no others." Further, this results in inaccurate information being provided the Congress regarding the AOC's use of funds and the cost of AOC construction projects.

CONTRACT DELAYS

Several of the major contracts on the project to modify and enlarge the Capitol Power Plant have experienced significant delays that, through inflationary factors related to increased time, have added to the cost of the project. For example, even though the site preparation contract was completed in April 1975, construction of the refrigeration plant was not started until June 1976. The delay resulted because the AOC and the designing firm underestimated the complexity of the drawings for the refrigeration plant. Other major contract delays included:

- About 100 days for completion of the refrigeration plant due to an error in the design for the cooling towers. In total, the contractor (refrigeration and operations buildings and tunnel) requested time extensions of 325 days. The contractor's claim was eventually settled for about 150 additional days.
- The mechanical, electrical, and other work contractor requested 351 additional days because of AOC changes to the control panels for the refrigeration plant. AOC officials stated that a settlement, involving time extensions of about 125 days, is pending.
- Award delay of a contract for the central control board for the operations building (to control both the old power plant facilities and the new refrigeration plant) because the AOC rejected the consulting engineer's proposal.

CURRENT STATUS

Originally planned for completion in mid-1975 at a cost of \$18.6 million, the modifications and enlargement of the Capitol Power Plant is now scheduled for completion in mid-1982 at a cost of \$30.6 million. The AOC attributes the increases to cost escalations resulting from the extended time it has taken to do the project, design development changes, and more stringent environmental control requirements.

In February 1980 the AOC was estimating a \$1.6 million surplus out of the \$30.6 million appropriated for the project. As of July 31, 1981, the AOC's records showed an unobligated balance

of about \$3.5 million, with anticipated work estimated to cost about \$3.5 million needed to complete the project. The AOC's \$3.5 million estimate for additional work, however, does not include provisions for administrative costs and contingencies.

RESTORATION OF LIBRARY
OF CONGRESS BUILDINGS

BACKGROUND

Although the Library of Congress was established around 1800, it was not until 1897 that the Library's first building, the Main Building (now the Thomas Jefferson Building), was opened. Before that time, the Library was housed in various locations, including the Capitol Building.

Despite predictions that the Jefferson Building would provide ample space to meet the Library's needs for 150 years, by 1910 it became necessary to enlarge the building to accommodate the Library's expanding collections. In addition to continued enlargement of the Jefferson Building over the years, in 1938 the Annex Building (now the John Adams Building) was opened for occupancy.

In the 20 years following completion of the Adams Building, the Library's collections and staff more than doubled. In recognition of the need for more Library space, Public Law 89-260, approved on October 19, 1965 (2 U.S.C. 141 note), authorized construction of the Library of Congress James Madison Memorial Building. With the completion and occupation of the Madison Building, the Library and the AOC are proposing a major restoration/firesafety project for the Library's Jefferson and Adams Buildings. In addition to restoring the beauty and magnificence of the Jefferson Building, the project is intended to make the Library's treasures more accessible and to improve services to the Congress, scholars, and general public.

The Jefferson and Adams Buildings are bounded by East Capitol Street, Independence Avenue, First Street, and Third Street, S.E. The two buildings have a combined net floor space of about 1,317,000 square feet, including about 360,000 square feet for office, work, and reading rooms; 830,000 square feet for storing the Library's book collections; and other public facilities. 1/

When it was completed in 1897, the Jefferson Building was intended to be a large, monumental library building, containing a single, major reading room, large single-use bookstack areas, numerous exhibition galleries, and open courtyards in the building's four corners. However, as the Library's activities and collections expanded, major changes and additions were made to the building, including the following:

1/The Madison Building provides the Library with about 1 million net square feet of office/work space and about 425,000 net square feet of space for book collection activities.

<u>Change or addition</u>	<u>Time frame</u>
Bookstack in southeast courtyard	1910
Coolidge Auditorium in northwest courtyard	1925
Bookstack in northeast courtyard	1927
Extension of East Front completed	1933
Whittall Pavilion in northwest courtyard	1939
Modernization of electrical system	1959
Installation of air-conditioning system	1962 - 1966
Renovations to the storm/sanitary sewer system	1964 - 1974
Renovation of the Main Reading Room, including new lighting, heating, and ventilation systems and a new book carrier system	1965
Improved illumination in bookstack areas	1967 - 1971
New book conveyor system (part of Madison project) and improved access to building for handicapped	Current

In its search over the years for more space to accommodate its increasing staff and book collections, the Library also significantly altered the interior of the Jefferson Building, including

- using space originally intended for exhibits and public access as work space;
- puncturing openings in building walls, floors, and interior partitions to provide more space for book collections; and
- developing temporary office spaces in the bookstacks themselves.

To create office space in certain areas of the building, it was necessary, in some instances, to construct temporary walls, floors, and ceilings.

The associate architect hired by the AOC for preliminary planning of the restoration effort described the Jefferson Building as one of the finest examples of Beaux Arts Architecture in the world. Built to last, it is adorned inside and out with an array of art work and crafts, including frescoes, mosaics, ornamental plasters, inlaid floors, and paneled and vaulted ceilings, interwoven with the finest architecture of the period.

The Adams Building was designed primarily to provide a functional book storage facility. Unlike the Jefferson Building, it has few areas containing unique or sensitive architectural features. The building's main features consist of two large bookstacks to house the Library's collections. Surrounding curtains and pavilions offer space for office work associated with the collections.

PROPOSED RESTORATION OF LIBRARY BUILDINGS

The essence of the Library's proposed restoration plans for the Jefferson Building, exclusive of the firesafety considerations, was outlined by the Librarian in a March 9, 1977, letter to the AOC. For the first floor, or Main Reading Room level, the Librarian envisioned a series of specialized reading and office areas ringing the central room. The second floor would be devoted to the study of civilizations, with the west front devoted to public exhibit areas specializing in the Library's great treasures.

The ground floor uses would be more diverse. The rear (east side) of the building would be used for library support functions. The spaces at the front of the building would be used for servicing public events.

Originally, the Jefferson Building was sparsely populated with combustible (book collections) materials. As the combustibles increased and the building's system of barriers (walls, floors, and partitions) were punctured to provide more space, the building's fire ignition potential increased proportionally. The building is now populated by combustibles to the extent that it is considered to be at the high-risk level as regards fire potential.

The Library plans only minor restoration--cleaning, repainting, and partitioning work--in the Adams Building. The building's major needs, according to Library officials, are for fire protection and additional bookshelves for those stack areas now used as temporary office space.

The Adams Building is comprised of the perimeter structure, including curtains and pavilions, surrounding the two major bookstacks. Reading and study rooms are located above the bookstacks. When the building was constructed, the bookstacks were reserved for the storage of the Library's collections, while the curtains and pavilions were used for offices. Other space, such as the fourth floor, was reserved for mechanical equipment and general storage.

Since opening in 1938, the character of the building has changed substantially with the introduction of offices into the bookstacks. In addition, space initially restricted for storage or mechanical equipment has been converted to office use. Other activities not included in the original design were also added in the lower levels of the building.

All of these changes to the Adams Building brought increases in the number of occupants and associated increases in fire hazards. The Library's firesafety consultant concluded that the building was overflowing with combustibles. The consultant further noted that little or no firesafety improvements had been made to cope with the increased fire hazards. To the contrary, the consultant cited several examples where substantial barriers to fire spread were penetrated as systems were interconnected throughout the building.

On September 28, 1977, the AOC entered into a \$70,000 professional services contract with an associate architect for a "detailed study and report on restoration of the interior of the Library of Congress Main [Jefferson] Building." The funds for this preliminary design study were obtained by reprogramming, with the approval of the appropriate House and Senate Committees, \$71,000 appropriated in 1976 to renovate the Jefferson Building's Rare Book Room.

The initial objectives for the project were established by the Librarian's March 9, 1977, letter to the AOC. The objectives were further defined in meetings between Library officials and the AOC before award of the associate architect's contract. In recognizing that he would not have a complete Library program to work with, the associate architect anticipated that the final program would be part of the working drawings stage.

On July 28, 1978, the associate architect issued his report setting forth preliminary plans and cost estimates for restoring the Jefferson Building. The associate architect classified the building as an Architectural Preservation project, as opposed to an Historical Preservation project. Pursuant to the associate architect's viewpoint, Architectural Preservation entails the preservation of better buildings of a past period and condones their conversion and practical adaptation to uses or purposes for which they were not originally intended. In contrast, Historical Preservation presupposes the careful, authentic, and pure restoration of a building through exhaustive research and authentic replacement, documentation, and interpretation.

Under the associate architect's concept, certain areas, such as the ground floor, attic floor, Wilson Room, and Main Reading Room, required only minimal rearrangement and redecoration. Those areas destined to become museum and exhibit halls required careful, painstaking work by highly skilled artisans. The associate architect concluded that no actual work on the old sections of the building should begin without first doing a deep and penetrating research program, including obtaining the advice of knowledgeable conservators regarding the protective coatings to be applied after cleaning and/or reconstruction.

Regarding office/work areas, the associate architect's report recommended maximum flexibility, including free access and elevated floor systems to provide space for wiring and ducts.

The report also recommended modifications to the building's structural, mechanical, and electrical systems to effect greater safety through increased code compliance.

The associate architect's report also contained a timetable, developed primarily by the Library, that envisioned restoring the Jefferson Building in two major phases, each having numerous sub-phases, to allow the Library to function without interruption. The first phase would restore the exhibit areas and public spaces at the west front of the building. The second phase would restore the general work space areas.

Although the report estimated the total cost of restoring the Jefferson Building, exclusive of firesafety work, at \$20.5 million, the associate architect qualified his figures by citing the difficulty of accurate estimates so early in the planning stage, particularly estimates of the costs of additions, alterations, and restoration work. 1/

Coolidge Auditorium project

In addition to restoring its interior, the Library and the AOC are proposing renovation of the Jefferson Building's Coolidge Auditorium. Funds for renovating the Coolidge Auditorium were first requested by the AOC in 1977. The request was denied by the Congress. The AOC's fiscal year 1980 budget requested \$900,000 for the renovation. That request was also denied by the Congress. For fiscal year 1981 no funds for the Coolidge Auditorium project were requested.

For fiscal year 1982 the AOC incorporated the Coolidge Auditorium project into the overall restoration/firesafety project and requested \$50,000 for design work. As of March 1981, the AOC estimated the cost of renovating the Coolidge Auditorium at \$945,100.

FIRESAFETY PROPOSALS

In June 1975 the Library hired a firesafety consultant to evaluate the Jefferson and Adams Buildings. 2/ The consultant issued two reports, dated August 30 and September 11, 1978, on the measures needed to fire protect the Jefferson and Adams Buildings, respectively.

1/For fiscal year 1980, the AOC estimated the cost of renovating the Adams Building, exclusive of firesafety considerations, at \$500,000.

2/The Library paid the consultant about \$50,000 for his services.

In essence, the consultant's proposals concentrated on protecting each building by compartmentalizing the interior areas and using alarm and automatic sprinkler systems. For the Jefferson Building, the recommended plan provided for 94 sprinkler systems and 94 local alarm systems. For the Adams Building, the consultant recommended 81 alarm systems and 81 sprinkler systems. In addition, special extinguishing systems would be added or improved at specific hazard locations in the Adams Building, such as the computer room and the exhibit shop area. Using April 1978 data, the consultant estimated the cost to fire protect the Jefferson and Adams Buildings at \$4,570,000 and \$5,700,000, respectively.

Public Law 95-94, approved on August 5, 1977 (91 Stat. 679), appropriated \$100,000 for fire protection improvements in the Jefferson and Adams Buildings. Public Law 95-391, approved on September 30, 1978 (92 Stat. 786), appropriated an additional \$200,000 for this purpose. As of February 10, 1981, about \$49,000 of the \$300,000 had been obligated, primarily for salaries.

OVERALL RESTORATION/FIRESAFETY PROJECT

As now envisioned by the AOC, one overall project will encompass the restoration and firesafety work for both the Jefferson and Adams Buildings, including renovating the Coolidge Auditorium. As of February 1981 the AOC was estimating that the overall restoration/firesafety project could be accomplished in 5 years at a cost of about \$55.5 million. 1/

CURRENT SITUATION

For fiscal year 1980 the AOC requested \$3.5 million for the overall restoration/firesafety project, including \$2.4 million for design and \$300,000 to enable his in-house work forces to begin removing temporary partitions and to initiate minor renovation work in the Jefferson Building. Of the \$3.5 million requested, the Congress appropriated only \$250,000 for design. 2/

For fiscal year 1981 the AOC requested \$7 million for the overall project, primarily for design and fire protection work. Public Law 96-536, approved on December 16, 1980 (94 Stat. 3166), appropriated \$936,500 of the AOC's request, \$773,000 for design and \$163,500 for removal of temporary partitions. As of

1/Does not include the \$300,000 already appropriated for fire-safety work in the buildings or the \$70,000 spent for the preliminary study of the Jefferson Building.

2/Public Law 96-86, approved Oct. 12, 1979 (93 Stat. 657).

January 31, 1981, none of the appropriated funds had been obligated. For fiscal year 1982 the AOC is requesting \$18 million for the overall restoration/firesafety project.

The \$250,000 appropriated in fiscal year 1980 was used to award a contract to an A/E firm to serve as the project's new associate architect. Under the terms of the September 25, 1980, contract, the new associate architect was to develop a preliminary design for interior restorations, renovations, modifications, and alterations of the restoration effort, plus cost estimates and scheduling plans for the overall restoration/firesafety project.

The preliminary design was to cover all aspects of the restoration effort, except for restoration of the existing surface decorations. AOC officials stated that they planned to hire consultants for the surface decorations if the restoration work could not be done by the AOC's in-house work forces. In the interim, the AOC's maintenance staff has spent about \$27,000 in maintenance funds to remove about 85 to 90 percent of the temporary partitions from the Jefferson Building.

The associate architect submitted his cost estimates, work schedules, and preliminary designs to the AOC during March 1981. At the time we completed our review, the AOC's staff was reviewing the associate architect's presentation for feasibility, concept, and costs. The material provided by the associate architect is also being reviewed by the Library's staff.

AOC officials stated that they now plan to use the funds available from the fiscal year 1981 appropriation to negotiate a new contract with the associate architect for preparing the next level of design (intermediate and/or working drawings). The officials also noted that the AOC has not yet hired a consultant to estimate the work involved in and the cost of restoring the surface decorations.

The cost and schedule estimates previously developed by the AOC are now subject to revision on the basis of the new associate architect's preliminary presentation. The Library's current occupancy plans envision backfilling half of the Jefferson Building during restoration. Library officials stated that if funding is delayed beyond fiscal year 1982, however, pressure to use the unoccupied space may force them to occupy part of it.

POTENTIAL PROBLEMS IN RESTORING LIBRARY BUILDINGS

In this report, we cited the types of situations that have contributed to problems encountered on Capitol Hill construction projects. We believe that the potential for the same kinds of problems exists in the proposed restoration of the Library's Jefferson Building. Because the planned work in the Adams Building primarily involves firesafety and cleaning rather than

restoration, we do not believe that the potential for problems on that project is nearly as great.

Even though restoration of the Library buildings has not yet reached the detailed design phase, some of the same conditions we found on the other AOC construction projects have already begun to surface, including (1) funding delays, (2) lack of realistic cost and work schedule estimates, and (3) restoration work being planned in phases while the buildings are occupied.

Restoration of the Library buildings will be a difficult and complicated project. Making the structures firesafe and restoring the Jefferson Building to its original purposes and magnificence will require a thoughtful and thorough approach and program, devoid of the types of situations that have hampered the timely and economical completion of other Capitol Hill projects.

In our opinion, such an approach and program should, as discussed in detail below, embrace the following concepts.

- Development of a timely and adequate funding program to insure that the project is not delayed due to the lack of funds.
- Removal of all existing temporary construction work and development of a final design, including the necessary restoration requirements, before starting work on the overall restoration/firesafety project.
- Development of realistic cost and work schedule estimates.
- Minimal occupancy of the building during restoration to facilitate the work.
- Careful evaluation of whether the work should be done by the AOC's in-house work forces, contracted-out, or some combination thereof.

Funding

Both the Madison and the Hart Buildings experienced significant delays due to the unavailability of funds when needed. For example, design work on the Madison Building was deferred for about 30 months because no funds were appropriated for that purpose in fiscal years 1968 and 1969.

The same situation has already occurred on the Jefferson Building. A work timetable developed by the Library, and accepted by the original associate architect, envisioned design development starting in October 1979, with actual restoration work in the building beginning as early as January 1980. Although the AOC requested \$3.5 million for the overall project for fiscal year

1980, the Congress appropriated only \$250,000. For fiscal year 1981 the Congress appropriated only \$936,500 of the \$7 million requested by the AOC.

Final design and work program

The preliminary work programs prepared for the project indicate that the AOC and the Library plan to remove all the existing temporary construction work and develop a final design before beginning actual restoration work. We believe that this is the proper approach, especially in light of the AOC's observation that:

"I think everyone who has ever had anything to do with historic preservation or the reconstruction of an existing building, knows that one meets unanticipated problems as one opens the building up."

Cost and work schedule estimates

Until the temporary construction work in the buildings is removed and the final design is completed, we do not believe it is feasible to develop realistic cost and work schedule estimates. Accordingly, if the Congress is to have an accurate picture of the cost and time involved in restoring the buildings and making them firesafe, the AOC and the Library should develop cost and work schedule estimates after the removal of the temporary construction work and development of the final design are completed. Then, the AOC and the Library should seek the funds for the actual work involved in the overall restoration/firesafety project.

This approach would conform to the desires of the House Committee on Appropriations, which stated in House Report No. 96-245, that it

"* * * wants to be assured there is a comprehensive plan for the renovation, and that the total cost and time phasing of the project is known at the outset."

We recognize that this approach could, in the short run, result in some initial delays in starting the actual restoration/firesafety work. However, we believe that, in the long run, it will help minimize some of the cost and completion estimating disappointments experienced on other Capitol Hill projects.

Occupancy and phasing

Our report on House Annex No. 2 described the problems encountered from trying to do renovation work in phases while a building is partially occupied. We believe that on a project as complex as the Library buildings, partial occupancy and phasing should be kept to a minimum if similar problems are going to be kept to a minimum or avoided.

The current intent is to keep the buildings open to the public and Library employees during the overall restoration/fire-safety project. The Library is considering partially backfilling, before restoration, that space in the Library buildings being vacated by employees relocating to the Madison Building.

We recognize that it may be necessary to keep the buildings operating during restoration. However, any decision in this regard should consider the problems this approach entails. Also, any increase in the occupancy of the buildings or restrictions on construction work time further increases the potential for problems.

If the buildings are to remain open and occupied during restoration, then some degree of phasing is unavoidable. However, in our opinion, the combination of phasing and partial occupancy provides the foundation for problems similar to those that occurred and are occurring on House Annex No. 2. If phasing must be used, then we believe the number of phases and the amount of occupancy should be minimized.

Use of AOC's in-house work forces

Under the AOC's current plans, the overall restoration/fire-safety project will be done primarily by the AOC's own in-house work forces. We are concerned that the AOC will be unable to recruit and retain the necessary in-house work forces, in terms of numbers and expertise, to effectively and efficiently restore the Jefferson Building.

Only one other major construction project--renovation of House Office Building Annex No. 2--has been done by the AOC's own in-house work forces. As discussed in our previous report and in chapter 2, the use of the AOC's work forces has not prevented the Annex No. 2 project from experiencing the same types of cost, delay, and management problems typical of Capitol Hill construction projects. Further, the AOC's use of in-house work forces helped to reduce the scope and quality of the Annex No. 2 renovation project.

Potentially, from the standpoint of cost, restoring the Jefferson Building will be a much larger project than renovating Annex No. 2. Also, because of the ornate art work and architecture that has to be restored, the work will require considerable artistic expertise. Accordingly, any decision to use in-house work forces must be weighed against the AOC's ability to recruit and retain an adequate work force, both in size and in artistic abilities, to do the restoration work.

Until the restoration plan is finalized and approved, we do not feel it is feasible to determine what types of work forces--in-house, contracted-out, or some combination thereof--will be

best suited to restore the buildings. Accordingly, we believe that the AOC should thoroughly study the types of workers that will be needed to restore the Library buildings in accordance with whatever restoration plan is adopted.



Washington, D.C. 20515

July 28, 1981

Mr. Donald J. Horan
Director
Procurement, Logistics and
Readiness Division
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Horan:

This is in response to your request of May 26, 1981 for my comments on your draft report entitled, "Use of More Conventional Design and Construction Methods Would Help Control Cost Growth and Delays on Capitol Hill Construction Projects." As you know, that study examines the findings and conclusions contained in recent reports of the General Accounting Office covering four major construction projects which this office has undertaken on behalf of the United States Congress. The primary purpose of the report, as I understand it, is to identify problem areas that might surface in connection with the proposed restoration of the Jefferson and Adams Buildings of the Library of Congress, and to recommend to Congress approaches for minimizing the effects of such problems, particularly with regard to project cost.

Inasmuch as the composite report does not appear to raise any new questions about the four projects on which reports have been previously published, it has not been deemed necessary for me to address the issues that have already been examined in considerable depth in the earlier reports. As you know, this office commented extensively on the findings presented in those previous reports, as well as on the results of your earlier audit of the Rayburn Building project which is also cited in the current study. Therefore, I have focused my present comments chiefly on the conclusions your auditors have reached in your latest report and on the merits of the recommendations presented therein.

Since the thrust of the report involves your recommendation concerning the use of so-called conventional construction methods, rather than phased construction, my comments begin with an analysis of several key assumptions upon which that recommendation is based and over which there appear to be substantial differences of opinion. It is important to recognize at the very outset, I believe, that a certain amount of semantic confusion exists in the industry with regard to such terms as phased construction, fast track construction and construction management. As your earlier report on phased

GAO note: The footnotes in this appendix refer to GAO's analysis included in each chapter.

construction methods used at three Federal agencies pointed out, agencies tend to adapt these design and construction techniques to their own particular needs and circumstances (see Report B-118623, October 26, 1977). Since a variety of adaptations have evolved in the construction industry, it seemed to me to be important to define with some precision the specific techniques considered within the scope of the phased construction methods to which you object. I gather from the draft report that your auditors regard simultaneous design and construction as the key factor distinguishing phased construction from single phase methods as well as the major advantage to be gained by the phased construction approach in reducing construction time and cost.

In analyzing the problems described in the report, particularly those considered to be associated with the so-called phasing method of design and construction, your auditors take the position that no construction should begin until all information needed for decisionmaking is known, even though key decisions on enough aspects of the project have been made to permit the commencement of initial stages of construction. Moreover, their conclusions seem to suggest that after the major design and funding choices are made, construction should proceed without the need for reconsideration or further policy guidance. Under these conditions, construction cost estimates can be developed with considerable accuracy, a single general contractor can be designated for the entire construction effort, and construction schedules can be followed without the interruptions that might be caused by changes in policy. 1/

There is little question that under such unique circumstances single contract construction methods will prove to be quite effective in completing projects on schedule and within budget. Measured against that specific but limited standard, the major construction projects undertaken by this office over the last decade predictably can be found wanting. Your auditors conclude that the main cause of these presumed shortcomings is the phasing approach that we have used which has included the beginning of construction before all design issues are resolved and, in some cases, before all funds finally needed to complete the facility are appropriated. To support this conclusion, the report notes that in instances where phased construction was employed, the projects experienced delays, problems in securing the necessary funding, and perhaps most important, construction costs in excess of original estimates. Having thus established the apparent cause, the report then recommends that phased construction no longer be used for Capitol Hill projects with the intended result that problems associated with it will likewise be eliminated.

I take serious exception to this line of reasoning, and wish to call your attention to several deficiencies in the assumptions and analysis upon which it rests. First, and I believe your auditors may agree, we do not view the complex authorization, appropriation and oversight procedures inherent in any Capitol Hill construction project as "problems" per se, but rather as

1/See pp. 28 and 29.

inescapable "facts of life" around which those of us responsible for construction operations must organize our activities. In responses to previous audits, we set forth what we consider to be the significant differences between Capitol Hill construction projects and those constructed for the Executive Branch under the jurisdiction, for example, of the General Services Administration or for the public and private sectors generally. I reiterate these considerations here in order to underscore their implications for the construction of major facilities on the Hill. Changes in Congressional membership and leadership during the course of a major construction project; or in the "client" agency's mission and key personnel, coupled with the responsibility of Congress for the design and funding of projects intended for its own use, often require that important options be reserved as long as possible so that the most appropriate information is available or a wider consensus forged. 1/

While it would no doubt be preferable from a construction management standpoint to have all issues resolved at the outset of a project, it is unrealistic to believe that every project can proceed on that basis. It is absolutely imperative, in my view at least, for Congress to retain its central role in authorizing and funding projects for the Legislative Branch and in overseeing progress on important details concerning facility design and use. That such involvement and control may inevitably require additional time for consideration of decisions than might be needed in projects elsewhere, or may not permit full funding at the outset of construction, must be regarded as a reality of this particular construction process, rather than impediments which must be overcome before a project can be initiated.

A second premise open to serious challenge, in my opinion, is the unproven assumption that single phase construction methods will always be less costly than multi-phased construction under all circumstances. Your auditors reached this conclusion, it appears, by comparing preliminary construction schedules and cost estimates developed under a specific set of anticipated conditions with the actual time and cost of construction. Deviations from the original estimates were thus attributed to the phased construction approach. 2/

These conclusions do not appear to take into consideration any other factors contributing to actual construction costs and timetables. A comprehensive reconciliation of a project's preliminary cost estimates against actual costs would require a detailed analysis of a wide assortment of other factors in addition to the method of construction used; these factors include subsequent changes in scope of work, more severe inflationary pressures than originally assumed, delays in funding and changes in design or construction requirements that could not reasonably be anticipated at the time preliminary estimates were prepared, and delays attributable to a contractor's failure to

1/See p. 29.

2/See p. 29

perform in accordance with contract specifications. Of course, considerations such as these are hardly unique to a particular method of design and construction, and because they are not susceptible to control, are frequently encountered in projects constructed with so-called conventional methods as well. 1/

Without referring to the complexities involved in this type of analysis or indicating whether such an analysis was in fact performed, the report, in my judgment, oversimplifies the problems through a generalized discussion of "cost overruns" which are characterized as largely if not solely attributable to the method of construction.

It strikes me as being more appropriate to use a less pejorative and, incidentally, more accurate term. A true additional cost (or "cost overrun") would, in my opinion, really be the difference between what the project actually cost and what it might have cost if built with exactly the same characteristics, but by some other method. To view preliminary estimates as though they were contractor's bids can obviously lead to inappropriate conclusions regarding costs and hence incorrect management decisions on future projects.

To show the potential effects of postponing construction until all design and funding issues are resolved, we analyzed the Hart Building project to compare costs of multi-phasing versus single phase construction methods. That analysis is available for your examination. We found that the so-called conventional technique would have cost the Government anywhere from \$2.5 million to \$11.0 million more to build the same \$137.7 million facility now under way, with the actual increase depending on when the construction contract could have been awarded. Stated differently, in my judgment phased-construction on the Hart project has saved the American taxpayers a considerable sum, which could possibly amount to \$11 million. 2/

Another important consideration involved in a comparison of these design and construction methods is the amount of disruption to routine operations that can accompany major renovation projects, such as the House Office Building Annex No. 2 project and the proposed renovation of the Jefferson and Adams Buildings of the Library of Congress. We agree with your auditors' assertion that interior construction on a large scale is likely to be more complex and costly in an occupied building than in an unoccupied one. With all other things being equal, an unoccupied structure clearly offers the most expedient and efficient environment for construction and for this reason would generally be preferred. However, construction cost and complexity obviously cannot be the only criteria for comparing alternative approaches for

1/See p. 29.

2/See p. 28.

undertaking a project. As I feel certain you will agree, consideration should also be given to the impact of each alternative on the normal flow of business regularly conducted in the building and the costs associated with providing temporary space in other locations during the course of the renovation effort. Such costs would obviously not only include the out-of-pocket expenses incurred in the moving of staff and the temporary housing of programs in other facilities, but also the nonquantifiable costs of disrupting services to the Congress and inconveniencing the general public. 1/

To summarize, therefore, we regard the considerations involved in determining the most appropriate construction techniques and strategies for a given project to be far more complex than those presented in your draft report. There is no indication, for example, that your auditors analyzed potential cost increases that would have arisen from funding delays and other uncontrollable forces under conventional construction methods before they concluded, apparently on the basis of preliminary estimates alone, that phased construction is the "primary factor" contributing to cost escalation and slippages in construction schedules. Neither is there any evidence to suggest that more conventional techniques would prevent funding concerns and other unresolved issues from delaying the start of construction to the point where inflation offsets efficiencies that might accrue by awarding a single construction contract to one general contractor.

As a result of these complexities which I do not find addressed in the draft report, I cannot agree with the notion that the single phase construction approach will always be the most effective and least costly regardless of the particular circumstances encountered on any given project. I take the position that construction methods must be tailored to the unique scope of work, policy and funding considerations, and decision timetable expected for each particular project; accordingly, so-called conventional practices will be preferred in some cases, while multi-phased construction will be more appropriate in others. Flexibility to make these judgments on a case-by-case basis and to recommend the strategy best suited to the particular circumstances is absolutely essential, in my opinion, in order to minimize costs and maximize the availability of appropriate facilities to the Congress. I must therefore disagree with the inflexible approach advocated in the draft report.

Although I cannot support the report's central recommendation, particularly the intensity of your objections to phased construction of Capitol Hill projects, other suggestions contained in the report are meritorious, provided, of course, that appropriate recognition is given to the special circumstances which we sometimes encounter. With regard to the development of standard policies and procedures for associate architects, for example, I agree that information of this nature can be useful when it serves to help communicate important expectations in the area of design and engineering, and does not establish rigid standards that unnecessarily inhibit the relationship or restrict the exchange of ideas or the consideration of alternative approaches and concepts. 2/

1/See p. 40.

2/See p. 39.

I do, for example, support the development of guidelines in those areas where significant changes are not expected as we move from one project to another. The recent publication of an operating procedures manual for the Hart project, for example, has proven to be extremely helpful and has been favorably received by our construction contractors. Although the handbook was not available at the time we entered into the A/E contract for the Hart project, it will be provided to prospective A/E firms in the future to help explain our internal administrative procedures as well as to outline the management controls and organization structure used in the supervision of construction projects.

It is also important to bear in mind that since I am, by law, the designated architect for construction projects in the Capitol complex, our relationships with A/E firms are marked by factors which rarely come into play in other government construction projects and which are also uncommon in typical contracts between private owners and A/E firms. Thus, I am not only the contracting officer for construction purposes, but the architect as well as the owner's (government's) representative. For smaller projects, for example, our own in-house staff of architects and engineers performs the necessary professional services. On larger projects, "outside" A/E firms are engaged as associate architects and in effect act as extensions of staff, serving under my overall supervision. This relationship demands the same level of professional rapport and respect as is generally required among partners in a joint architectural venture, qualities that are not susceptible of precise definition or quantitative measurement. Other special factors that affect the design process include the role of Congressional Committees/Commissions in setting policy for projects; the monumental character of Capitol Hill projects; the high quality standards expected in construction design and materials; the uniqueness and architectural significance of buildings in the Capitol Complex; and the extensive day-to-day participation in and supervision of projects by our staff architects, engineers and construction management personnel.

In addition to this unique relationship, other circumstances diminish the utility of standardized design details, operating procedures and architectural performance criteria. For example, we carry out our construction activities under the policy direction and jurisdiction of several different committees and/or commissions depending on the location and intended uses of the project. As explained above, it is not uncommon to find that the membership of these governing bodies changes during the course of a project. Hence, it has generally been considered inadvisable to invest considerable time and effort in developing certain performance standards and operating procedures for a given project that are subject to change as that project moves forward, and that may have very little applicability to subsequent projects constructed under the jurisdiction of another authority or governing body. And because the nature of the construction effort varies significantly from project to

project, we have in the past generally decided not to develop comprehensive standards for numerous design details that might be appropriate in one setting but not in another.

I regard the development of a sound and reasonably detailed program description to be of greater value to the work of associate architects than a listing of performance standards and other procedures that may vary from one project to the next. During the planning stages of the James Madison Memorial Building, for example, we and the Library devoted two years to a design effort aimed at assembling a detailed program for use by associate architects. However, as a result of staff changes, including the appointment of a new Librarian, and also rapid changes in library technology coupled with a changing mission of the Library of Congress as provided by law, much of this work was modified which necessitated "going back to the drawing board" with new ideas and directions.

In view of the monumental character and rich variety of architecture found in the Capitol Complex, it appears to me unlikely that standards established by the General Services Administration for speculative office buildings would be appropriate for the types of facilities constructed for use of the Congress.

I nevertheless remain open to suggestions for ways in which a better understanding can be reached with our associate architects on critical design characteristics and performance criteria at the earliest possible point in the planning stages of a project. Following the suggestions in your report, I intend to review the standards established by the General Services Administration to determine their applicability, if any, for our purposes. In addition, I shall continue to take what I regard as necessary steps to assure that we have reached such an understanding with prospective associate architects before recommending that we enter into contracts with them. 1

With regard to the proposed Library renovation project, the draft report expresses your concerns about our ability to recruit skilled craftsmen to perform the restoration work envisioned as part of that project. We accept the general premise that specialized skills may be required to perform certain restoration tasks and that individuals with the requisite expertise must be engaged to perform them. It seems, however, that there may be a misunderstanding regarding our plan to do this project with so-called in-house forces. Our recommendation is that we manage the project as a general contractor, in effect, with responsibility for making certain that experienced personnel are retained to work on the project, either as employees of the office or under contract, just as is presently done in the Capitol. We have decorative painters on our permanent payroll, and yet we hire artists and restorers on a contract or per diem basis for specific specialized tasks. Decisions on the specific mix of services to be rendered by in-house

1/See p. 39.

personnel versus those under contract need not be considered at this point, but will be made as part of the construction management process at the appropriate time and after careful study.

We, of course, recognize the absolute necessity of attracting personnel who have the expertise required for the project. In that regard, it should be recalled that in-house labor forces were used with excellent award-winning results in the two most significant restoration projects undertaken during the past decade, namely, the Old Senate and Supreme Court Chambers in the Capitol. We have also been responsible for securing the services of skilled artisans in a number of smaller scale projects such as the ornate painting in the Brumidi corridor and along the House Wing of the Capitol, restoration of works of art, and the commissioning of portrait busts and statues commemorating leaders of our country. The high caliber of our curatorial staff and the workmanship on projects such as these vividly demonstrate not only a keen sensitivity to this area of concern, but also a capacity to attract competent individuals and oversee their work. On projects of this nature, an outside contractor would have to recruit artisans or contract with individuals specializing in various restoration activities. Experience has consistently shown that we can achieve the highest quality results with our own undertaking of these types of efforts. 1/

The report also recommends that this office implement improved inventory controls over construction materials to ensure that materials are used as intended. As you know, the experiences with inventory control procedures for the House Office Building Annex No. 2 project were indicative of needed improvements. Since that time, the office has developed more effective controls for both new construction and routine maintenance activities; efforts are also under way to computerize stock issuance and replenishment transactions to provide timely, updated information on inventory levels and usage. In response to a question from the House Subcommittee on Legislative Branch Appropriations, I recently expressed my views on the importance of strengthened inventory management controls and the kinds of procedures we have under consideration for the Library renovation project. For more specific comments on this topic, a review of the discussion of this subject which appears in the published record of the Subcommittee's hearings on the fiscal year 1982 budget request of this office (Part 2, Legislative Branch, pages 773-774) would be useful. 2/

Finally, I would like to call attention to several instances in the draft report where your auditors may not have had access to all of the relevant information or may have misunderstood the reviewed material. For example, it is not clear that certain modifications that have been made to the Hart Building design and scope of work resulted from direction by the Senate itself

1/See p. 40.

2/See p. 40.

and that the Senate Office Building Commission thus approved the changes to the original design that have been incorporated in the construction contracts. In addition, there is an omission of the funding delays and other difficulties outside the control of the construction process itself that made it necessary to consider modifications to the Hart Building. 1/

The draft report also indicates that maintenance funds have been requested to do certain construction work in the Dirksen and Russell Buildings that had originally been part of the Hart project scope of work. Your auditors were apparently inadvertently unaware that portions of our request for \$5 million in the FY 1982 budget are required to move certain support offices located in the Capitol to the Senate Office Buildings in accordance with a study made in connection with the West Central Front project and authorized by Public Law 95-94. 2/

In addition, since the annual budget request is not limited to the maintenance activities of this office, it appears somewhat misleading for the report to suggest that maintenance funds have been requested for this renovation work. Instead, as we have commonly done each year in requests for funds for capital improvements, we have requested funds as part of a no year appropriation that may be used for authorized purposes including the construction work proposed in the fiscal 1982 budget. The report gives the incorrect impression that the office intends to make these renovations with funds appropriated for maintenance purposes. 3/

CONCLUSION

By calling attention to problems that have arisen in recent construction projects, the report presents an opportunity to provide valuable insights into the difficulties encountered in building major facilities on Capitol Hill. My most serious difficulty with the report stems from the fact that its key findings regarding phased construction are conclusory in nature and do not, in my judgment, appear to be substantiated by rigorous analysis of the full range of factors contributing to cost escalation and construction slippages. I believe, for example, that your auditors have placed too much emphasis on comparing actual costs with preliminary cost estimates without explaining the reasons for higher construction costs. Consequently, the report in draft form falls short of presenting a complete and balanced picture of the advantages and disadvantages of multi-phased construction in relation to single phase construction methods.

The report, for example, does not explain that at the time the basic concept of phased construction was originally recommended, it was considered by most of the industry as a major advancement in the state of the art of construction management and promised tremendous savings in cost increases

1/See p. 41.

2/See p. 41.

3/See pp. 41 and 42.

caused by annual inflation, now 18 percent or more in new construction. The report does not discuss the possible merits offered by phased construction in enabling Congress to leave some of its decision options open until late in the construction process and to stagger appropriations for a major project over several years instead of requiring the full amount to be appropriated before construction begins. The report does not indicate the effects of inflation on project costs had conventional construction methods been used instead of the phased approach, thereby postponing the start of construction for several years. Whether the disadvantages of phased construction outweigh the advantages under conditions normally experienced in constructing projects for the Legislative Branch requires, I believe, a far more comprehensive analysis than the report appears to provide. 1/

Let me hasten to repeat that I agree fully with the proposition that projects can proceed more expeditiously when all necessary decisions, including the enactment of appropriations, can be made in the beginning and with little delay after initial planning has been completed. I agree with your auditors' conclusion that so-called conventional construction methods would normally be preferred under such circumstances. I reach a different conclusion on the course of action to take when ideal conditions do not exist and when considerable time will be required before design and funding decisions can be finalized. Under those circumstances, I believe that it is vital not to rule out the use of phased construction as a means of beginning those stages of construction on which a consensus has been reached on design and funding questions.

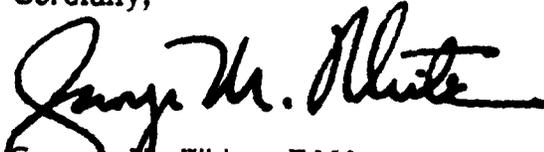
In summary, I believe that there is no one way to approach a construction project. The use of phased construction for future projects should be based on the circumstances presented by each project, rather than on the basis of generalizations made from projects that may have substantial distinguishing characteristics from the project under consideration. I believe that it is imperative that the Congress retain a flexible policy so that the interests of the government can be served to the maximum extent possible by applying construction methods that fit each project.

I sincerely appreciate the opportunity you have afforded me to review and comment on your draft report; that, and my desire to respond constructively to your recommendations, is, in my judgment, indicative of the spirit of cooperation and the continuing search for improvement in our activities that is characteristic of our mutual desire to better serve the Congress.

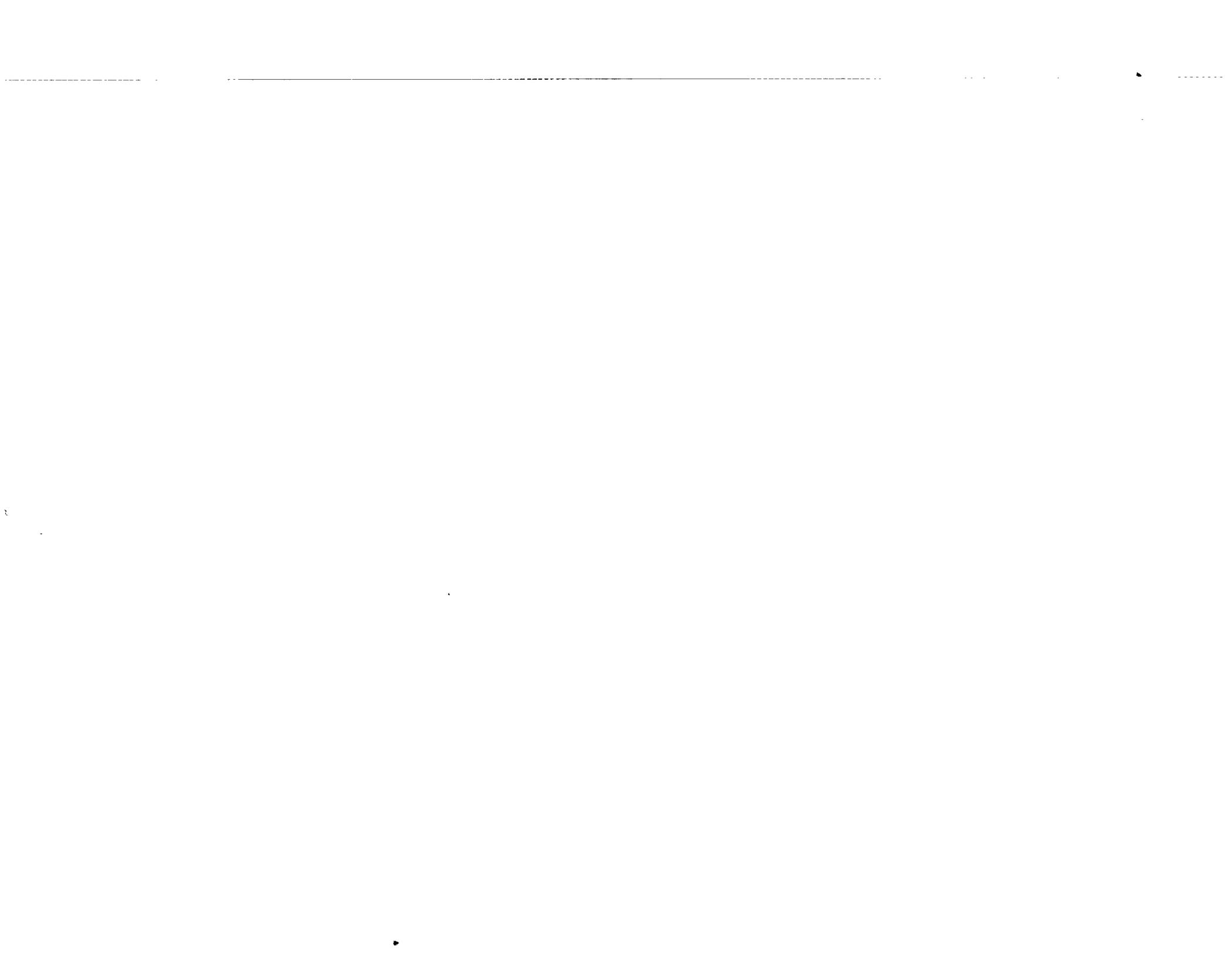
1/See p. 30.

I shall, of course, be pleased to discuss any further comments you may have or answer any questions concerning my reactions to your conclusions and recommendations.

Cordially,


George M. White, FAIA
Architect of the Capitol

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