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Opportunities for Design Quality Improvement Through Architect/Engineer (A/E) Liability Management

by
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This report identifies opportunities for improving the U.S. Army Corps of Engineers (USACE) Architect/Engineer (A/E) Liability Program. To establish which areas need improvement, the U.S. Army Construction Engineering Research Laboratory (USA-CERL) surveyed the literature and analyzed the results in terms of applicability to USACE. Next, the A/E Liability Research Steering Committee was formed to provide feedback for the study.

USA-CERL initially identified three general areas as having potential impact on the A/E Liability Program. These areas were presented to the steering committee, which focused these three categories into four specific areas of opportunity. (1) design synthesis, (2) design criteria, (3) pursuit of A/E liability cases, and (4) identification of negligence.

Based on an analysis of these opportunities for improvement, this study recommends the following actions: (1) develop technical design quality assurance guidelines, (2) require that A/E firms develop quality control programs based on the complexity of particular projects, and (3) develop an automated system to train new employees in the application of A/E liability procedures.

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FOREWORD

This investigation was performed for the Directorate of Engineering and Construction, Headquarters, U.S. Army Corps of Engineers (HQUSACE), under Project 4A162731AT41, "Military Facilities Engineering Technology"; Work Unit BO-051, "A/E Liability Management and Recognition System."

The work was performed by the Facility Systems Division (FS) of the U.S. Army Construction Engineering Research Laboratory (USA-CERL). Dr. M. O'Connor is Chief, USA-CERL-FS. The technical editor was Dana Finney, USA-CERL Information Management Office.

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COL Carl O. Magnell is Commander and Director of USA-CERL, and Dr. L. R. Shaffer is Technical Director.

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OPPORTUNITIES FOR DESIGN QUALITY IMPROVEMENT THROUGH ARCHITECT/ENGINEER (A/E) LIABILITY MANAGEMENT

1 INTRODUCTION

Background

Approximately 30 percent of all contract modifications issued on U.S. Army Corps of Engineers (USACE) construction contracts are reported to be the result of design deficiencies. To improve this record and reduce the potential for expensive litigation, the U.S. Congress and USACE have recently placed great emphasis on the early, consistent detection of design deficiencies that have a high probability of occurring due to architect/engineer (A/E) negligence or breach of contract.

There are, in general, two ways the A/E Liability Program could improve. The first is to increase the effectiveness of USACE design quality assurance, thereby reducing the number of cases of A/E liability that must be processed. The second way is to improve the ability of field operating agencies to quickly resolve and close a case, given the existing A/E liability processes.

Objective

The objective of this study was to identify specific opportunities for improving the USACE A/E Liability Program.

Approach

To identify potential areas of improvement, USA-CERL surveyed the literature and analyzed the findings with respect to USACE application. To verify the findings, the A/E Liability Research Steering Committee was established. This group was composed of USACE personnel who administer the A/E Liability Program at all levels of the organizational hierarchy throughout the United States. The steering committee reviewed the findings and suggested revisions; this feedback was incorporated into recommendations for improving the A/E Liability Program.

Scope

Since A/E liability issues are based both in engineering and law, certain legal concepts are defined and discussed for this study. Although this report is not meant to be a treatise on the legal system, a general understanding of the relevant legal concepts is necessary to arrive at workable potential solutions.

Mode of Technology Transfer

Results of this research will be distributed to the USACE Districts and Divisions for use in developing local regulations and practices.

2 EXPERIMENTAL PROCEDURE AND LEGAL DEFINITIONS

Procedure

Much literature has been published on the issues of A/E liability, risk management, design deficiencies, and the insurance crisis. Therefore, the first step in this work was to analyze the existing knowledge base in light of USACE requirements. This analysis was done to avoid identifying issues that have already been analyzed and found inappropriate for public construction organizations.

A literature survey is an appropriate method of initial review; however, unless the concepts developed are tested within the context of daily procedure and practice, the conclusions cannot be verified. To provide practical input to this work, the A/E Liability Research Steering Committee was formed. Members were identified as being in key positions within the USACE A/E Liability Program. In addition, each individual expressed an interest in working with USA-CERL to identify and prioritize problems related to A/E liability.

The steering committee convened during February 1987 to review USA-CERL's initial recommendations and provide additional input. The specific objectives of this meeting were to:

1. Review proposed problem statements
2. Prioritize problem statements
3. Revise problem statements
4. Identify critical factors in problem solutions.

The results of the meeting were used to identify potential opportunities for improvement in the A/E Liability Program as outlined in Chapter 3.

Legal Definitions

These definitions are limited to terminology frequently used when discussing A/E liability issues. To apply these definitions to points of reference familiar within USACE, some case studies are provided.

Design Deficiency

During the 1982 House of Representatives Appropriations Committee hearings on "Planning and Design Activities for Military Construction Projects, Department of Defense," a definition was offered for "design deficiency" that will be used throughout this report. By this definition: "a design deficiency is any deficiency in drawings and/or specifications that results in a facility which will not adequately perform its intended mission."[1] Since the nation's lawmakers view the problem in this way, it is important

[1] U.S. House of Representatives, *A Report to the Committee on Appropriations, U.S. House of Representatives on Planning and Design Activities for Military Construction Projects, Department of Defense* (U.S. Government Printing Office, February 1982), p 78.

that USACE spend time analyzing this definition. To fully understand the definition, it is necessary to examine it in terms of three of its components: "intended mission," "adequate performance," and "design deficiency."

The most general component is the intended mission. For a mission to be intended, significant forethought and planning should have occurred. This planning effort spans the entire Military Construction, Army (MCA) program prior to the construction contract notice to proceed. While the "intended mission" may change during the project due to criteria alterations or user-requested changes, the definition should refer only to the mission at the time of the design contract. This distinction is important because the A/E firm can only plan and design for the intended mission as defined.

If the intended mission changes during the construction process, USACE may, as appropriate, negotiate with the A/E to increase the scope of work necessary to accommodate the revised intended mission. Once both parties have agreed on the revised scope of work, the A/E contract will be modified and the work will then be viewed as being part of the contract's intended mission.

The construction contractor must follow plans and specifications which were developed by the A/E firm to satisfy this intended mission. Often, new intended missions, and the resulting changes in facility criteria, are identified by a new using agency. While these changes may be agreeable to the construction contractor or the facility engineer, they reflect a clear change in the project's original intended mission.

The second part of the definition to examine is the requirement for failing to "adequately perform" the intended mission. The A/E communicates the way in which a facility is to perform its intended mission through plans and specifications. It is the responsibility of the contracting officer's authorized representative and the construction contractor to execute and actually determine if the intended mission has, indeed, been described adequately.

The clearest evidence of nonperformance is structural failure of a major building component, such as a roof that collapses. Another example is a gym floor that fails to support the weight of a basketball team--its intended mission. In the first example, the A/E failed to follow structural guidelines which are generally accepted engineering principles. In the second example, the designer did not allow for the weight explicitly stated as critical to use of the gym.

The third and most specific element of the definition deals with the connotation of the word "deficiency." A deficiency has become, due in large part to the current legal climate, almost synonymous with cash settlements. However, this interpretation is erroneous. A deficiency does not imply or assign blame for any condition, but is a technical decision that notes an error or omission in the plans and specifications.

There are two overall causes for design deficiencies. The first is failure to develop and describe adequate design criteria, and the second is failure to synthesize the design into a consistent, cohesive whole.[2]

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[2]Federal Construction Council, *Agency Practices on Holding Architects and Engineers Responsible for Design Deficiencies*, No. 78 (National Academy Press, 1985), p 25.

Failure to develop adequate design criteria is evident through design deficits that can be described as due to one of the following reasons:

1. Inadequate initial requirement statement

2. Inadequate design criteria

3. Misinterpretation of requirements

4. Inaccurate data

5. Insufficient field investigation.

Failure to synthesize a design into a coherent whole is seen mainly in the failure to coordinate technical specialists and/or the plans and specifications.

Damage

Costs incurred as a result of a design deficiency which would not otherwise be incurred to construct the facility are called "damages." Damages are those costs above what would have had to be included in the original contract for the work to be accomplished. One way to view damages is that they are the payment needed to return the facility to the point where it was before the contract was made or the problem occurred.

Damages typically include the material, labor, and equipment costs necessary to tear out or repair design-deficient construction. In addition, overhead, delay, and inefficiency costs may be included in the damages if these costs resulted from design deficiencies.

Another type of damage that USACE may suffer as a result of a design deficiency is additional cost in administering the construction contract. In some cases, actual costs for additional administration have been claimed; however, the Government was awarded only an amount reflecting the Supervision and Inspection (S+I) rate (approximately 5 percent). A recent Comptroller General decision indicated that the USACE District may keep monies recovered for additional S+I costs.

Liability

When a change is necessary as a result of a design deficiency, USACE regulations require that the District Office determine the party responsible. Responsible parties so determined may be held financially and professionally accountable, or liable, for the results of their actions.

Liability is interpreted in different ways, depending on the particular surrounding circumstances and trade custom. For example, if a manufactured product such as reinforcing steel caused a floor to collapse, investigators will attempt to determine if the problem is a result of the A/E's improper selection, handling of the product, or the product itself.

If the problem is a result of the manufacturing process and not the selection or handling of the product during delivery or installation, the steel company may be required to redesign, repair, and bear all other damages resulting from the problem. If the manufacturer's product was not the cause of the deficiency, the contractor or the A/E may be held liable for the facility's failure to meet its "intended mission." If the

contractor, through improper handling, damaged the product or did not install it according to the drawings, then he* may be held accountable for the damages.

While the term liability may be interpreted differently depending on the particular circumstances, there are really only two ways to recover damages in a design contract. The first is negligence and the second is breach of contract. These words have specific legal definitions that will be generally explained in the following two sections.

Negligence

Four tests are used to establish negligence:

1. Confirmation of the A/E's duty
2. Breach of duty
3. Cause-in-fact
4. Proximate cause.

All four tests must be satisfied before issuing a judgment against the A/E.

The first test must establish the designers' "duty." In the professional service contract, it is the duty of the A/E to provide the contracted services at the level of effort at which other professionals with the necessary level of experience would provide, given the same circumstances.

While many persons unfamiliar with construction will attempt to apply the standards of strict product liability to A/E design, the A/E firms, as well as other professional service companies, are generally not held to the same level of responsibility as a manufacturing company. The justice in the *LaRossa V. Scientific Design Company* case stated the issue as follows:

> Professional services do not ordinarily lend themselves to the doctrine of tort [strict] liability without fault because they lack the elements which gave rise to the doctrine....Professional services form a marked contrast to consumer products cases and even in those jurisdictions which have adopted a rule of strict products liability a majority of decisions have declined to apply it to professional services....Those who hire [experts]...are not justified in expecting infallibility, but can expect reasonable care and competence. They purchase service, not insurance.[3]

Another way to establish duty is by the "economic" theory. This theory confirms the duty of the design professional beyond the "reasonable" standard of professional care in order to safeguard the public welfare. This theory uses a formula which states that, even though the A/E has acted with the expected standard of care, the firm and its employees may be held liable for failures if the probable cost of damages and injury will greatly exceed that of preventing the potential damages.

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*The male pronoun is used for convenience in this report to imply both genders.

[3]Engineering Board of Contract Appeals, *LaRossa V. Scientific Design Company*, 402 F.2d 937 (3 Cir. 1968) 942-943.

The walkway disaster at the Hyatt Hotel in Kansas City, MO, applied this economic theory in establishing duty. The failure was caused by a contractor-certified connection that was not strong enough for use in the hanging walkway. The connection detail of the walkway deviated from the construction plans and had been submitted to the A/E for review. Although the A/E was not contracted for shop drawing review, due to the fact that the plans had been submitted to him, the court found that the A/E was negligent. The economic theory was applied as follows: since the potential damage and loss of life (due to a failure of the connection) was far greater than the several hours that would have been required to review the submittal, the A/E was negligent for not conducting the review.

Once duty has been established, the "breach" test is applied. This test seeks whether the designer performed the contracted services within the level of professional service typically expected from another designer given the same circumstances. This standard of care is called the "duty."

If the designer breached his duty, the next step in establishing negligence is called "cause in fact." This test attempts to determine if the deficiency occurred as a direct result of the A/E's failure to perform his duty of professional care. This test can be viewed as an "if-then" case, presenting the issue as: "IF the designer had correctly designed the beam, THEN the building would not have collapsed."

Once it has been determined that the A/E was responsible for the resulting problem by applying the first three rules, the rule of "proximate cause" is applied. This test determines if the designer, and not some intervening cause such as natural events or Government direction, actually caused the problem.

The proximate cause test, as with the other three tests, is based on the "objective standard" of professional opinion. If the A/E could have reasonably foreseen the outcome, the duty was breached and the proximate cause test has been met. While it is clear that failure to check a beam size could cause a building to collapse, there may be instances in which a design was incorrect but some other circumstance actually caused the problem. If, for example, the designer had correctly sized a beam but the contractor did not build the beam according to specifications, the designer may not have foreseen the problem and the proximate cause test would not be met. As this example illustrates, it is essential that the design be constructed according to plans and specifications to pass this final test.

Breach of Contract

Another area of liability falls under "breach of contract," which is another way the A/E can be held accountable for damages without having to meet the four tests for negligence. It is generally understood, however, that if an A/E is negligent, he has probably breached the contract by not following through as specified in the contract. For example, if the A/E's contract specifically stated the requirement to design a gym and the A/E sizes the beams so that they do not carry the design load, then he has breached the contract by not providing a structurally sound floor as is needed in gyms.

To prove a breach of contract, USACE must show that it did not, either directly or indirectly, cause the breach. While USACE design contract project managers are aware of the importance of careful discussion with the A/E, they should also be aware that informal discussions, design review comments, or any interaction between the A/E and USACE may be construed as changing the A/E's responsibility for the design deficiency. Under contract theory, once any change has been agreed upon by both parties, the

contract is treated as a new document. Therefore, it is very important to fully document all interactions between USACE and the A/E.

Tacit modifications also may occur indirectly. If the designer proposes some additional work that would benefit the Government and USACE does not specifically tell the designer *not* to proceed, this may be an oral modification. Although oral modifications are contrary to regulations, any discussion with the A/E firm by USACE may be construed later, during litigation, as an oral modification.* Another possible situation is that the using agency suggests certain changes; unless USACE specifically disagrees, there may be a tacitly agreed upon oral modification. Because these changes often occur during design meetings, extreme care should be taken to document all interaction with the A/E.

An example of an oral modification is when the Government directs the A/E to change the design. Changing the original design may cause the A/E concern over the consistency of the new design. A careful A/E should reject, in writing, any modification that will cause design deficiencies. This rejection must point out the potential damages due to the modification. Provided this documentation is done, the A/E will generally not be held liable for directed modifications.

Case Studies

Application of the above definitions to USACE construction can help explain how complex situations may arise out of seemingly simple facts. An example case study will serve to illustrate the types of problems that USACE can encounter during a typical project.

The example project is a renovation of an office building on a military base. Among other items in the initial design study is a requirement to address the existing wall condition. The building's walls are greatly out of plumb and many wallboard nails have popped out. The using agency decides that paint will be an adequate wall treatment throughout the building since the occupants will be primarily junior officers.

The time between initial design decisions and actual construction for this project may be several years. During this time, many of the personnel who have developed the original design requirements may transfer out of this organization. Therefore, it would not be unusual for the using agency to modify the requirements for the facility due to a change in their "requirements" several years into the design cycle. For example, if, instead of junior officers, the headquarters (HQ) office were to move into the facility, the decision to paint over existing wall conditions may be reconsidered. It is possible that vinyl wall covering (VWC) may be specified to hide both the poor wall condition and provide a more appealing wall finish for HQ staff.

The responsibility for this modification rests with the using agency since it had made the original decision to use paint based on the first design requirement of providing offices for junior officers. However, those who did not define that requirement may perceive the decision to use paint as a design deficiency and look to the A/E for recovery. It is important that persons in the construction phase recognize that the original requirements may be different from the requirements of the building occupants. Unless

*Oral modifications are often referred to as "directed" changes.

this is understood, the A/E may be considered to be the cause of the problem until further investigations are conducted.

Using the same project, another situation will illustrate a problem that occurs during the design process under breach of contract concept. The original requirement in this new scenario is to provide offices for HQ. To cover the poor wall condition, the A/E proposes that VWC be used. HQ agrees that the wall covering is a very important feature and should be included in the project. This agreement constitutes one portion of the scope of work in the design contract.

Before construction begins, the budget for the facility is decreased and the District Office tells the A/E that the scope of work will have to be reduced. Specifically, the District indicates that the finish schedule and selection of VWC should be revised. Although the A/E recommends against reducing the thickness of the VWC, the District requires the change to be made to keep project costs within the funding limitation.

Once construction begins, the contractor indicates that the Government will receive an inferior product due to the specified width of the wall covering. The contractor also submits a proposal for increasing the width of the VWC to hide the terrible condition of existing walls.

To analyze the problem, the Resident Engineer contacts the A/E, in accordance with the design contract requirements, for an opinion regarding the validity of the contractor's assertion. The Resident Engineer will also coordinate with the Engineering Division as outlined by individual District regulations. The A/E indicates that the wall covering should be changed. The Resident Engineer agrees and issues a change under Contract Clause three.[4] The additional cost to the construction contract as a result of the change is the difference in material, labor, and equipment between the original and new VWC. In addition, time may also be considered in the settlement since the new material may take longer to hang.

This case is a clear design deficiency since the thin material specified would not meet the requirement of hiding the existing wall conditions. The modification, however, was not initiated by the designer, but by the Government. Since the contract requirements were met and the designer objected to the direction, the designer should not be found to have breached the contract.

These examples have illustrated the breach of contract issue. In addition, they have given some sense of the responsibility and potential liability that can be assigned to the parties involved. The same project will now be extended to illustrate damages and negligence.

In the new case, the A/E chooses the thin wall covering. The construction contract begins and despite the Resident Office demanding better performance from the contractor, the VWC arrives onsite only 1 week prior to the project completion. The contractor, however, does an excellent job of installing the material to meet the completion date. The final inspection occurs on time and the HQ staff is ready to occupy the building--but just as the Chief walks close to a wall which is particularly out of plumb, the wall deflects and the covering tears.

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[4]Federal Acquisition Regulation (FAR) 52.243-4 (April 1984).

Once the Chief has expressed his comments about the project's quality, the Resident, District, and Division offices decide to review the situation. Their initial review is a technical determination regarding the facts of the case.

The VWC, intended to hide the existing conditions, is not adequate because the wall deflection and extended nail heads do not allow a continuous bond between the wall and VWC. Without this bonding, after the adhesive is set, there are many areas where the VWC can tear. Based on this initial technical determination, the item will be called a design deficiency.

The costs to remove the torn and surrounding material, repair the wall, and purchase additional wall covering will be evaluated to determine the damages due to the design deficiency. Once damages are estimated, the District will attempt to determine if the A/E should be held liable by applying the tests for negligence or breach of contract.

The first point that must be established is that the A/E was responsible for providing a design for VWC. Since that work was in the design contract, the A/E had a duty to provide a design for VWC that would hide the existing poor wall condition. The professional standard of care would indicate that if an A/E contracts for wall covering, he should take into account imperfections in the existing walls.

Once duty has been established, the breach test will be applied. This test asks if the designer performed according to his duty. In this case, the designer did breach the duty since the wall covering did not hide the existing poor wall condition.

The cause-in-fact test is now applied. This test may establish that, since the A/E did not specify the correct thickness, the VWC tore. It will most likely determine that the designer's actions in specifying the wall covering actually caused the tears in the finished product.

Finally, proximate cause will be applied to determine if another A/E, given the same circumstances, could have reasonably foreseen that the type of VWC specified would have torn; if so, then the proximate cause test of negligence will be met.

In rebuttal, the A/E can follow several arguments. For example, he can challenge the duty question by saying that he was only responsible for providing wall covering over walls that were somewhat imperfect and was not provided adequate information on the actual wall condition. Or, to combat the breach test, the designer might provide evidence that the contractor did not install the wall covering according to the specifications.

Responding to the cause-in-fact conclusion, the A/E can argue that there were other factors beyond his control that caused the wall covering to tear. An example might be that the walls had warped as a result of ground settlement and the specified material would have worked if the building had not settled.

If these rebuttals are not accepted, the proximate cause issue may be addressed. The A/E will attempt to show that the standard of professional practice was provided in the specifications but that the conditions were such that no one could have expected this situation to occur.

If the question of breach is addressed, the A/E might cite other projects in which this material had been used previously under similar conditions with no problems. The standard of professional care would have therefore been met.

The battle facing the Government in an A/E liability case is that (1) a proactive stance is required and (2) the data needed to build a case must come from many different sources. These sources include the contract documents, design reports/reviews, field personnel accounts, standards of practice, the manufacturer's installation instructions, as well as many other types of information. Building a case is a difficult job even when all the information is at hand.

Profile of Claims Within USACE

To ensure that a designer provides a level of service to be expected from other professionals, USACE A/E contracts require that the designer provide all additional costs to redesign a design deficiency.[5] The attitude that the A/E will be liable for damages resulting from deficiencies has become very popular during the past several decades.

The National Society of Professional Engineers (NSPE) has published figures (Table 1) showing the dramatic increase in litigation that has occurred from 1960 to 1980.[6] According to NSPE, 80 percent of this increase has been due to A/E errors and omissions.

To compare this information with USACE's success in obtaining damages from designer negligence, data can be used from the Quarterly Command Review briefing held for the fourth quarter of 1986. This briefing presented the USACE-wide total of cases identified, pursued, and settled from FY84 to FY86. To allow a comparison of these data with those in Table 1, the total USACE figures were adjusted to the number per 100 projects. If a very conservative assumption is that there have been 600 projects for each of these years, the data for claims would be as shown in Table 2.

The first contrast noted between Tables 1 and 2 is that USACE is pursuing far fewer cases of A/E liability than is the private sector. That may not, however, indicate that USACE has failed to pursue winnable cases of A/E negligence; there may be other reasons for the differences in these figures. Although not addressed in previous studies, one way of explaining this difference may be that USACE design contracts, which require the A/E to correct all errors and omissions without additional cost to the Government, provide a method of recourse unavailable to many private owners. Also, USACE construction field offices typically identify and solve design deficiencies before damage causes complications.

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[5]ER 715-1-10, *Architect/Engineer (A/E) Liability Management* (Headquarters, U.S. Army Corps of Engineers [HQUSACE], March 1986), p 1.

[6]*Guidelines for Development of Architect/Engineer Quality Control Manual, Manual for Considerations and Voluntary Audit Procedures*, No. 1957 (National Society of Professional Engineers, August 1982), p ii.

Table 1

Claims Filed in the Private Sector*

Year	Claims per 100 Firms	Paid Claim Frequency/100	Avg. Paid ($)
1960	12.5	--	--
1962	14.9	--	--
1964	15.8	--	--
1966	17.5	--	--
1968	18.0	--	--
1970	20.7	5.7	33,650
1972	24.1	6.4	38,501
1974	30.0	7.8	40,907
1976	36.1	9.1	45,766
1977	33.0	9.1	47,170
1978	36.0	8.3	52,703
1979	44.2	9.9	55,427
1980	45.3	10.1	65,996
1981	45.0	10.4	64,682

*Source: *Guidelines for Development of Architect/Engineer Quality Control Manual, Manual for Considerations and Voluntary Audit Procedures*, No. 1957 (National Society of Professional Engineers, August 1982), p ii. Used with permission.

Table 2

Claims Filed by the U.S. Army Corps of Engineers

Year	Claims per 100 Firms	Paid Claim Frequency/100	Avg. Paid ($)
1984	4.6	1.8	26,636
1985	5.6	2.5	45,000
1986	11.7	7.2	6,000

3 IDENTIFICATION OF IMPROVEMENT OPPORTUNITIES

Improvements to the A/E Liability Program could take two forms: (1) reducing the number of negligence cases and (2) speeding the processing of cases through the system. The three areas of opportunity initially proposed are:

1. Improve design quality
2. Assist decision-makers
3. Devise alternative dispute resolution methods.

Improving Design Quality

Many attempts to alleviate the problems of A/E liability have focused only on retrieving damages. This process may not, however, have the most impact on the USACE A/E Liability Program. A more cost-effective research effort may be in anticipating design deficiencies. Figure 1 shows the relative impact of changes to total project cost as a function of the timing of the change.[7]

As the figure illustrates, the phases of the project most likely to affect the overall cost are the conceptual planning and design phases. These are also the points in the project where design deficiencies actually occur.

During the conceptual planning stage, the using agency, USACE, and A/E attempt to translate the intended mission of the facility into floor plans and general requirements for further design. Since these meetings cannot cover every assumption held by all parties, there is a high potential for misunderstandings in the design criteria, which often result in design deficiencies.

During the design phase, the A/E must coordinate the consultants who provide special technical services such as heating, ventilating, and air-conditioning (HVAC) and electrical design. This coordination often fails, causing errors in design synthesis.

To reduce the potential for errors in design criteria and synthesis, USACE uses two types of project review systems: (1) design reviews allow the using agency and USACE an opportunity to determine if the design will meet the design requirements, and (2) Biddability, Constructibility, and Operability (BCO) reviews by USACE attempt to identify problems of synthesis that may occur during construction or operation of the facility.[8]

Analyzing and collating these comments is a difficult process that requires experience in architecture and in civil, mechanical, and electrical engineering. Even though USACE reviewers may have the necessary experience, addressing the hundreds of comments generated on each project is a tedious task.

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[7] *Constructibility, A Primer*, Constructibility Task Force Publication 3-1 (Construction Industry Institute, The University of Texas at Austin, July 1986), p 2.

[8] Engineer Regulation (ER) 415-1-11, *Biddability, Constructibility, and Operability Reviews* (HQUSACE, 3 March 1986).

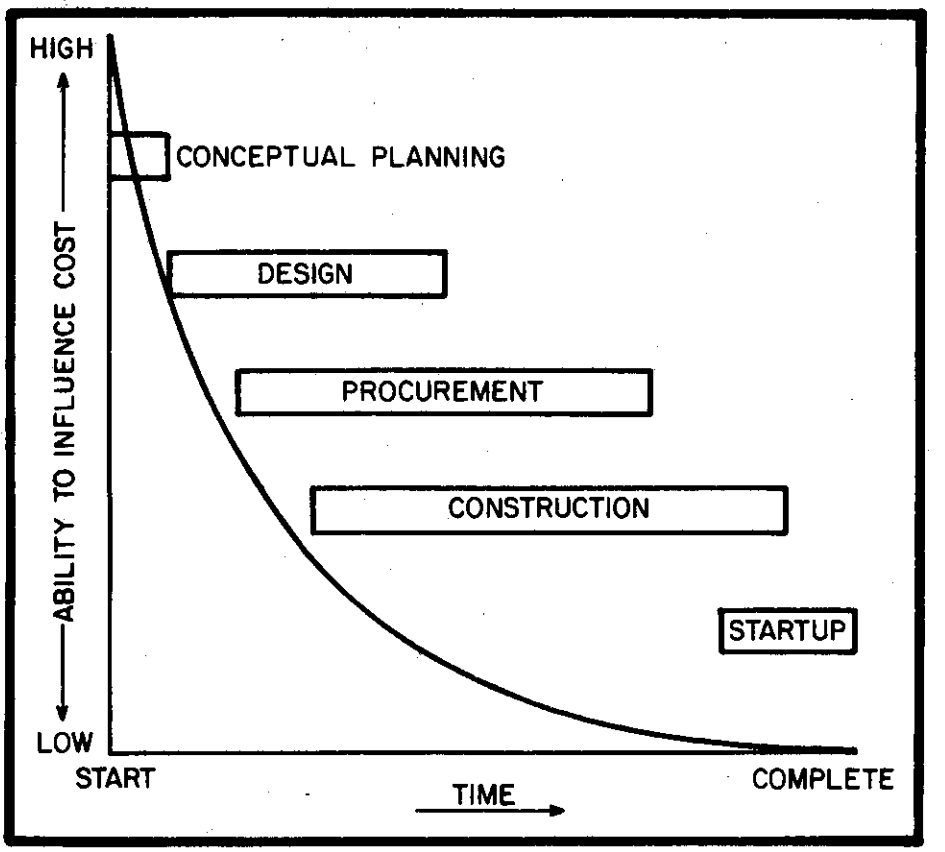

Figure 1. Ability to influence final cost over project life. Source: *Constructibility, A Primer*, Constructibility Task Force Publication 3-1 (Construction Industry Institute, The University of Texas at Austin, July 1986), p 2.

At present, USACE uses two automated systems to assist in the first problem (collating and tracking comments). One system is specific to hospital construction and the other applies to any other type of facility. Called the Automated Review Management System (ARMS), it has recently been pilot-tested at several District Offices.[9]

The second opportunity that should be addressed for improving the design and BCO review processes is the quality of reviews. Although experienced personnel can spot important faults in plans and specifications, they may not have the time necessary to complete a thorough review due to other duties.[10] Reviews often are delegated to employees who may not have enough experience in either design or construction.[11]

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[9]J. Kirby, D. Hicks, and D. Fury, *Automated Review Management System*, ADP Report P-87/08 (U.S. Army Construction Engineering Research Laboratory [USA-CERL], January 1987).

[10]MAJ E. T. Mogren, *The Causes of Costs and Modifications to Military Construction Contracts*, thesis presented to the U.S. Army Command and General Staff College, Fort Leavenworth, KS (1986), p 91.

[11]American Consulting Engineers Council, "Quality Assurance for Consulting Engineers," *ACEC Guidelines to Practice*, Vol V, No. 2 (1986), p 41.

The role of both the design and BCO reviews is to ensure the quality of the A/E's plans and specifications. This quality assurance role, however important, may not succeed unless the designer implements procedures to ensure that appropriate comments are checked against original design assumptions and fed back into the design. The A/E firm may use a similar type of internal check-and-balance system to monitor its own work. This type of system is called a "design quality control system." Design quality control has been advocated by the NSPE, the American Consulting Engineers Council (ACEC), American Institute of Architects (AIA), and other professional associations as a way to reduce A/E liability.[12]

An A/E firm's use of design quality control procedures will reduce the number of construction details omitted and improve coordination between engineering consultants. The additional cost to the A/E firm to provide quality control is small compared to the losses that may occur if there are problems with the job. Money saved by avoiding additional design time and site visits to correct a few errors and/or omissions may equal the entire cost of an A/E quality control program.

A more formal procedure that is very cost-effective on innovative or high-technology facilities is called "peer review."[13] A peer review is conducted in two phases. The first phase is typically an overall review of an A/E firm's quality control and management practices by another A/E firm. The second phase is an in-depth analysis of the selected facilities by experienced architects and engineers who have not seen the project before. These individuals may be either in-house or outside designers. The reason that peer review is so effective is that the reviewer is able to look at the project from an objective point of view and is therefore more willing to investigate questionable design assumptions.

Implementing design quality control procedures will never provide a design free from all defects. Properly followed quality control procedures should, however, provide a design that is free from "obvious" errors and omissions. Ultimately, A/Es are hired for their professional judgment, and the independence to create a set of plans and specifications from a blank piece of paper must be maintained.

USACE should consider adopting a set of technical quality assurance guidelines to complement the improvement in design quality that will occur as more A/E firms use quality control procedures. Athough design reviewers may be very experienced, they typically specialize. The quality assurance guidelines would be used to assist reviewers in areas with which they may not be familiar.

If quality assurance guidelines were distributed to reviewers on paper, the material would fill several volumes and comments on specific items would be difficult to find because of the large number of entries. The result would be that the guidelines, however good, would not be used. If, however, these guidelines were distributed in an electronic format, they could be organized to provide searching and cross referencing according to ad-hoc reviewers' needs. This type of "design quality encyclopedia" would also assist reviewers in areas outside their specialties. Research conducted at Purdue University

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[12] *Guidelines for Development of Architect/Engineer Quality Control Manual.*

[13] W. L. Dougherty, "Peer Review: A Management Tool for Public Sector Projects," *Civil Engineering, ASCE* (February 1984), pp 46-49; G. M. Reynolds, "Legal and Insurance Trends in Engineering," *Issues in Engineering, ASCE* (January 1980), pp 3-10.

indicates that an electronic design quality encyclopedia would not only be technologically possible but would also be widely accepted by design reviewers.[14]

The American Society of Civil Engineers (ASCE) has recently completed a draft that may eventually become such a set of design quality standards for the construction industry.[15] A member of the steering committee for this manual has proposed that the major resistance to compiling such a manual is not that specifying quality would cause problems in the design process, but that people feel there is just too much information and do not want to spend the time required to capture it.

Although there is some controversy regarding the role of design quality information, many in the construction industry feel that providing design quality assurance guidance is an important step in improving design. Rather than dismiss the issue simply because there is controversy, USACE should further investigate design quality encyclopedia information to determine it potential for improving design quality.

These standards also could help form the basis for the designer's performance evaluation. Rather than a completely subjective opinion of the design quality, reviewers could check each designer for compliance with the standards. A method of combining subjective and objective evaluations has been proposed by the Construction Industry Institute[16] and should also be considered by USACE.

Many USACE offices close out an A/E contract when the design has been completed. This practice severly limits communication with the designers when design deficiencies appear during construction. Several USACE offices have reported refusal by A/Es to provide corrections to design errors or omissions after their contracts were closed out.

At the April 1988 Architect/Engineer Responsibility Coordinators' Conference, shop drawing review and site visits were shown to be methods to allow A/E contracts to remain open throughout the construction phase. While most contractor-certified shop drawings need not be reviewed by the designers, major structural, electrical, or mechanical items *should* be reviewed by the A/E. Optional construction site visits are another way to keep the design contract open. The A/E is then paid for the visits that actually take place. An alternative to the optional site visit is the mandatory site visit at specified construction contract milestones.

Assisting Decision-Makers

If a case of A/E liability does occur for a project, some specific steps must be taken to identify the liability, prepare documentation, and recover potential damages. Although HQUSACE has published guidelines to help Divisions and Districts develop a

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[14] D. E. Hancher and J. D. Lutz, *A Proposed Framework for the Development of a Knowlege Base for Design Quality Review (Interim Report)* (Division of Construction Engineering and Management, School of Civil Engineering, Purdue University, May 1988).

[15] *Quality in the Constructed Project—A Guide for Owners, Designers and Constructors*, Vol 1 (ASCE, May 1988).

[16] *Evaluation of Design Effectiveness*, Publication 8-1 (Construction Industry Institute, University of Texas at Austin, July 1986).

systemized approach to investigating, pursuing, and reporting A/E liability,[17] each office is permitted to develop its own system to process design deficiencies. However, each office must include the following activities in its process:

1. Identify design deficiency
2. Review and analyze design deficiency
3. Compile data and document evidence
4. Compute damage estimates
5. Prepare findings
6. Determine negligence
7. Communicate findings with A/E
8. Reconsider Government position
9. Negotiate with A/E
10. Initiate legal action
11. Update files after action.[18]

These activities are described in detail in Appendix A.

Since District Offices are responsible for these steps, each must staff the action through the organization. Figure 2 represents one possible way that information can flow through the organization in processing A/E liability cases.[19]

As Figure 2 shows, the first step in reviewing potential cases of A/E liability at the Baltimore District Office is to complete the Change Review Memorandum (CRM). The Resident Contracting Officer and staff at a Resident or Area Office will identify and describe all items of a contract modification on the CRM.[20] This form contains space for identification of design deficiencies and an initial A/E liability finding.

The form is forwarded to the Contract Compliance Manager (CCM) whose duty is to coordinate and monitor CRM processing. Depending on the type of modification, either a member of the District's Construction Division or an Investigative Committee will review the initial A/E liability findings. This review provides an opportunity for representatives from the District's Construction and Engineering Divisions as well as the Office of Council to submit written comments. Once these comments have been added, the CRM is returned to the CCM for further processing.

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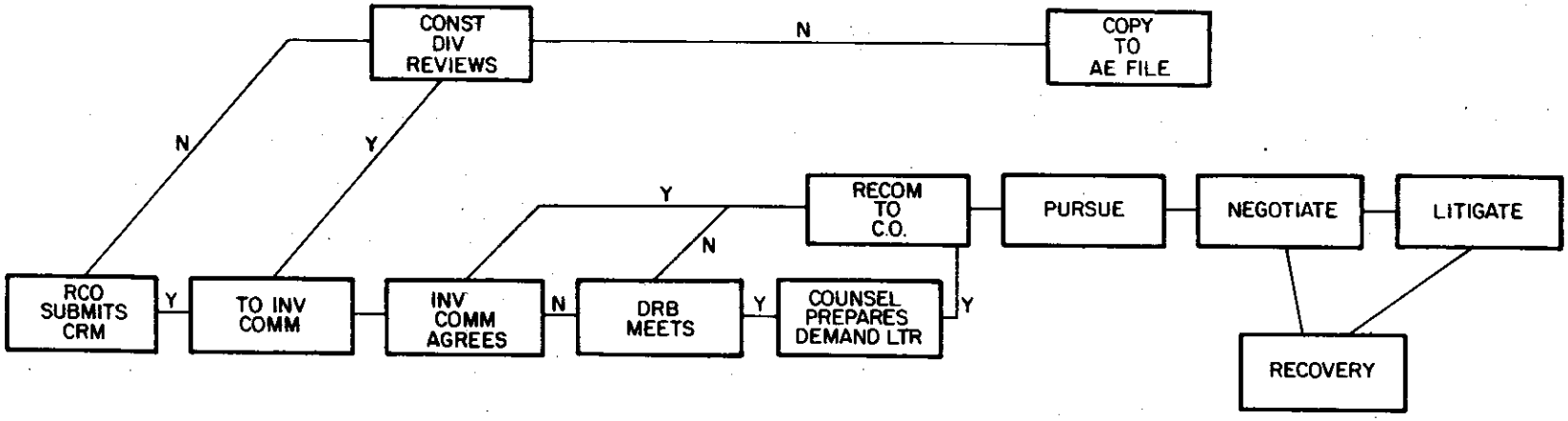
[17]ER 715-1-10.

[18]Baltimore District Regulation 1180-1-19, *Responsibility of Architect/Engineers* (Baltimore District, U.S. Army Corps of Engineers, June 1981).

[19]ER 715-10-1.

[20]ER 715-10-1, Form NAB 1465, Revised May 1984.



LEGEND

C.O. - Contracting Officer
CRM - Change Review Memo
DRB - Design Review Board (Construction Div., Engineering Div.,and Counsel)
INV COMM - Investigative Committee (Construction Div., Engineering Div.,and Counsel)

RCO - Resident Contracting Officer
Yes, Potential Recovery Identified (Y)
No, Potential for Recovery Found (N)

Figure 2. A/E liability process in the Baltimore District.

If there is complete agreement for or against pursuit of A/E liability, a Contracting Officer's finding is documented and appropriate action is taken. In the case of disagreement, a special meeting is called to obtain a consensus. This meeting is held before the Design Deficiency Review Board (DDRB), which includes the Chiefs of the Engineering and Construction Divisions and the Office of Council. The Chief of the Office of Council is the chairperson of the DDRB. A formal finding, to be signed by the Contracting Officer, is drafted to recommend pursuit or nonpursuit of A/E liability.

The Baltimore District program ensures (1) rapid execution of necessary actions and (2) that documented reviews are completed within a reasonable time. The rapid processing is mostly due to the CCM, who is responsible for suspense tracking of all CRM forms. Documented reviews are expedited by requiring that the CRM forms for all contract modifications be either signed by the Contracting Officer or filed after the Construction Division Review.

To protect the taxpayer, Department of Defense policy is to pursue all "clear" cases of design deficiencies. Although it is essential that USACE clients obtain a quality design, pursuit of liability places a significant drain on District Offices, which cannot hire the number of personnel necessary to fully implement the program.

The manpower problem is particularly acute for projects that have many cases of negligence or breach but little resulting damage. While each individual case may be minor, pursuing all of them would drain District resources and produce high administrative cost. These costs may, however, be recovered and returned to District operating accounts.

Several District Offices have proposed ways to modify the guidance on pursuit of "clear" cases. These alternative proposals generally rely on an economic analysis to determine expected benefit-to-cost ratios in pursuing classes of modifications noted to be design-deficient. A drawback to these alternatives is that they neither meet the intent of the regulations nor uphold one of the most essential USACE values--the commitment to quality.

The challenge to USACE should not be how to justify the dismissal of large numbers of A/E liability cases, but how to (1) define clear cases of A/E liability and then (2) speed administrative processing time. These two areas represent the most promising opportunities for improving the A/E Liability Program.

A clear case of A/E liability is often identified by a failure to meet quality design practice. Based on the quality design practice defined in the contract, the initial reviewer of a design deficiency could determine if the A/E had adhered to that practice. If the designer did not, then the reviewer would forward his findings as a clear case. Many types of design review manuals are available for use in defining the limits of a quality design. In addition to these documents, design quality control performance guidelines developed by USACE could provide a good basis for this first attempt at determining a clear case.

The efficiency of administering the A/E Liability Program could be improved by both procedural and automated methods. Procedurally, cases may be processed differently based on the estimated dollar damage. For example, many cases of liability in one contract which have small amounts of damage could be grouped together at the end of a project to comprise one substantial case.

USACE already uses several automated systems that track and monitor the A/E Liability Program. Savannah District's system tracks design-deficient change items through the INFORMIX database program which operates on the XENIX operating system. Omaha District's system tracks construction contract modifications noted to be design deficiencies in a dBASE III program that operates under the MS-DOS operating system.

A program designed for HQUSACE and Division Offices is called A/E EASE. This application software provides not only for management of the A/E Liability Program, but also offers useful features such as an appointment schedule, telephone directory, and graphics.[21]

Alternative Dispute Resolution

If an A/E's actions are deemed negligent, he will usually want to delay settlement. Many A/E firms prefer to have a lump sum assessed against them at the end of the project to help in deciding if they will pay out-of-pocket or let liability insurance cover the damages. Such delays in a construction project cost a tremendous amount of money; for this reason, USACE often will correct a problem with contingency funding rather than delay the project.

Between damages and subsequent litigation, the higher cost to USACE typically will be litigation. Besides attorneys' salaries, USACE must pay witnesses for the time they spend in consultations and in court. These witnesses typically would have moved on to other duties, so that the litigation also disrupts their organization.

As the number of cases increases, the amount of time that a District's legal staff can spend researching each case decreases. When this situation occurs, responsibility is placed with the persons who were involved in the original situation.

Ways to reduce the time currently required to settle cases of A/E liability have been discussed at the highest levels of Government.[22] To reduce the time required to bring cases to court, Government and industry are using Alternative Dispute Resolution (ADR) methods. Use of ADR has recently been encouraged by the U.S. Court of Claims,[23] many in the legal profession,[24] and the U.S. Congress.[25]

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[21] E. W. East, et al., *Managing With A/E EASE*, ADP Report P-88/20 (USA-CERL, in press).

[22] J. K. Coyne, "Analysis of the Tort Reform System and Proposals for Change," Testimony of Executive Vice President, American Consulting Engineers Council, at the Hearings on the Liability Insurance Crisis, Subcommittee on Investigations and Oversights, Committee on Public Works and Transportation (January 21, 1986), pp 187-200.

[23] U.S. Claims Court, General Order No. 13, "Notice to Council on ADR Techniques" (15 April 1987).

[24] ACUS Recommendation 87-11, *Alternatives for Resolving Contract Disputes*, 1 CFR, 305.87-11, Federal Register, Vol 52, No. 250 (30 Dec 87), p 49148.

[25] ACUS Recommendation 86-8, *Acquiring the Services of Neutrals for Alternative Means of Disputes Resolution*, 1 CFR, 305.86-8, S.2774, 100th Congress, 2nd Session, 1988.

The first two ADR methods that may assist in the prompt resolution of cases are arbitration and mediation. Arbitration and mediation can be used as the first steps in determining the merit of a case. Although this system could be perceived as creating another level of case review and litigation, there are several alternatives. An innovative approach that some companies have used successfully is to select a board representing professional, technical, and civil organizations. Some insurance companies have supported this effort since it can reduce legal fees while simultaneously expediting settlement of cases. The USACE South Atlantic Division has developed guidelines for using a type of arbitration called "disputes review board."[26] If utilized, this procedure requires that the board review the case within 30 days of a preliminary Contracting Officer's decision. These guidelines are also being used by USACE Southwestern Division.[27]

The third method of ADR, the mini-trial, has been endorsed by the U.S. Department of Justice[28] and USACE.[29] It has been used successfully by USACE, the Naval Facility Engineer Command (NAVFAC), and the National Aeronautics and Space Administration (NASA) to settle several multimillion dollar cases.[30]

Using procedures developed for mini-trials, cases are generally resolved within 1 to 3 months. The mini-trial itself may last less than 1 week. Through the mini-trial process, one USACE claim of $55 million was resolved after 4 days of meetings.[31] The benefit of the mini-trial is that each party is forced to assess its chances of winning the case.

Steering Committee Results

In February 1987, the A/E Liability Research Steering Committee met with USA-CERL representatives to discuss opportunities for improving the A/E Liability Program. The focus of the meeting was to investigate the three areas of opportunity proposed by USA-CERL (as described above): (1) improved design quality, (2) assistance to decision-makers, and (3) alternative dispute resolution. The goals were to identify which problem is most critical to reducing the number of cases in the system and/or improving USACE's ability to process cases.

Group Survey

The group first reviewed for completeness a list of specific problem statements within the three categories of design quality, program administration (i.e., for helping decision-makers), and dispute resolution. Within each of these three categories were two levels of detail--the general and the specific problem statements. General problem areas were identified by Arabic numbers within each category. Specific problem statements

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[26] *Implementation of ADR Procedure* (U.S. Army Corps of Engineers, South Atlantic Division, 8 May 1986).

[27] D. P. Arnavas and J. J. Duffy, "Alternative Dispute Resolution," *Federal Publications*, No. 88-8, (July 1988), pp 8-9.

[28] U.S. Department of Justice, *Commercial Litigation Branch Policy Concerning the Use of Mini-Trials* (June 1986).

[29] Engineer Circular 27-1-3, *Alternate Dispute Resolution: Mini Trials* (HQUSACE, 23 September 1985).

[30] D. P. Arnavas and J. J. Duffy.

[31] W. M. Scholsser Co., Armed Services Board of Contract Appeals (ASBCA) 32248 (1987).

were listed by letter under each of the general problem areas. Table 3 contains the completed list of categories with general and specific problems.

Each group member ranked the importance of both the general problem areas and the specific problem statements. Obtaining both sets of data was essential in confirming the accuracy of the initial three-leveled data structure. Two major problems could have arisen by ranking only the general problem areas. The first was that specific problem statements may not have been categorized correctly. Second, some specific problem statements could have ranked much higher than the general problem area to which the statement belonged.

Table 3

Categories, General Areas, and Specific Problem Statements

Category 1: Problems in Design Quality

1. Failure to develop adequate design criteria due to:

    a. Inadequate initial requirement statement
    b. Inadequate design criteria
    c. Misinterpretation of requirements
    d. Inaccurate design data
    e. Insufficient field investigation
    f. Lack of internal QA/QC program for A/Es
    g. Insufficient time
    h. Substitution of as-builts for site investigation

2. Failure to synthesize a design into a coherent set of plans and specifications which results from:

    a. Lack of coordination of technical specialists
    b. Failure to include adequate detail in plans and specifications
    c. Failure to edit guide specifications properly
    d. Failure to take advantage of overlay computer-aided drafting techniques
    e. Accelerated schedules
    f. Changes in design intent
    g. Lack of internal/external QA/QC program

Category 2: Problems in Program Administration

1. Failure of USACE to use A/E for redesign due to:

    a. Government complicity in design deficiencies
    b. Unwillingness of A/E to provide redesign
    c. Time delay in orchestrating A/E redesign
    d. Lack of understanding of the mitigation rules
    e. Simple changes not being cost-effective

Table 3 (Cont'd)

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2. Failure to identify changes as design deficiencies because of:

   a. Lack of promptness in deficiency recognition
   b. Loss of clarity due to change item groupings
   c. Failure to adequately document deficiency
   d. No system to define detailed design deficiencies
   e. Concern for "performance indicators" of cost/time growth

3. Failure to follow through on noted design deficiencies as a result of:

   a. Inability to track the action's progress
   b. Inability to determine status of action
   c. Design/construction rivalries
   d. Ease of correcting problem locally
   e. Misconception about probability of winning case

4. Failure of performance feedback due to:

   a. Lack of objective standard on which to judge performance
   b. Failure to conduct performance evaluations
   c. Failure to disseminate performance information
   d. Problems with A/E rebuttal of reviews
   e. Construction input not being communicated

5. Failure to pursue improved policies because of:

   a. Difficulty in collecting/verifying information
   b. Failure to identify meaningful trends
   c. Inability to accurately project policy's results
   d. Inability to determine policy's benefit/cost ratio
   e. Misinterpretation of MACOM goals and interest

Category 3: Problems in Dispute Resolution

1. Failure to identify damages because of:

   a. Improper definition of damage
   b. Difficulty in estimating impacts
   c. Lack of adequate detail in construction estimates

2. Failure to pursue winnable cases due to:

   a. Insufficient time allowed to investigate
   b. Unavailability of onsite personnel
   c. Inappropriate/unavailable case law
   d. Lack of guidance for pursuit activities
   e. Lack of manpower to prepare and litigate cases

Figures 3 and 4 show the ranking sheets used by the Steering Committee. Worksheet 1 (Figure 3) lists the general problem areas noted in Table 3. Worksheet 2 (Figure 4) allowed each committee member to indicate specific problem statements from the list in Table 3 which were thought to be most significant. These worksheets provided a method to determine the following:

- How important is this problem?
- What would be USACE's management reaction to a proposed solution for particular problems?
- How many organizational elements may be included in a solution to a problem?
- In which areas has your organization already attempted/provided solutions to a problem?
- What is your ability to implement a potential solution to this problem?
- To what extent do you think technology can provide assistance in a solution to a problem?

These questions were translated into the worksheets as shown in Figures 3 and 4. Other categories on the worksheets are explained below.

1. "Most Important" indicates how the problem areas should be prioritized. Lower numbers correspond to the most important problems to be tackled, with the number 1 denoting the most important problem.

2. "Management Support" shows the potential support that reviewers thought a solution could receive. Responses appear as three symbols: "+", "0", and "-". The plus sign indicates that the organization will support a solution to the item by providing money and personnel. The "0" indicates that support will be available if no resources need to be expended. The "-" notes that there will be little management support for a solution to the problem.

3. "Organization" indicates how many organizational elements should be involved in a solution. Each member placed a check mark into each of the RO (Resident Office), DIS (District), DIV (Division), and OCE (Office of the Chief of Engineers) columns to suggest those which might use a potential solution to the problem.

4. "Already Solved" provides a space to show which of the problems have already been solved.

5. "Personal Ability" ranks the potential success of each member in implementing a solution to the particular problem.

6. "System Interest" allows the member to indicate personal and organizational interest in using an automated system to help solve the problem.

After each member had completed both worksheets, the data were summarized using the procedure described below. Results of these steps are shown in Figure 5 for the general problem areas, and in Figure 6 for specific problem statements.

WORKSHEET ONE: RANKING PROBLEM AREAS

	Most Important (1 best)	Mgmt Support (+ 0 −)	Organization RO	DIS	DIV	OCE	Already Solved (Y/N)	Personal Ability (Y/N)	System Interest (Y/N)
CATAGORY 1: Design Quality									
1. design criteria									
2. design synthesis									
CATAGORY 2: Program Administration									
1. a/e redesign									
2. identify changes									
3. follow through									
4. performance feedback									
5. justify policy									
CATAGORY 3: Dispute Resolution									
1. identify damage									
2. pursue cases									

Figure 3. Blank worksheet 1.

WORKSHEET TWO: RANKING SPECIFIC PROBLEM STATEMENTS

PROBLEM NUMBER	Most Important (1 best)	Mgmt Support (+ 0 −)	Organization				Already Solved (Y/N)	Personal Ability (Y/N)	System Interest (Y/N)
			RO	DIS	DIV	OCE			

Figure 4. Blank worksheet 2.

WORKSHEET ONE: RANKING PROBLEM AREAS

	Most Important (1 best)	Mgmt Support (+0-)	Organization RO	DIS	DIV	OCE	Already Solved (Y/N)	Personal Ability (Y/N)	System Interest (Y/N)
CATAGORY 1: Design Quality									
1. design criteria	4	+2	1	6	3	3	1Y		1Y
2. design synthesis	3	+2	1	6	3	2	N		4Y
CATAGORY 2: Program Administration									
1. a/e redesign	7.2	0	5	6	1	0	N		N
2. identify changes	4.7	+1	6	6	1	1	2Y		4Y
3. follow through	6.3	−1	2	6	1	2	2Y		5Y
4. performance feedback	5.7	−1	2	6	3	3	1Y		5Y
5. justify policy	9	0	1	6	5	5	1Y		3Y
CATAGORY 3: Dispute Resolution									
1. identify damage	5.3	0	6	6	1	1	3Y		4Y
2. pursue cases	4.3	+2	3	6	4	1	1Y		3Y

Figure 5. Results of general problem area ranking.

WORKSHEET TWO: RANKING SPECIFIC PROBLEM STATEMENTS

PROBLEM NUMBER	Most Important (1 best)	Mgmt Support (+0-)	Organization				Already Solved (Y/N)	Personal Ability (Y/N)	System Interest (Y/N)
			RO	DIS	DIV	OCE			
1.2.a.	2	+1	1	4	3	2	4N		2Y
2.2.c.	6	0	3	3	1		3N		2Y
2.3.e.	4.6	+1	3	3	2	1	3N		1Y
2.4.a.	7.8	0	4	4	2	2	1Y		4Y
2.5.d.	6	+2	3	3	3	2	3N		2Y
3.1.a	6.2	0	4	4	1	1	1Y		4Y
3.1.b	6.3	0	2	3	1		1Y		1Y
3.2.e	2.3	+1	2	3	2	1	1Y		3N

Figure 6. Results of specific problem statement ranking.

The general problem area results from worksheet 1 were summarized as follows:

1. Most Important: average the members' rankings.

2. Management Support: let a "+" equal "+1" and a "-" equal "-1", then sum the members' rankings.

3. Organization: enter the number of times each level of organization was checked.

4. Already Solved: sum of the members' "Yes" responses.

5. Personal Ability: sum of the members' "Yes" responses.

6. System Interest: sum of the members' "Yes" responses.

To summarize the specific problems from worksheet 2, the following procedure was used:

1. List all problems that were noted by three or more persons.

2. Average these problems as noted in the procedure above for ranking the general problem areas.

Survey Results

The goals of the survey were to identify the most critical issues in (1) reducing the number of cases entering the system and (2) expeditiously processing each case. The committee's results show ways in which both of these goals can be accomplished.

The most significant problem facing USACE, according to this survey, is design synthesis. In both the specific problem statement and the general problem areas, the design synthesis issue was ranked highest. The entire category of design quality was ranked highest among all categories. The result of improved design quality would be a reduction in the number of cases of A/E liability--which is the first goal of this research.

Following the design quality issue, reviewers ranked one item each from the dispute resolution and program administration categories. Identifying changes which have resulted from negligence and then pursuing these cases were prioritized as second and third in the ranking. If these two areas were improved, then cases could be processed more efficiently (i.e., the second goal of this research would be met).

The committee identified four areas as providing the most promising opportunities for improvement: (1) design criteria, (2) design synthesis, (3) pursuit of cases, and (4) identification of changes. Each area was then reviewed by the committee in greater detail. This investigation consisted of two parts. Initially, potential root causes for these problems were listed; then the list was shortened to several items deemed most important by committee vote. The causes determined and their relative weights according to the committee were:

1. Design Synthesis:

   28%-Lessons learned are not applied to future projects
   28%-Design quality assurance program is lacking

28%-Designers use risk avoidance tactics
14%-Technical disciplines are coordinated poorly.

2. Design Criteria:

33%-Requirements are not defined clearly enough
33%-Life-cycle consideration is lacking
33%-Communication between the A/E and using agency is poor.

3. Pursuit of Cases:

50%-Case reviews are delayed
50%-Documentation is insufficient/unavailable.

4. Identification of Changes:

40%-There is a necessity to mitigate damages by Resident Office
20%-Consistent classification/interpretation of modifications is lacking
20%-Damage estimates are vague
20%-Additional education is required at the Resident Office.

Chapter 4 summarizes these findings and suggests improvements in these specific areas of opportunity that could be incorporated into USACE policy and procedures.

4 APPLICATION OF FINDINGS TO USACE

The most important finding in this study is that design quality and A/E negligence are actually the same issue, which reflects the A/E's duty to provide a quality design. If this duty were represented as a coin, then on one side of the coin would be a clear understanding of the quality of design which USACE expects to receive. On the other side of the coin would be the quality to which the designer may be held accountable should something not go as planned.

After evaluating the findings, USA-CERL developed three recommendations for improving design quality through better A/E liability management:

1. Develop USACE standards that clearly specify the expected quality of A/E designs.

2. During the A/E prequalification stage, require that A/E firms have an established quality control procedure. For large projects, require A/Es to implement a peer review procedure.

3. Create a design quality knowledge base and distribute this information to as wide an audience as possible by providing: (a) a draft USACE Design Quality Manual and (b) a prototype computer system to assist in determining "clear" cases of A/E liability.

The sequence of these recommendations is important in producing the most positive impact on the USACE A/E Liability Program. The first recommendation will set the stage for significant improvements in the area of design criteria synthesis. The second step will implement the improvements of step 1 into the design community. The final action will provide for USACE-wide distribution of knowledge about the first two steps.

USACE Standards

In general, the most important issue to determine in establishing A/E liability is the "standard of care." Until recently, the courts have been required to set all standards because design/construction industry standards did not exist. Building codes are one type of standard now admissible in court.[32]

USACE's design standard typically is in the form of Corps of Engineers Guide Specifications (CEGS). These CEGS are edited by the designer to create the construction contract specifications for a particular project. Although these specifications are generally thought to be the underpinning of design contracts, often there is confusion as to whether state and local codes or specific industry standards apply.

State and local building codes usually do not apply when a project is constructed with Federal funds on Government property. However, specific industry standards may not be well understood, even among persons experienced in a trade. Therefore, one

[32]The legal applicability of building codes gained precedent from the Leo A. Daly Co., ENG BCA No. 4463, 85-1 BCA 17,470. The court held that violation of governing codes, guide specifications, and good practice, resulting in a building that contains marked defects in strength and is unsuitable for its intended purpose, entitles the Government to damages.

opportunity for improving the quality of designs might be to have USACE endorse the Uniform Building Code as the foundation for CEGS.

Professional organizations have long been attempting to standardize local codes and capture the expertise of craftspersons. USACE, in adopting the Uniform Building Code as a basis for CEGS, could help the design/construction industry in streamlining the search for appropriate regulations and in providing improved designs.

The design/construction industry has recognized the need to establish a standard of care for quality in design synthesis and criteria and has begun to develop independent standards by which A/E work can be judged.[33] One such standard endorsed by ACEC is called "Redi-Check." This standard, rather than being a detailed checklist, is a conceptual framework that provides guidelines for design quality studies. The following excerpt is taken from the section on the review of mechanical and plumbing plans:

1. Verify that all new electrical, gas, water, sewer, etc., lines connect to existing ones.

2. Verify all plumbing fixture locations against architectural plans. Verify all plumbing fixtures against the schedule and/or specifications.

3. Verify the storm drainage system against the architectural roof plan. Verify that pipes are sized and that all drains are connected and do not interfere with foundations. Verify that wall chases are provided on the architectural plan to conceal vertical piping.

4. Verify sanitary drainage system pipe sizes and that all fixtures are connected.

5. Verify HVAC floor plans against architectural plans.

6. Verify that sprinkler heads are included in all rooms.

7. Verify that all sections are identical to architectural/structural plans.

8. Verify that adequate ceiling height exists at worst-case duct intersections.[34]

Redi-Check contains many more of these general "quality of design" checks. The developer of this system has indicated that 10 times the cost of performing these reviews will be saved by using Redi-Check during the design/construction process. When 10 construction projects used this system and were tracked through design to occupancy, there were no design deficiencies due to errors and omissions.[35]

This type of standard addresses the highest priority concerns of the A/E Liability Research Steering Committee--design quality and synthesis. Adopting a set of USACE design quality standards is also the first recommendation of this report.

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[33]American Consulting Engineers Council.
[34]American Consulting Engineers Council, Appendix B, p 44.
[35]American Consulting Engineers Council, Appendix B, p 41.

Design quality standards would also improve the A/E Liability Program by defining "clear" cases of A/E liability. This definition will allow for rapid initial determination by the Resident and/or District Office and provide for consistent classification or interpretation of changes.

Two frequent objections that may be raised to implementing any type of checklist are that: (1) many problems will fall somewhere between items on the list and (2) once a design contractor becomes aware of what the Government is checking, the Government will be at greater risk. The first objection is correct, to a limited extent, but fails to recognize that almost all projects could be improved by raising the critical standards for the majority of projects. The second objection is incorrect. Providing a contractor with all the information the Government has is one of the most significant contributions that could be made in improving plans and specifications.

Methods of Implementation

To effectively implement design quality standards, two types of procedures, design quality control and peer review, have been suggested by many professional organizations. In following this line of thought, the second recommendation of this study is that the criteria for selecting an A/E firm to receive USACE design contracts include a requirement for a formal quality control procedure. The prospective A/E firm's program should be modeled after the guidelines for developing a quality control program published by NSPE and endorsed by ACEC and AIA. These guidelines will ensure a procedure that emphasizes five primary areas: "sound judgment, disciplined management techniques, adherence to professional standards of practice, equitable contract agreements, and, most importantly, commitment to improvement."[36]

Capturing and Distributing Design Quality Knowledge

Capturing design quality knowledge would involve collection of USACE experience in identifying quality design. This substantial body of knowledge may be contained in District Office design checklists. These documents should provide the data to allow the specific definitions of design quality needed to establish legal duty.

Information collected in this way should be compiled into a draft Design Quality Manual that would be forwarded to District Offices for review and comment. Survey forms accompanying the document would be used to collect information regarding completeness, consistency, and possible categorization of the information.

During this review and comment period, additional research could be conducted to identify the most efficient way of distributing this data through an automated system. Feedback from the surveys should help in focusing the objectives for this automated system.

A/E Liability Recognition System

One of the most frequently expressed comments from District Offices was also reflected in the survey group. Most offices felt that the indepth pursuit of A/E liability

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[36] *Guidelines for Development of Architect/Engineer Quality Control Manual.*

is a relatively recent occurrence, and they wanted to share the expertise of those Districts that have active programs. Expert system technology is especially suited for sharing expertise among large organizations.

The use of such a system would provide consistent and correct application of the guidelines that people use to analyze a case of potential A/E liability. These guidelines must be based on a foundation of the basic legal principles and then extended to situations which are settled prior to litigation. Such a system may be updated periodically so that cases from many Districts or Divisions may be exchanged.

Obviously, such a program would not be necessary for experienced personnel. These personnel may be interested, however, in reviewing similar cases settled at other Districts.

Appendix B provides the first step in developing an expert system for A/E liability. This appendix contains a report developed by Northeastern University's Center for Law and Computer Science entitled "A 'Paper' Knowledge Base for A/E Liability." The report provides a flowchart of the analysis of A/E liability cases and has briefs of all relevant case law.

District personnel using such an expert system would become more aware of how A/E liability cases are analyzed, allowing them to more fully realize the implication of daily activities on future litigation. An expert system could also provide guidance to a project manager or project engineer about what actions to take given the situation at hand. This ability to provide guidance would be crucial to the effectiveness of an A/E liability recognition system as a training tool since it will allow the program to simulate A/E liability situations in progress.

5 CONCLUSIONS AND RECOMMENDATIONS

The USACE Liability Program could be improved in two general ways: reducing the processing steps or number of cases that must be processed, and enhancing the ability of field operating agencies to identify "clear" cases of liability and resolve them quickly. To find opportunities for achieving these improvements, USA-CERL surveyed the field and established a steering committee to help develop recommendations.

The study identified four specific areas of opportunity for improving the program: (1) design synthesis, (2) design criteria, (3) pursuit of liability cases, and (4) establishment of negligence. Each area represents a point in the existing liability program where the system is likely to break down due to the lack of a structured approach.

To improve these areas, USA-CERL recommends the following actions, which should be carried out in the sequence indicated:

1. Develop USACE standards that clearly specify the quality expected from A/E designs. More emphasis on incorporation of industry standards such as the Uniform Building Code should be considered in developing the USACE standards.

2. Make USACE contract awards contingent on the A/E firm's proof that it has an established quality control procedure, including peer review when appropriate.

3. Collect lessons learned and expertise from the Districts and Divisions, and use this information to provide a central knowledge base. Distribute the information as widely as possible within USACE through publication of a Design Quality Manual and development of an automated system to help field operating agencies identify "clear" (i.e., winnable) cases of A/E liability.

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APPENDIX A:

RESPONSIBILITY OF ARCHITECT/ENGINEERS (DR 1180-1-19)*

*A USACE Baltimore District Regulation.

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MARYLAND

DISTRICT REGULATION
NABCO-E

DR 1180-1-19
30 June 1981

CONTRACTS
Responsibility of Architect-Engineers

1. Purpose: To publish policy and procedure applicable to the evaluation and determination of Architect-Engineer liability for design deficiencies.

2. Applicability:

a. This regulation is applicable to all elements of the Baltimore District administering contracts for which Architect-Engineer services have been furnished.

b. This regulation shall be applicable to all design deficiencies arising out of contracts for which Architect-Engineer services have been or are being provided.

3. References:
a. DAR 7-607.2
b. DAR 18-118

4. Definitions:

a. Design Deficiency: An error, omission, or other condition in the designs, drawings, specifications or other service furnished by the Architect-Engineer, the existence of which necessitates corrective action by construction contract modification.

b. A Design Deficiency Memorandum shall be submitted to the Contract Compliance Manager for each change order and where appropriate, shall include all the facts pertaining to the design deficiency. The format for this submittal is contained in Appendix A.

c. The Investigative Committee shall consist of a member or members of District Counsel, Engineering Division and Construction Division.

d. The Design Deficiency Review Board shall be comprised of the Chief, Engineering Division; Chief, Construction Division; and the District Counsel or their designated representative.

e. Contract Compliance Manager (CCM) shall be a member of the Office of Construction Division, responsible to monitor and promote this program.

f. Contracting Officer as used in this regulation pertains to the Architect-Engineer design contract.

5. Responsibility of Architect-Engineer Firms: DAR 18-118 establishes requirements in regard to the responsibilities of Architect-Engineers producing plans, specifications, designs, or other services. DPC #76-14, dated 13 March 1978, revised DAR 18-118 in response to the Comptroller General's report to Congress entitled "Procedures Used for Holding Architects and Engineers Responsible for the Quality of their Design Work," dated 14 July 1977. DAR 18-118 is quoted below for ready reference.

18-118 Responsibility of Architect-Engineer.

18-118.1 Construction Contract Change Orders. Whenever a construction contract modification or change order is required by reason of any error or deficiency in design, drawings, specifications or other services which were furnished by an Architect-Engineer under contract with the Government, Contracting Officers shall follow the procedures prescribed herein.

18-118.2 Design Within Funding Limitation. The clause set forth in 7-608.3 obligates the Architect-Engineer to design a project within a contractually specified dollar limit. In the event construction bids received on his design exceed the project limitation, the Architect-Engineer's sole responsibility is to redesign the project so as to come within the funding limitation. However, if the unfavorable bids or proposals are beyond his reasonable control (such as if there was an unanticipatable increase in material costs or undue delay by the Government in issuing a construction solicitation), the Architect-Engineer is not required to redesign at no cost to the Government. Whenever the Architect-Engineer is not required to redesign pursuant to 7-608.3, a written statement setting forth the reasons for such determination shall be placed in the Architect-Engineer contract file.

18-118.3 Redesign Responsibility for Design Errors or Deficiencies. Whenever the designs, drawings, specifications, or other services furnished by an Architect-Engineer contain any errors, deficiencies or other inadequacies, paragraph (a) of the clause 7-607.2 obligates the Architect-Engineer to make the necessary correction at no cost to the Government. Whenever the Architect-Engineer is not required to redesign pursuant to paragraph (a) of the clause 7-607.2, a written statement setting forth the reasons for such determination shall be placed in the Architect-Engineer contract file.

18-118.4 Liability for Government Costs Resulting from Design Errors or Deficiencies. Whenever a modification or change order to a construction contract is required by reason of an error or deficiency for which the Architect-Engineer might be liable to the Government for damages pursuant to paragraph (b) of the clause in 7-607.2, the Contracting Officer shall obtain required legal advice and shall consider the extent to which the Architect-Engineer may be reasonably liable. He shall enforce such liability where recoverable costs will exceed administrative costs and place a written determination thereon in the Architect-Engineer contract file stating the reasons for such determination to assess or not to assess additional costs against the Architect-Engineer.

a. The foregoing DAR clause covers three basic areas in A-E contracting: The A-E must design within the funding limitation, correct deficient designs, and assume liability for deficient designs resulting from negligence.

b. Paragraph 18-118.2 of DAR requires that the A-E design within the funding limitation and is set forth in the A-E's contract by the insertion of DAR clause 7-608.3. It is the Architect-Engineer's sole responsibility to redesign the project in the event anticipated construction costs exceed the project limitation. The contract provision is as follows:

DESIGN WITHIN FUNDING LIMITATIONS (1971 APR)

(a) The Architect-Engineer shall accomplish the design services required under this contract so as to permit the award of a contract, pursuant to standard Department of Defense procedures, for the construction of the facilities designed at a price that does not exceed the estimated construction contract price set forth in this contract. When bids or proposals for the construction contract are received which exceed such estimated price, the Architect-Engineer shall perform such redesign and other services as are necessary to permit contract award within such funding limitation. These additional services shall be performed at no increase in the price of this contract. However, the Architect-Engineer shall not be required to perform such additional services at no cost to the Government if the unfavorable bids or proposals are the result of conditions beyond his reasonable control.

(b) The Architect-Engineer will promptly advise the Contracting Officer if he finds that the project being designed will exceed the funding limitations and he is unable to design a usable facility within these limitations. Upon receipt of such information, the Contracting Officer will review the Architect-Engineer's revised estimate of construction cost. The Contracting Officer may, if he determines that the estimated construction contract price set forth in this contract is so low that award of construction contract not in excess of such estimate is improbable, authorize a change in scope or materials as required to reduce the estimated construction cost to an amount within the estimated construction contract price set forth elsewhere in the contract, or he may adjust such estimated construction contract price. When bids or proposals are not solicited or where they are unreasonably delayed, the Government shall prepare an estimate of constructing the design submitted and such estimate will be used in lieu of bids or proposals to determine compliance with the funding limitation.

The foregoing clause states that the design must permit award at a price that does not exceed the estimated construction contract price. When the bids received are higher than the estimated cost, the A-E will redesign when required to permit award at no additional fee. However, no action by the A-E is required if the unfavorable bids are the result of conditions beyond his reasonable control.

During design the A-E must inform the Government if estimated costs exceed funds available. The Government may reduce the scope or take other action as required. If the project is designed and placed "on the shelf" until a later date, the Government will prepare an estimate to determine compliance with the funding limitation.

Paragraph 18-118.3 of DAR requires that the A-E correct errors in the design documents at no cost to the Government. The A-E contract contains clause 7-607.2, which sets forth these requirements, and is as follows:

(a) The Architect-Engineer shall be responsible for the professional quality, technical accuracy and the coordination of all designs, drawings, specifications, and other services furnished by the Architect-Engineer under this contract. The Architect-Engineer shall, without additional compensation, correct or revise any errors or deficiencies in his designs, drawings, specifications, and other services.

Para 18-118.4 of DAR requires that the Government determine the extent to which the A-E is liable for costs incurred as the result of contract modifications during the construction process. The A-E contract contains clause 7-607.2, which sets forth these requirements, and is as follows:

(b) Neither the Government's review, approval or acceptance of, payment for, any of the services required under this contract shall be construed to operate as a waiver of any rights under this contract or of any cause of action arising out of the performance of this contract, and the Architect-Engineer shall be and remain liable to the Government in accordance with applicable law for all damages to the Government caused by the Architect-Engineer's negligent performance of any of the services furnished under this contract.

6. Design Deficiency Management Procedures: It is the intent of this regulation that a formalized approach to evaluating and processing questions of A-E liability with regard to contract changes be established and that it be implemented with fairness, uniformity and dispatch. The overall process of identification and evaluation is indicated on the flow chart contained in Appendix B. The procedures set forth hereinafter address the following management functions, all of which must be accomplished to insure the program's success.

a. Identification of design deficiencies.

b. Review and analysis of design deficiencies.

c. Compilation and documentation of data and evidence.

d. Computation of damage estimates.

e. Preparation of findings.

f. Determination of negligence or breach of contract.

g. Communications with Architect-Engineer.

h. Reconsideration of Government position.

i. Negotiation with Architect-Engineer.

j. Initiation of legal action.

k. After action documentation of files.

7. The proponent of this plan will be a "Contract Compliance Manager" (CCM) who will be a member of the District's Construction Division. Staffing of the investigative functions within divisions will remain flexible to permit the use of individuals having the highest degree of expertise necessary to evaluate each individual question of liability; however, the Design Deficiency Review Board responsible for recommending final determinations to the Contracting Officer will be comprised of the following:

a. District Counsel, Chairman

b. Chief, Construction Division

c. Chief, Engineering Division

d. Assistant Chiefs of Divisions shall serve as alternates.

8. In general, the process will be as follows:

a. A Design Deficiency Memorandum (DDM) is to be completed by the Area Engineer for each change issued to a construction contract. The DDM is to be submitted as soon as possible but in no case more than 30 days after issuance of NTP or modification covering change. DDM's are to be forwarded to the Contract Compliance Manager, through the appropriate Construction Division Project Manager.

b. The Contract Compliance Manager (CCM) receives and logs all DDMs. The course of action to be followed will be determined by the CCM, but will generally be as follows:

(1) DDM's for changes issued under GP-3 which have impact indicated and a recommendation by the Area Engineer to initiate recovery action, will be referred to all three members of the Investigative Committee for review and comment. Response will normally be required within 30 calendar days.

(2) All other DDM's will be referred to the Construction Division member only.

c. Investigative Committee members will individually review and provide written comments to the CCM within 30 days. Informal communication between committee members can be pursued if necessary but no formal meetings are anticipated at this stage of review.

d. The CCM receives investigative committee comments.

(1) If committee members are in total agreement, the CCM drafts a DF to the Contracting Officer with the appropriate recommendation, in accordance with paragraph f. below.

(2) If disagreement between committee members exists, the CCM calls a meeting for further review. If the committee then agrees, the CCM proceeds as indicated in (1) above; if, however, disagreement still exists, the CCM drafts a memo outlining majority and minority opinion for presentation to the Design Deficiency Review Board (DDRB).

e. The Design Deficiency Review Board meets to consider. The CCM supports the Board's fact finding requirements. When Board decision is unanimous, CCM drafts recommendation to be forwarded to the Contracting Officer through Board members. When the Board fails to reach unanimous decision, Office of Counsel drafts a finding for presentation to Contracting Officer. Appropriate Division opinions are included in findings provided to Contracting Officer.

f. Recommendation to the contracting officer may take one of the following courses, and applies only to those changes where potential liability was initially identified:

(1) Action warranted, and impact cost is substantial. Recommendation will be made to the Contracting Officer that recovery action be initiated. Investigative Committee recommendation will be through the DDRB for concurrence. Non-concurrence by any member should be resolved by a subsequent DDRB meeting prior to any further action.

(2) Action warranted, but impact cost is nominal and would likely be exceeded by the cost of recovery. Recommendation will be made to the Contracting Officer for concurrence, but recovery action will be held in abeyance pending identification of other changes to the same contract with further impact costs. Again, the IC recommendation will be made through the DDRB, and non-concurrence by any member will be resolved as indicated in (1) above.

(3) No action warranted. The IC or DDRB will recommend directly to the Contracting Officer that no action be initiated.

g. The Contracting Officer reviews matters presented for his consideration. If the Contracting Officer concurs in the absence of liability, such determination shall be returned to the CCM who will route a copy to the AE contract file. If the decision is to pursue recovery, such determination shall be routed through the CCM to Office of Counsel who will prepare a "Demand" letter for the Contracting Officer's signature. If the decision is to hold action in abeyance, the CCM will maintain records of such changes, and re-initiate action when deemed appropriate.

h. Engineering Division will, upon execution of a demand letter, enter into negotiations (assisted by Office of Counsel, and Chief, Construction Division) with the Architect-Engineer to obtain an equitable adjustment of the A-E contract amount.

i. Counsel. If negotiations with the A-E are unsuccessful, a decision of the Contracting Officer will be written by Counsel and delivered to the A-E by appropriate means. At this point, negotiations are curtailed by Engineering Division.

j. Contract Compliance Manager. Upon completion of action on DDM's where the Area Engineer has recommended recovery action be inititated, the CCM will provide a copy of the completed action to the Area Engineer, indicating the disposition of the matter.

k. For projects where A-E design was contracted for "by others," such as the Air Force or other customers, or another Corps District, DDM's resulting in a recommendation to pursue recovery will be referred to the appropriate contracting authority. Transmittal will be by letter prepared by the CCM for signature by the District Engineer, coordinated by DDRB members.

l. The DDM file maintained by the CCM shall be utilized in the development of a final evaluation of A-E performance.

9. Specific Guidance:

a. Area Engineer: The basic responsibility for identifying and initiating actions pertaining to potential AE liability rests with the Area Engineer. This plan, therefore, establishes the requirement that the Area Engineer analyze each change issued, regardless of originating office, on contracts within his management control. This plan is applicable to projects designed by an outside consultant Architect-Engineer as well as projects where the basis for project award was an in-house design or a one-step procurement. However, recovery action is not applicable to in-house designs or one-step procurement.

(1) With but minor exception, questions of A-E liability will be limited to changes issued to correct an error or omission in the basic contract documents. Changes issued to upgrade design to reflect a now current code, Using Service's changed criteria, differing conditions such as an existing unknown sub-surface condition, or changes issued under Clause GP-5 are not candidates for study and a statement on the DDM to this effect will suffice to complete the area's action. All errors/omissions type changes will, however, have the DDM form completed in full, and will have supporting data attached. Special attention shall be given to providing a clear, concise statement describing the necessity for the change and a recommendation dealing with the designers potential for liability. To avoid duplication of effort, a copy of the modification and/or findings of fact may be attached in support of blocks 8, 9, and 10 of the DDM. This statement will be provided for all errors/omissions changes, and where exception is taken to the position provided in Engineering Division findings, the difference shall be highlighted. It is to be noted that even if the architect has erred, the question of liability must be analyzed further since negligence as opposed to

human error must be shown. Since negligence for the purpose of this document cannot be quantified or further defined, each action will be a matter of judgement and the subsequent review/determination process will evaluate the possibility of negligence by the Architect-Engineer. Where impact is indicated and the Area Engineer is recommending recovery action, it is imperative that a thorough description of the problem/conflict be provided, and appropriate documentation be provided for review by the IC or DDRB.

(2) The Area Engineer must during the development of RFP documents, recognize the need to complete a DDM as well as justify the issuance of the change itself. He must, therefore, consider consulting with the designer and/or authorize field visits as required in his judgement, to insure the change is absolutely essential and the solution is the most cost and time effective. Unless the architect has been informed or given a chance to participate in the development of the change, the Government's position with regard to recovery action may be prejudiced.

(3) The Area Engineer will in addition to identifying the change, estimate the potential damage cost to the Government. In most cases this cost will not be the same as the cost of the change since had the additional work been reflected in the contract documents, the cost would have been included in the orginial bid price. The recoverable costs will, therefore, be limited to those similar to:

(a) Tear out and replacement

(b) Restocking and rehandling of material delivered but no longer required

(c) Delay costs

(d) Government investigation and design

(e) A-E field visits

(f) Impact on unchanged work

Government estimates for changes will attempt to clearly separate these additional costs from those direct costs which would have been incurred had there been no question of A-E liability. A copy of the Government Estimate will be attached to support impact costs shown on the DDM.

(4) An initial DDM will be prepared for all changes as soon as possible but in no case more than 30 days after issuance of an NTP or modification to the Contractor. Additional information and/or a revised DDM will be provided by the Area Engineer on request of the CCM or if a significant change in the Area Engineer position occurs. The DDM will be completed and submitted to the CCM as follows:

(a) Area Engineer recommends action to recover damages: Original plus 3 copies.

(b) Area Engineer does not recommend recovery action: Original plus 1 copy.

While the DDM need not be typed, every effort will be made to provide clear and legible text.

(5) The Area Engineer is reminded that it is not within his authority or responsibility to render final determinations with respect to A-E liability. His correspondence shall, therefore, avoid statements which suggest a final determination as opposed to a recommendation for study based upon factual and estimated data. Similarly, Findings of Fact for construction changes, where justification is a Clause 3 Change to rectify an error and omission, shall include a statement to the effect that the question of A-E liability is being reviewed in accordance with established District policy. The Area Engineer will record the DDM initiation action in his change order register for furtherance of management control.

(6) Finally, the Area Engineer is responsible for establishing a training program to familiarize his staff with this regulation and principles and procedures necessary for its effective implementation.

b. Office of Counsel: Upon receipt of a Design Deficiency Memo (DDM) from the CCM, District Counsel will assign a Counsel member to the District investigative group. The Counsel member of the investigative group shall independently analyze the alleged design deficiency. Upon conclusion of the investigation, he will draft and submit through District Counsel factual findings and comments on the liability of the Architect-Engineer for the design deficiency. Upon receipt of these findings and comments, District Counsel will review same and forward to the Construction Division CCM for further action.

c. Engineering Division: The Chief, Engineering Division, is responsible for management of all A-E contracts and for review, evaluation, and the technical sufficiency of all designs prepared by the Baltimore District. In order to assure the effective accomplishment of this responsibility, it is essential that all construction modifications be reviewed and evaluated to lessen recurrence in future projects. To accomplish this, all DDM's will be routed by the CCM through the Chief, Design Branch, for review prior to placing in the A-E contract file. In addition, those construction contract modifications which may have been generated by errors and omissions on the part of the designer, whether in-house or A-E, must be evaluated in depth to determine whether there is negligence and the degree thereof.

(1) In the case of in-house designs, financial culpability or recovery action are not applicable. However, the Chief, Design Branch, is responsible for the detailed evaluation and preparation of a follow-up report on in-house design deficiencies.

(2) For A-E designs, a detailed estimate of total damages must be made, along with a determination of potential liability.

(3) The Chiefs, Military Branch, or Project Planning Branch (or permanent alternate) are responsible as appropriate for detailed evaluation of AE design deficiencies. He will develop the Engineering Division findings for the Investigative Committee.

(4) The Assistant Chief, Military Branch, or assigned alternate, is designated as the Engineering Division member of the Investigative Committee for both military and civil A-E design deficiencies.

(5) The Chief, Engineering Division or permanent alternate will be a member of the DDRB.

(6) The appropriate Engineering Division Project Manager is responsible for placing in the Architect-Engineer contract file, a statement as required by DAR 18-118.3, whenever the A-E is not required to redesign to remedy an error or omission. This will be done by completing the appropriate block of the DDM and attaching a statement for the A-E file.

d. Construction Division: The Chief, Construction Division, as proponent of this plan, is responsible for monitoring overall performance of field offices and providing general and specific guidance on implementation of the program as appropriate. In order to assure effective accomplishment of this mission, the following specific direction is provided:

(1) The Chief, Office Engineering Branch, is assigned the additional duties of Contract Compliance Manager as described throughout this regulation.

(2) The Assistant Chief, Construction Division will be responsible for staffing the Investigative Committee and as such will cause the development of a division position in response to each DDM forwarded by the CCM.

(3) The Chief, S&I Branch will provide technical support to the Chief, Construction Division as required, during Design Deficiency Review Board Meetings in order that all available facts are impartially presented for consideration. Finally, the Chief, S&I Branch will initiate an on-going in-house program to assure sufficient employee familarity with and sensitivity to the program.

(4) The Chief, Contract Administration Branch, will support the Construction Division's Investigative Committee upon request and will be tasked to provide damage estimates and review other potentially controversial aspects of these determinations.

(5) The Chief, Construction or the Assistant Chief, Construction as his alternate will attend all Design Deficiency Review Board meetings and be a voting member of the panel.

(6) Where required, funds for the cost of review of DDM's will be provided by Construction Division. Normally, these costs will be charged to project funds as design during construction, however, if such funds are deficient, S&A will be utilized.

(7) AMPRS Change Order Reason Codes. The Automated Military Progress Reporting System (AMPRS) requires that all contract changes be assigned a standard reason code. These codes are utilized by computer programs designed to generate special reports to the Congress regarding the cost of design deficiency changes. For contract changes resulting from criteria changes, differing site conditions, or value engineering change proposals, the appropriate reason code will be used when first entering the change to the AMPRS data base. All design deficiency changes will be entered initially with the reason code equal to "other." Upon completion of processing of the DDM, Office Engineering Branch will change the reason code to reflect the final decision for each change.

10. It is to be noted that any funds recovered by the Government as the result of recovery actions described in this regulation, are deposited directly into the U.S. Treasury and are not available to finance project construction. Therefore, in those cases where the defect can be corrected under a separate contract as opposed to a change order, consideration should be given to requiring the responsible Architect-Engineer to arrange for the corrective action to be accomplished at no cost to the Government. While this approach may delay correction, it would be the most cost effective and eliminate any debate relating to equity.

FOR THE COMMANDER:

James B Royce
JAMES B. ROYCE
LTC, Corps of Engineers
Deputy District Engineer

2 Appendices
A. Design Deficiency Memorandum (DDM)
B. Flow Chart

Distribution D
NABCO-E: 25 Extra

DESIGN DEFICIENCY MEMORANDUM Appendix A	DR 1180-1-19 30 June 1981

1. PROJECT TITLE	2. LOCATION	
	3. CONST CONTRACT NO.	
4. DESIGNER: ☐ A-E ☐ IH ☐ OTHER A-E NAME: A-E CONTRACT NO:	5.a. CHANGE SYMBOL	5.b. MOD P-
	6. COST OF CHANGE	7. POTENTIAL IMPACT COST

8. REASON FOR CHANGE

9. DESCRIPTION OF DESIGNED CONDITIONS (Narrative description plus sketches.)

10. DESCRIPTION OF REVISED CONDITIONS (Narrative description plus sketches.)

NAB FORM 1465, REV JUNE 1981

11. AREA ENGINEER FINDING & RECOMMENDATION

a. This change (is) (is not) considered to be the result of a design deficiency.

b. Impact costs (have) (have not) been experienced.

c. A-E (was) (was not) consulted.

d. (Recommend) (Do not recommend) initiating recovery action.

COMMENTS IN SUPPORT OF ABOVE POSITION:

DR 1180-1-19
Appendix A
30 June 1981

Signature AREA ENGINEER DATE:

12. ENGINEERING DIVISION PROJECT MANAGER COMMENT

Was the A-E required to redesign to correct the design errors or omission reflected in this DDM? ☐ YES ☐ NO (Written determination attached per DAR 18-118.3)

Signature PROJECT MANAGER DATE:

13 a. INVESTIGATE COMMITTEE/DDRB RECOMMENDATION

13 b. PREPARED BY: CONTRACT COMPLIANCE MANAGER

14. INV COMM.

CONCURRENCE:

CONST DIVN ENGRG DIVN COUNSEL

15. DDRB

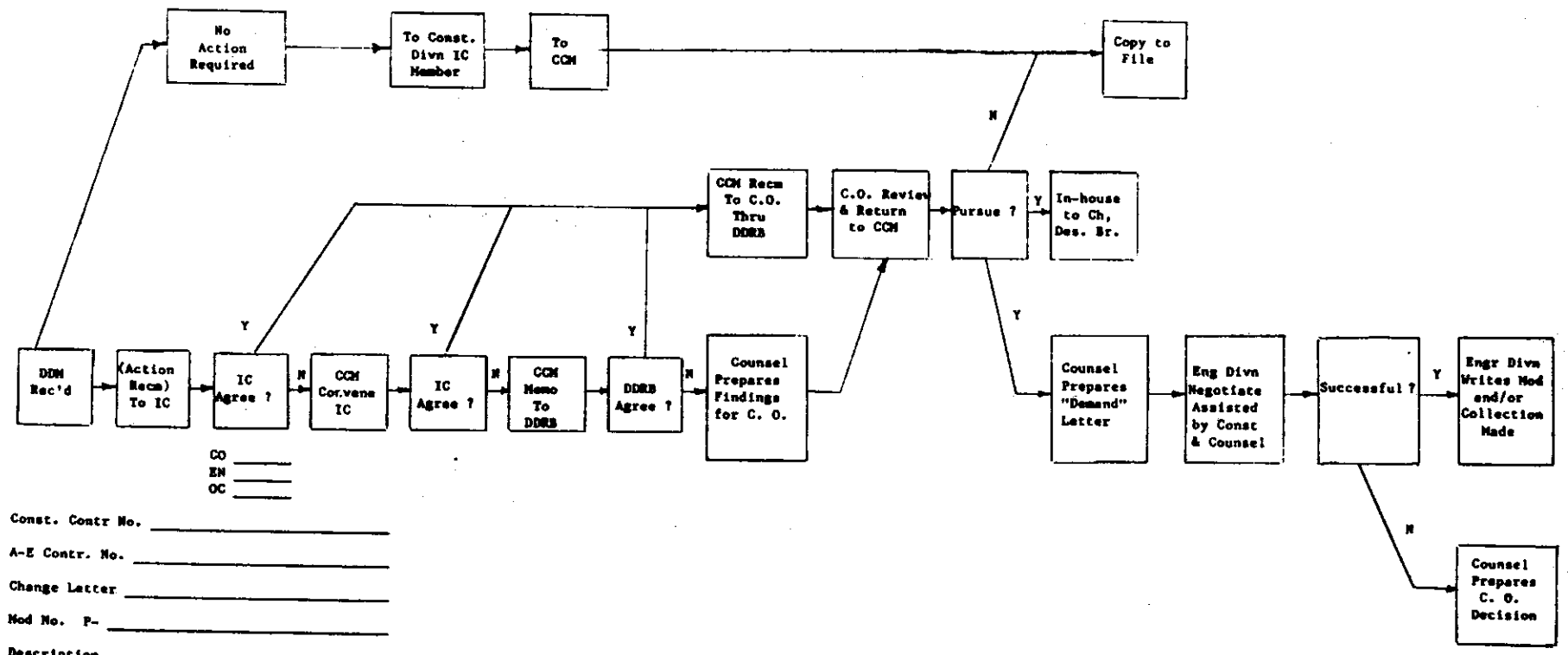
CONCURRENCE:

CONST DIVN ENGRG DIVN COUNSEL

16. CONCUR/NON-CONCUR

CONTRACTING OFFICER DATE:

DDM Processing
Flow Chart



CO _____
EN _____
OC _____

Const. Contr No. _____

A-E Contr. No. _____

Change Letter _____

Mod No. P- _____

Description _____

_____

_____

Area Office _____

APPENDIX B:

A "PAPER" KNOWLEDGE BASE FOR A/E LIABILITY: FINAL PROJECT REPORT*

*Prepared for USA-CERL under Contract No. DACA86-88-M-0209 by Carole D. Hafner and Donald H. Berman, The Center for Law and Computer Science, Northeastern University, Boston, MA 02115, July 6, 1988.

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1. Overview of Project Status

Task 1 (Legal Research) is completed. Twenty-two cases were located in an extensive search using LEXIS and WESTLAW, in addition to other legal reference works.

Task 2 (Case Briefing) is completed. A short brief of each case is presented in Attachment A of this Appendix.

Task 3 (Legal Analysis) is completed. The legal analysis of A/E liability is presented in Section 2, along with detailed information linking the legal concepts of this domain to specific cases where those concepts arose.

Task 4 (Legal Analysis Flowchart) is completed. The legal analysis flowchart for A/E liability is included as Section 3. Information linking the nodes of the flowchart to case law is contained in Sections 2.2-2.4.

Task 5 (Project Report) is completed. Discussion and issues for further study are included as Section 4.

2. Legal Analysis of Architect-Engineer Liability

2.1 General Considerations

The legal standard of performance for Architect-Engineers is set forth in the following standard Government contract clause, which is cited in the majority of Board of Appeals cases described in the Attachment:

(a) The Architect/Engineer shall be responsible for the professional quality, technical accuracy, and the coordination of all designs, drawings, specifications, and other services furnished by the Architect-Engineer under this contract. The Architect-Engineer shall, without additional compensation, correct or revise any errors or deficiencies in his designs, drawings, specifications, and other services.

(b) Neither the Government's review, approval, or acceptance of, nor payment for, any of the services required under this contract shall be construed to operate as a waiver of any rights under this contract or of any cause of action arising out of the performance of this contract, and the Architect-Engineer shall be and remain liable to the Government in accordance with applicable law for all damages to the Government caused by the Architect-Engineer's negligent performance of any of the services furnished under this contract.

(c) The rights and remedies of the Government provided for under this contract are in addition to any other rights and remedies provided by law.

Other pertinent clauses cited in many of the Board cases are:

(d) The Architect-Engineer shall, if necessary, visit the site and shall hold such conferences with representatives of the Government and take such other action as may be necessary to obtain the data upon which to develop the design and preliminary sketches showing the contemplated project.

(e) The preliminary sketches shall include plans, elevations, and sections developed in such detail and with such descriptive specifications as will clearly indicate the scope of the work, and make possible a reasonable estimate of the cost.

Many A/E contracts do not stop at the final design stage, but require the A/E to check shop drawings furnished by the construction contractor, and to provide consultation and advice to the Government during the construction. However, actual supervision of the construction work is usually done by the Government. (In contrast, in the private sector architects are frequently responsible for supervising construction and representing to the owner that the work has been done properly and in conformance with the plans and specifications.)

The standard A/E contract imposes broad responsibilities on the A/E to create a design that accomplishes the purpose of the project, and to make drawings and specifications that are complete and unambiguous. The Government has not gone so far as to impose a "strict liability" standard, however. A finding of negligence is required in order to hold the A/E liable for damages, as stated in clause (b) above. Although the Board of Appeals cases are contract cases, clause (b) makes the issue of neligence a central one in most of them.

The responsibilities of an A/E, like those of other professionals, cannot be delegated. If the A/E has received incorrect information or advice from others, such as

public officials or expert consultants, this will not relieve him of liability if it is found that diligent application of professional skill would have resulted in a correct design. In particular, designs that violate Building Codes are not excused by the fact that they were approved by a Building Inspector. The Government's negligence can also be an issue. Although the Government's approval of a design does not relieve the A/E of liability, the Government is also obligated to exercise due care during the process of design review. If representatives of the Government participate in the design process and/or supervise the actual construction, then additional obligations arise for the Government to carry out these activities with due care. A doctrine of "mutual fault" which is part of Federal contract law may be applied to reduce damages if contributory negligence of the Government is found.

The flowchart presented in Section 3 shows that three basic questions must be answered in the affirmative in order to establish A/E liability:

(G1) Was the design defective? Defects in design can include the careless selection of materials that are inappropriate [Hull],* and can also include omissions of information that the contractor needs to build the structure properly [Clark-Dietz]. On the other hand, if the Government omits information from its Scope of Work that the A/E needs to design the structure properly, or pre-specifies some aspects of the design, then the A/E's design may be held to be in conformance with the Scope of Work and not defective [ALS, Lockwood].

(G2) Was the defect due to negligent performance by the A/E? It is usually necessary for the Government to call expert witnesses to show that the design was defective and the A/E was negligent. The A/E will call his own expert witnesses to testify that the design was in conformance with standard practice. Parsons, Clark-Dietz, and Mount Carmel provide examples of the importance of having authoritative and convincing expert witnesses. Although the need to present expert testimony to establish A/E negligence is not absolute [LADCO, Hull], the failure to do so is a frequent basis of appeal.

(G3) Was the damage to the Government proximately caused by the negligence of the A/E? The Government must prove that it sustained damages as a result of the defect, and must be able to show the amount of such damages. It is not sufficient to claim without proof the amount of damages.

The A/E has a number of defenses available against a claim of liability:

(A1) The design satisfies the Government's specification and is therefore not defective (i.e., the specification was defective for its intended purpose). This contention has failed unless the specification limited the A/E's discretion in creating the design or completely failed to inform him of some unusual requirement [ALS]. If the A/E can show he warned the Government about the potential negative consequences of some aspect of the Government's specification, then this contention has a much better chance of succeeding [Lockwood].

(A2) The damage is due to faulty construction rather than faulty design. Since the Government supervises the construction, finger-pointing among the A/E, the construction contractor, and the Government is common. The burden of proof is important here. The

*Names in square brackets are the names of cases briefed in Attachment A.

Government must show by a preponderance of the evidence that the damage was due to a design error and that the A/E performed negligently. If the A/E reviewed shop drawings that contained an error and did not correct it, this strengthens the Government's case [LADCO]. If the A/E requested more details about materials to be used, etc., and did not receive the information, this strengthens the A/E's case [Parsons].

A variation on the theme of faulty construction is the question of errors that are "patent" - that is, they are readily apparent to the contractor when he compares the drawings to the existing structure. If the error is patent then the A/E may not be liable, since the contractor is responsible for pointing out patent errors in the drawings and not going ahead with plans that are obviously incorrect [Notkin]. Although theoretically this may appear irrelevant to the contractual duty of the A/E to the Government, the tendency of the Boards to follow tort law principles in assessing contibutory negligence is apparent in several recent Board cases [Clovis, Parsons].

(A3) The damage to the Government was caused or increased by its own inaction or by failing to select the most economical method of repair [Eggers, Notkin].

Another significant reason why the Government's case may fail is:

(A4) The actual construction varied substantially from the design [Parsons]. This situation may occur when the construction contractor and the Government decide there is a defect in the design and without consulting the A/E they do something different than the design calls for. If the "fix" doesn't work, the A/E may escape liability, since the defect in his design is not the "proximate cause" of the problem. However, if it can be shown convincingly that the deviation from the design did not make any difference and that the same damage would have occurred had the design been followed, then the A/E may still be liable [Wolfenbarger].

Below is presented a summary of detailed information derived from the case law: the types of defects found in the cases, the actions of the A/E that weaken and strengthen his case, the actions of the Government that weaken and strengthen its case, problem situations that tend to produce disputes, and technical legal considerations that may be relevant to presenting a case.

2.2 Types of Defects

In considering the categories of design defects, it is important to note the importance of local Building Codes and other published sources of standards for structural, electrical, and mechanical design. Examples of such standards are the American Concrete Institute (ACI) code, and the National Electrical Code. These codes are frequently incorporated by reference into A/E contracts, and failure to follow the relevant Code has been found to be negligent design whether or not problems occurred with the structure, and sometimes without the necessity for expert testimony regarding the standard of care.

(a) Defects leading to performance failure of finished structure (buckle, leak, crack etc.)

Weston - storage tank buckled when filled
Eggers - leaky roof
LADCO - cracked concrete roof beams
Parsons* - water intake pipe broke - roof deflected & cracked

*A/E was found not liable.

Buchart-Horn - cracks in concrete roof
Grace - leaks in heat exchanger system
Lockwood* - explosion
Mount Carmel - leaks in skylight, cracks in wall
Campbell - roof leaked, foundation failed
Seiler - basement leaked, air-conditioning inadequate
Pankow - concrete stairs sank
Wilco - walls did not provide adequate structural support
Wolfenbarger - snow came into building

(b) Unworkable Design (mismatch with existing structures)
Hazen - slope of sedimentation tank bottom in error on drawings
O'Neal - specified cabling won't fit in conduits

(c) Violation of Building Codes or published professional standards
Notkin - alleged violation of Electrical Code
Italian - inadequate wind bracing violated Building Code
Pankow - glass in store front thinner than required by Building Code
LADCO - drawings failed to follow American Concrete Inst. Code
Gooch - plans did not conform to Electrical Code
Buchart-Horn - plans failed to follow American Concrete Inst. Code

(d) Construction plan and/or site design defective
Clark-Dietz - construction site flooded after collapse of levee, erosion of paving access bridge
Clovis - construction site collapsed due to underground water pressure

(e) Unfitness for the intended purpose
Giffels - jib cranes could not be installed without modification
ALS* - power supplies failed due to electromagnetic interference

(f) Other
Gooch - drawings did not provide sufficient detail
Hull - selection of unsafe material when safer choice available

2.3 Standards of Performance for Architect-Engineer

This section enumerates some of the criteria for negligence on the part of the Architect-Engineer that we have found to be significant. After each standard is a list of cases in which the standard was violated or claimed to be violated.

(a) Did the specifications and/or drawings contain errors, misleading or ambiguous instructions, or omit some required design information [Hazen, LADCO, Giffels, Gooch, Clark-Dietz]?

(b) Did A/E fail to follow published standards including manufacturer's literature, professional codes, and local building codes [Eggers, Buchart-Horn, LADCO, Italian, Pankow, Wilco]?

(c) Did A/E review and approve shop drawings [LADCO, Giffels, Grace, Hazen]?

*A/E was found not liable.

(d) Did the A/E fail to consider predictable impact of "natural forces" on design and protect against them [Clark-Dietz, Seiler, Wolfenbarger, Clovis]?

(e) Did the A/E fail to consider needed modifications of existing structures and include them [Gooch, O'Neal]?

(f) Did A/E recommend unsuitable materials for the project [Grace, Hull]?

(g) When a design change was made during construction, did A/E make or approve it without modifying other aspects of its design to make the total design correct [Parsons, Clark-Dietz]?

2.4 Standards of Performance for the Government

This section enumerates some of the criteria for the Government in dealing with an Architect-Engineer. After each standard is a list of cases in which the standard was violated or claimed to be violated.

(a) Did the Government make changes in the A/E's design after it was accepted and without fully informing the A/E and soliciting its opinions [Parsons]?

(b) Did the contractor fail to perform in substantial compliance with A/E's design [Parsons, but see Wolfenbarger]?

(c) Did the Government limit the A/E's discretion by prescribing certain aspects of the design or budget limitations that did not permit A/E to follow its best judgment [Lockwood]?

(d) Did the A/E or contractor warn the Government about a weakness in the design and propose a solution, which was rejected or which the Government delayed in implementing, incurring extra cost [Notkin, Lockwood]?

(e) Did the Government's engineers actually know about a potential problem and fail to ensure that it was addressed [Clovis]?

(f) Did the Government fail to provide information to the A/E during construction that was necessary to avoid the problem [Parsons, ALS]?

(g) Did the Government omit from the specification some unusual requirement that the A/E could not be expected to know about [ALS]?

(h) Did the Government overpay for fixing the problem? (If so, damages will cover only the necessary expense that it should have paid [Eggers].)

2.5 Potential Problem Situations

This section indicates some situations that appear to give rise to disputes between the A/E and the Government. Although this is not part of a formal legal analysis, it may prove useful to the designer of an expert system. The points listed here provide the beginning of a list of situations that should ring a "warning bell" with construction managers or supervisors.

(a) When a change in design is made after final approval of design drawings and specifications.

(b) When items are left out of a design to lower the bid.

(c) When an improvement requires careful integration with existing structure.

(d) When hazardous materials are involved.

(e) When A/E's design mixes performance and prescriptive description of materials.

2.6 Legal Perspectives

This section presents some considerations with which a litgator should be acquainted, relative to the burden of proof and other matters of legal theory and practice.

(a) The burden of proof is on the Government to show defective design, to show that design was substantially followed, and to show the amount of damages [ALS, Wolfenbarger]?

(b) Strict liability cannot be inferred from the standard contract. It is enough that A/E exercise professional skill and care [Parsons].

(c) Contributory negligence by the Government or the contractor can mitigate A/E's damages even though the suit is in contract [Parsons, Clovis].

(d) Presenting strong expert witnesses can be the deciding factor [Parsons, Mount Carmel, Clark-Dietz]. Expert testimony can be required to establish two distinct claims of the Government: 1) that there was an error in the design that contributed to the problem - it was not just an unavoidable accident; and 2) that the error was one which would not be made by a prudent A/E exercising due care. If a strict liability standard were followed, only claim 1) need be established. However, the current standard is a negligence standard which requires both 1) and 2) to be shown.

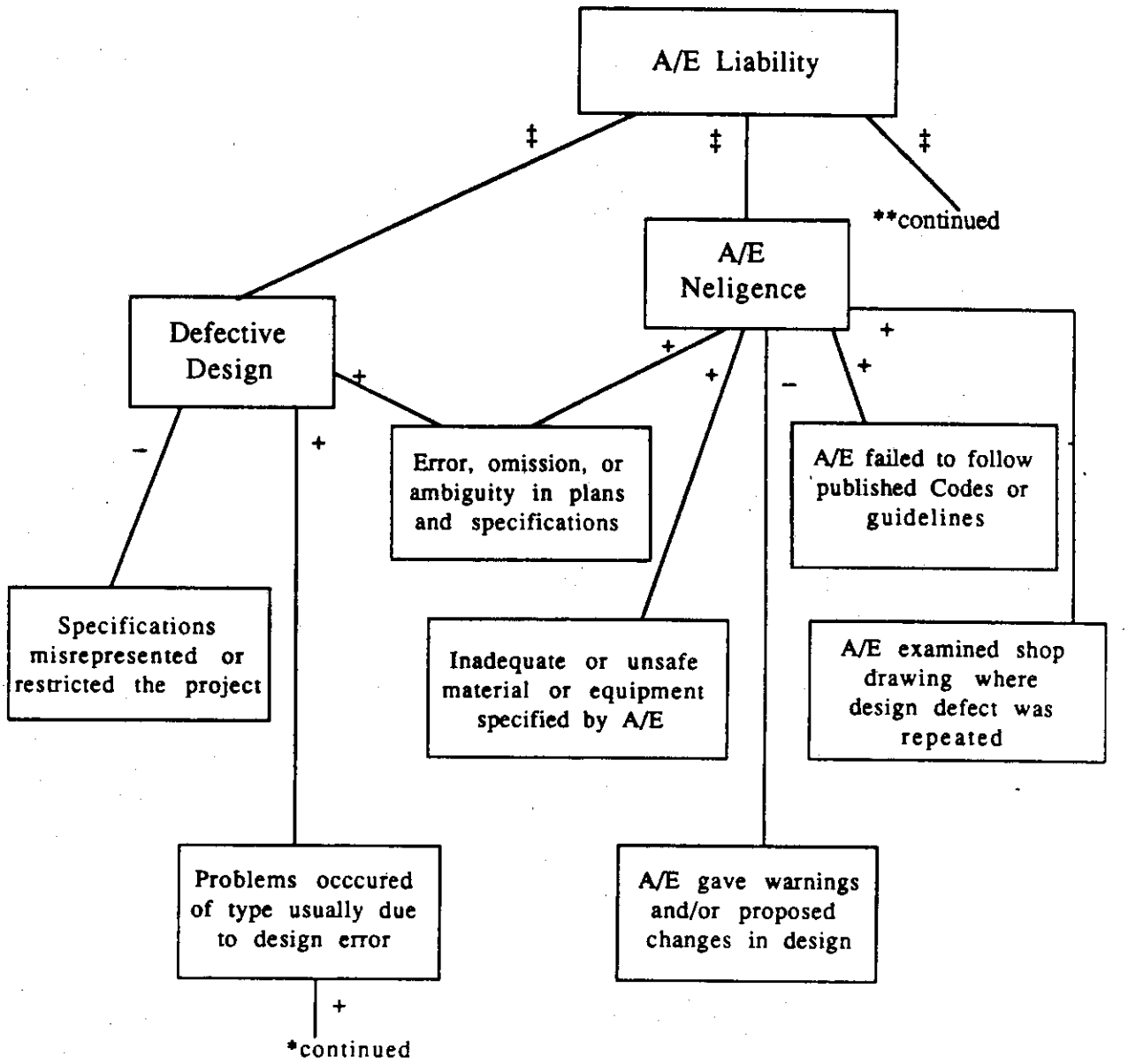
(e) Contractor's responsibility to field check drawings does not relieve A/E of liability for errors [Hazen].

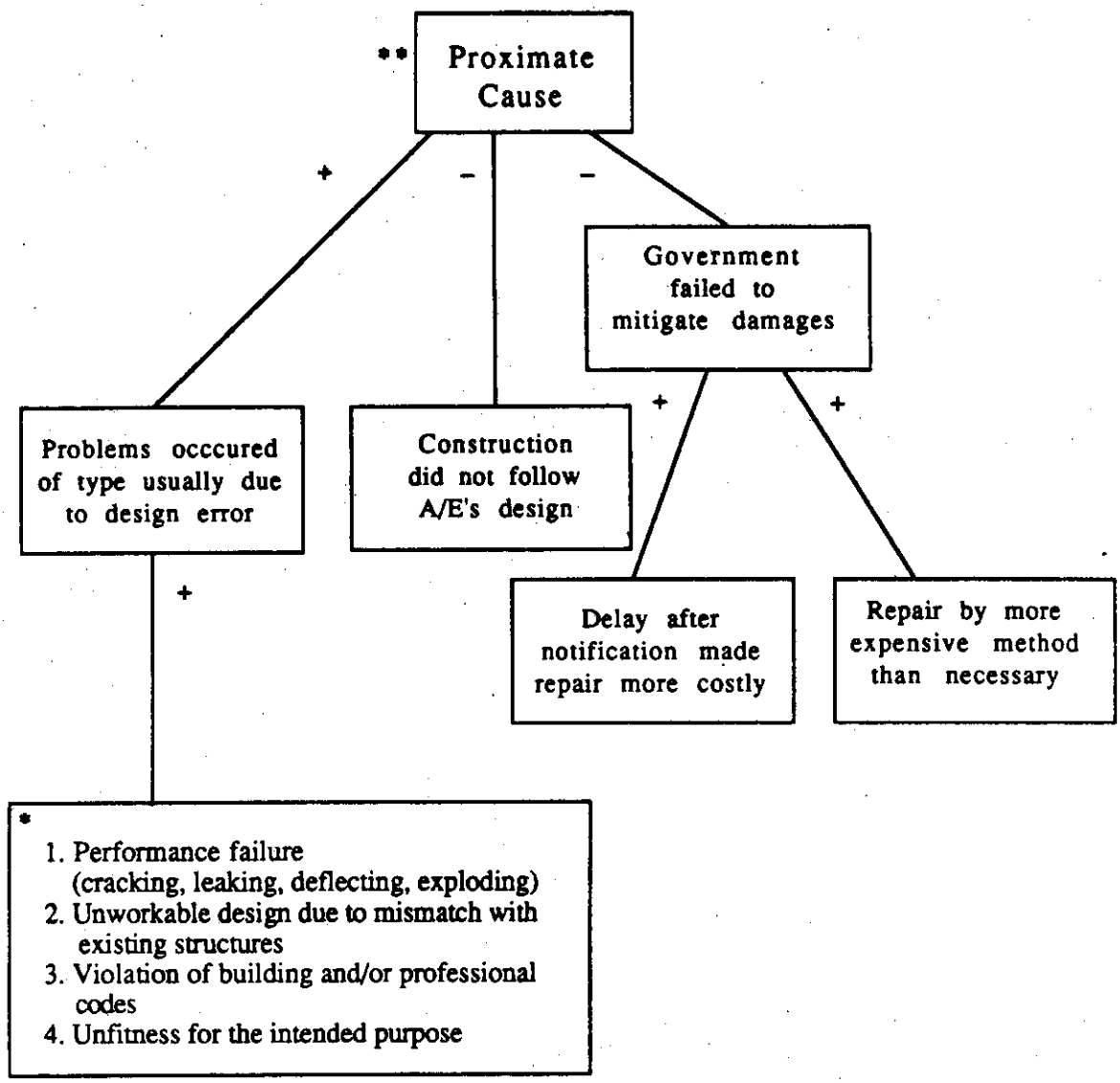
(f) Approval of plans by "general consultants" or city Building Department does not relieve A/E of liability [Buchart-Horn, Italian, Pankow].

3. Legal Analysis Flowchart of Architect-Engineer Liability

The flowchart in this section illustrates the legal issues and relationships of the A/E liability domain. The titles in the boxes are short expressions that stand for legal concepts explained more fully in Section 2 above. Thus, this flowchart should be viewed as a summary and supplement to Section 2; it will not stand on its own as an explanation of the A/E liability domain.

The boxes in the flowchart represent legal concepts (issues or conclusions), and the links connecting the boxes represent legal relationships. The relationships are directed upwards; that is, if a lower level concept is found to be true, it will generally influence the court's conclusion about the higher level concept(s) to which it is connected. For example, the legal conclusion "A/E liability" is the highest level concept in the flowchart. The lower level concepts "defective design" and "A/E negligence" will influence a court's conclusion about "A/E liability."





The legal relationships shown in the flowchart are of three different kinds, indicated by small symbols drawn next to the link. Necessary elements of a legal conclusion are symbolized by the "necessity" symbol (‡). For example, "defective design," "A/E negligence," and "proximate cause" are necessary elements of A/E liability.

Influential elements that support a legal conclusion are symbolized by a "plus" symbol (+), to indicate an increasing likelihood of the higher conclusion being true, given that the lower conclusion is true. Influential elements in the negative direction are symbolized by a "minus" symbol (-). For example, the A/E will generally be held negligent if his design drawings contained errors, omissions, or ambiguities. This is indicated by a "+" link in the flowchart. The A/E will generally not be held negligent if he warned the Government about a potential problem with the design and suggested ways to correct it. This is indicated by a "-" link in the flowchart.

4. Discussion and Issues for Futher Study

The "paper" knowledge base presented here represents a foundation for the development of a computer expert system on the topic of Architect-Engineer liability for deficiencies in design. A computer expert system for A/E liability would be useful in several ways. It could be used for training personnel to alert them to the kinds of dispute that arise and the legal theories used to resolve them. The expert system could also be used to offer advice to field engineers or supervisors when a potential problem is recognized. Finally, the expert system could be used as an aid to Government litigators.

In order to create an effective expert system based on this knowledge base, two additional design issues should be considered: first, a strategy should be developed for using the expert knowledge for the purpose intended: either training, field advising, or litigation support. The strategy development task should include interviewing experienced individuals who have been involved in real-life cases to determine what kind of strategy would be most useful. Additional knowledge based on cases that were settled instead of going to trial can be collected and integrated into the knowledge base during this stage.

Another design issue that should be considered is how the expert system will communicate with its users. In most expert systems, the program takes the initiative, asking the user questions about the situation of interest and finally presenting the computer's "diagnosis." However, there are disadvantages to this approach, and it would be wise to consider mixed-initiative alternatives.

As a follow-on to this project, it would be useful to integrate the A/E liability knowledge base with the closely related question of contractor liability. There are an equal or greater number of such cases, and in fact many of the cases briefed in this report involve contractor liability as well as A/E liability. Whether for training, field support, or litigation, it would be desirable for an expert system to be able to help the Government evaluate both A/E and contractor liability.

Attachment A. Relevant Case Law

Case 1. Appeal of A.L.S.

1.1 Citation. Appeal of - A. L. S. Electronics Corporation; ASBCA No. 23128 Armed Services Board of Contract Appeals; 82-2 B. C. A. (CCH) P15,835; June 8, 1982.

1.2 Legal/Procedural Context. Appeal by manufacturer of contract officer's decision to withold payment for defective supplies under warranty. Counterclaim by manufacturer for cost of repairs and investigations.

1.3 Background. ALS manufactured power supplies which were described in great detail in specs with every aspect of performance detailed. No reference was made to radio frequency or electromagnetic interference (EMI). ALS, however, did include some EMI suppression in the design, which would work at normal levels of EMI. There was a 1-year warranty in the contract.

Sample units were delivered and accepted after passing extensive tests at the extremes of the specification. But when the units were shipped to Philadelphia Naval Yard, almost all failed within a very short time. The Government invoked the warranty.

ALS tried to discover the cause and could not find anything wrong with the units. It concluded that some unusual conditions at the shipyard must exist, and suggested EMI as a possibility. The Government called in an expert who spent 4 hours examining written descriptions and produced a list of likely design defects. The expert did not actually examine the units. ALS claimed the design defects suggested by the expert would have come out during the extensive testing. One of the units operated for 9600 hours at the Philadelphia shipyard. An identical unit from the same production run logged over 35,000 hours in another location. No attempt was made by the Navy to investigate the presence of EMI at the shipyard, even though they had the instrumentation to do so.

1.4 Issues. Is the contractee responsible for identifying the cause of a failure?

Were the units defective in design or manufacture?

When a design fails due to environmental factors, who is responsible?

1.5 Holdings.

The most likely cause of the failures was an abnormal characteristic of the environment (unusual levels of EMI).

Since the contract did not require protection against this, the equipment was not defective or noncompliant and the warranty was not breached.

Contractor would be compensated for the units, and would also be compensated for trying to fix units whose failure was due to EMI.

1.6 Justification and Legal Theory.

Although the contractee is not responsible for identifying the cause of failure, it must establish by a preponderance of the evidence that defective design or

workmanship or noncompliance with the contract is the most probable cause of a failure. Abney Construction Company, Inc., ASBCA No. 23686.

When a specification includes very detailed technical requirements, but fails to provide for some other requirements which are "unusual," the specification may be held defective, relieving the designer of warranty liability.

Although the contractee is not responsible for identifying the cause of failure, if an environmental cause is suggested and the contractee has the capability of investigating it and ruling it out, and fails to do so, any inference drawn from this lack of evidence must be drawn against the contractee.

1.7 Notes. Although this is a manufacturer's warranty case and not directly on point, it may be relevant to the question of defective specifications vs. defective design. Warranty liability does not require a finding of negligence on the part of the designer, but the Government still lost this case because the specification did not call for "unusual" EMI protection. The court held that there was no defect in the design.

Case 2. Appeal of Buchart-Horn

2.1 Citation. Appeal of Buchart-Horn, Inc., ENG BCA No. 4620; Corps of Engineers Board of Contract Appeals; 86-1 B.C.A. (CCH) P18,670; December 24, 1985 and Slip Opinion; October 15, 1986 .

2.2 Legal/Procedural Context. A/E appeals from contracting officer's assessment of damages for repairs in a concrete roof and supporting structure that exhibited excessive cracking. The case against A/E was originally filed in U.S. District Court, charging negligence and breach of contract. After A/E had answered the complaint, the Government moved to stay proceedings pending exhaustion of administrative remedies, based on the "disputes" clause of the contract. The motion, opposed by A/E, was granted.

2.3 Background. A/E was hired to perform final design for part of the Washington, D.C. rapid transit system, including Grosvenor Station in Rockville, MD. The station was to be a two-story reinforced concrete structure with a slab roof supported by concrete beams. The ACI (American Concrete Institute) Building Code was incorporated by reference into the contract. A/E worked with a General Engineering Consultant (GEC), which provided general plans and criteria and which reviewed A/E's design.

After the construction was substantially complete, the Resident Engineer noticed an unusual number and type of cracks in the spandrel beams, which are the edge beams of the roof. A large amount of cracking in the transverse beams was also noticed, as well as cracking in the roof beams. Various engineering studies and repairs were undertaken, and the Government sought reimbursement from A/E as damages resulting from a negligent design. A/E argued that its design was not negligent, that the cracking relieved the torsional stress, that the flexural cracks were within the tolerable range, and that the repairs were unnecessary.

2.4 Issues.

Was the A/E negligent in the design of the concrete beams?

Was there contributory negligence on the part of the General Consultants that supervised the design and construction?

Was the Government's concern about the safety and integrity of the building justified, or were the cracks within the tolerable range?

Were the cracks proximately caused by A/E's design?

Were the repairs necessary?

2.5 Holdings.

A/E's failure to consider torsion in its design of the spandrel beams was negligent, resulting in unacceptable torsional cracking in the spandrel beams.

The design of the transverse beams was not consistent with the ACI Code requirements to control flexural cracking. The transverse beams exhibited severe and unusual flexural cracking, resulting from A/E's failure to comply with the ACI Code provisions respecting crack control.

The cracking of the roof slab, resulting in leaks, could not be blamed on A/E, since at least part of the problem was due to the shrinking characteristics of the concrete.

The General Consultants were not negligent in approving the design. Evidence of controversy within the engineering community about the proper standards for concrete construction did not relieve A/E of liability if it failed to follow the current professional standard and defects in the structure occurred as a result.

2.6 Justification and Legal Theory.

The code of a professional organization such as the ACI is evidence of the professional standard of care. A design review, as performed by the General Consultants, does not require checking of specific calculations. Although the failure of A/E to follow the ACI Code was not difficult to discover, the General Consultants were not required to investigate unless they had some reason to suspect a problem.

Case 3. Campbell V. Brownlee

3.1 Citation. Campbell County Board of Education V. Brownlee-Kesterson, Inc. et al., 677 SW 2d 457 (Tenn App, 1984).

3.2 Legal/Procedural Context. Owner sued architect, general contractor and subcontractors for damages caused by breach of contract. The contract was a standard AIA contract proposed by the architect. Architects were held liable for $898,982.72 in damages, and they appealed.

3.3 Background. A school complex was constructed which had a number of severe problems including a roof that totally failed, an athletic building whose foundation failed, and structural brick panels that were not installed properly. Architects were charged with preparing a faulty design for the roof; with deliberately and falsely advising the client that roofing and masonry work had been properly executed and

final payment should be made; with failing to require the proper borings and tests for the foundation; with ordering construction to begin on the athletic building over the objection of the contractor regarding unstable conditions in the subsurface area where the foundation was to be poured; with deliberately failing to advise the plaintiff that the contractor was responsible for additional expenses incurred due to the subsurface conditions, and for wrongfully advising the plaintiff that the failure of the athletic building was an unfortunate occurrence for which no one was to blame.

3.4 Issues. Issues of fact regarding design defects, violation of good practice, and bad faith on the part of the architect, and measurement of damages.

3.5 Holdings.

All of the liability assessed to the architects was proper.

There were major design errors in the plans and specifications for the roof.

Architects did not endeavor to guard plaintiff against defects in workmanship on the part of the contractor.

Architects acted in violation of good standards of practice by failing to require proper borings and tests for the foundation of the athletic building, and by ordering construction over the contractor's objections.

Architects acted in bad faith and in breach of contractual duties by wrongfully advising the plaintiff about responsibility for the failure of the athletic building.

The roof was a total failure and needed to be removed and replaced with a functional roof. There was no residual benefit to the owner which might be considered as a reduction of damages.

3.6 Justification and Legal Theory.

Architects and contractors may be jointly and severally liable for damages due to faulty workmanship, where the architect's failure to warn the owner was improper and in breach of contract.

3.7 Notes. This case illustrates sources of architect's liability other than defects in design drawings and specifications.

Case 4. City V. Clark-Dietz

4.1 Citation. The Mayor and City Council of the City of Columbus, MS, and Columbus Utility Commission V. Clark-Dietz and Associates - Engineers, Inc. and Basic Construction Company, 550 F. Supp. 610 (US Dist Ct, 1982).

4.2 Legal/Procedural Context. The City sued A/E and contractor for a) damages caused by the failure of a protective levee around the construction site; b) cost of remedial construction to improve the unfailed portions of the levee; and c) the cost of repairing slope paving near an access bridge designed by A/E.

4.3 Background. A/E designed and supervised construction of a waste water treatment plant, which was located in a low area between two creeks. Since the area was exposed to periodic flooding, part of the design was a protective levee around the site. In the center of the levee the design called for a slurry wall made of impermeable material that would extend from the ground down to an impervious subsurface soil stratum. When construction of the slurry wall was to begin, the contractor announced that the conduits or pipes which were to pass under the levee through the slurry wall were not immediately available. The supervising engineer, an employee of A/E, determined that the levee construction should proceed and the levee and slurry wall could later be cut for pipe installation. During the pipe installation, there was a disagreement between the contractor and A/E's engineers about how to prepare and install a seepage collar around the pipe. The engineers, although not experienced with this type of slurry, did not contact other engineers or make further inquiry about the effectiveness of their method of installation. Later the levee failed at two points where the pipes had been installed through the levee cuts. After evaluating the cause of the failure and the integrity of the remaining portions of the levee, seams of sand were found in the levee immediately above the slurry. Above the seams of sand, the soil material was found to be of inconsistent cohesiveness. A/E recommended a second, remedial slurry wall be added to the levee above the ground to remedy these weaknesses. Another issue litigated in this case was the failure due to erosion of embankment paving near an access bridge designed by A/E and built by contractor.

4.4 Issues.

Was the failure of the levee due to negligent design and/or negligent workmanship?

Who was liable for additional weaknesses found in the levee which made the second slurry wall necessary?

Was A/E liable for the failure due to erosion of the bridge embankment?

4.5 Holdings.

1. Failure of the levee

A prudent engineer would have considered the strength of the slurry wall before designing a method of restoring the levee's integrity after the cuts.

Failure of the levee was completely due to A/E's faulty design of the seepage collars around the pipes.

A/E was solely liable for the damages resulting from the failure of the levee.

2. Sand Seams

The sand seams above the first slurry wall resulted from its being improperly poured.

Although the designer of the slurry wall envisioned a layer, or key, or clay would be installed before digging the slurry trench, this was not indicated in the plans and specifications, and A/E's supervising engineer did not require it.

A/E was guilty of negligent design and/or negligent supervision in failing to specify the method of constructing the slurry wall.

A/E was responsible for the sand seams above the slurry wall.

3. Inconsisent soil quality

A/E's supervising engineer was diligent in performing numerous inspections of the soil in the levee, and could not be expected to examine each truckload.

Contractor was responsible for inconsistent cohesiveness of the soil above the slurry wall.

4. Need for a second slurry wall

A/E and contractor were each 50% liable for the cost of building the second slurry wall.

5. Failure of access bridge embankment

Negligent and defective placement of the access bridge so that the flow of the creek directly hit the embankment during periods of high water was the cause of the embankment failure.

A/E was liable for the cost of repairing the embankment.

4.6 Justification and Legal Theory.

An architect's professional duty includes investigating to determine whether specified materials called for in a design meet the proper standard.

Oral instructions given by A/E's supervising engineer, at variance with the written plans and specifications, are actually field modification of the plans and specifications.

A contractor who has followed plans or specifications supplied by the contractee, his architect or engineer, which have proved to be defective or insufficient, will not be responsible to the contractee for loss or damage which results solely from the defective plans, in the absence of negligence on the contractor's part or any express warranty by him.

Damages may be charged in proportion to each party's contribution to the deficiencies from which the damage arose.

4.7 Notes. This case illustrates that, in some circumstances, failure to specify the correct method of constructing or installing some part of a design may constitute a design defect. Although it is not stated in these terms, a rule that could be extracted from the case is: "if the designer knows when he creates a design that there are special requirements for building or installing it, then prudent practice requires him to communicate this in the plans."

The opinion states that the duty of professional care of the A/E is nondelegable, so that the A/E's reliance (if any) on outside consultants is irrelevant.

This case summarizes extensive testimony of expert witnesses. Although it is long and rather tedious, it is an excellent illustration of the reasoning process a trial judge goes through in attempting to decide which side of a case offers the most believable evidence and explanation of a construction problem.

Case 5. Appeal of Clovis Heimsath

5.1 Citation. In the Appeal of Clovis Heimsath and Associates; NASA BCA No. 180-1; National Aeronautics and Space Administration Board of Contract Appeals; 83-BCA P16,133; November 16, 1982.

5.2 Legal/Procedural Context. A/E appeals from contracting officer's assessment of damages from the allegedly defective design provided for construction of a Water Immersion Facility.

5.3 Background. A/E designed an underground concrete Water Immersion Facility (WIF) that was 25 feet deep at the Johnson Space Center in Houston, Texas (near the Gulf of Mexico). The contract provided that A/E should investigate subsurface soil conditions and provide recommendations to guide construction of the tank. On the subject of dewatering the construction site, the design documents included only a standard clause stating that water should be prevented from flowing into the excavation site. Both A/E and the Government failed to heed an engineering report, (forwarded by Government engineers to A/E), in which engineering consultants had recommended deep draining wells to relieve hydrostatic uplift pressure due to aquifers under the excavation site. During the construction, hydrostatic pressure caused an upheaval of the bottom of the excavation and resulted in a catastrophic failure of the shoring and bracing system for the construction. A Government engineer participated in the design team, and there were several days of design reviews. A/E had no responsibilities for supervising the construction. A/E did not recommend orally or in writing that the hydrostatic uplift pressure existing below the excavation site should be relieved during construction, and the Government never asked for a detailed explanation of the dewatering plans for the construction. There was disputed testimony that the A/E's representative told the Government that dewatering is the sole responsibility of the construction contractor, and that the Government engineer agreed that A/E was not required to do a detailed dewatering plan.

5.4 Issues.

Was A/E negligent in failing to specify in the design that hydrostatic uplift pressure must be relieved during construction, and failing to provide a method for relieving such pressure?

Was the construction contractor negligent in not properly dewatering the construction site?

Was the Government negligent in its supervision of design and construction by failing to notice or question the inadequacy of the dewatering procedures?

Whose negligence proximately caused the failure of the construction site?

Could the Government's negligence, if any, offset the A/E's negligence?

5.5 Holdings.

The A/E's design was premised on a dewatered condition of the construction site.

A/E was aware of the hydrostatic pressure and the need to relieve it, but the design failed to communicate this. A/E was negligent in not putting the Government and construction contractor on notice of the need to relieve the hydrostatic uplift pressure caused by the aquifer.

The construction contractor was not negligent.

It was negligent for the Government to fail to inquire about dewatering problems when the work was occurring in a Gulf Coast area known for high groundwater.

The Government was negligent in reviewing the design and supervising the construction.

It was proper to consider contributory negligence of the Government in fixing the amount of damages.

The A/E was liable for damages proximately caused by its negligence, but since the Government through its own negligence contributed substantially to the failure, the amount of its recovery was limited to one-half the monetary damages to which it would otherwise be entitled.

5.6 Justification and Legal Theory. Construction contractors are ordinarily responsible for all information provided in the bid documents, but they are not held responsible to hire specialists to interpret information relating to subsurface conditions unless the magnitude or criticality of a dewatering problem is disclosed therein. They cannot be charged with foresight greater than the design engineers themselves possessed, nor with re-engineering projects or conducting subsurface investigations.

When the Government does not employ the A/E for administration and inspection of the construction, it places upon itself the obligation to become totally familiar with the design and its basic assumptions.

Although the contract states that Government approval of a design does not absolve the A/E from liability for its negligence, the Government cannot rely on this clause as a shield to its own negligence, if any.

Principles of Federal contract law apply to this case, even though the damages resulted from alleged negligence. In contract law, a mutual fault doctrine is applied to the determination of damages - it is not necessary to find a breach of specific duty owed by the Government to the A/E.

5.7 Notes. This case is interesting because the fault was not with the final product but with the method of construction. It case provides a solid basis in contract law for awarding partial damages when there is contributory negligence on the part of the Government. It also imposes specific duties on the Government when it, rather than the A/E, is to supervise construction.

Case 6. Appeal of Eggers

6.1 Citation. Appeal of the Eggers Partnership; IBCA 1299-8-79; Interior Board of Contract Appeals; 82-1 BCA P15,630; February 12, 1982.

6.2 Legal/Procedural Context. A/E appealed a decision by contract officer to deduct $26,200 from the balance due under the contract, for construction cost to cure leaks in a roof designed by A/E.

6.3 Background. A/E designed a building with a roof covered by corrugated panels of asbestos-cement roofing. The design called for a relatively flat roof (4 in. pitch over 20 ft), which was necessary because the building was under an existing grandstand. The specifications directed that materials be secured to the framing in accordance with the manufacturer's installation manual. After award of the contract, the contractor informed A/E that the manufacturer recommended 3 inches of pitch per foot, and asked for reconfirmation of the pitch. A/E responded that the requirement applied only to a different kind of roofing support, and instructed the contractor in how to install it. Soon many leaks developed. Investigation showed that contractor followed A/E instructions. Manufacturer suggested a solution, which was found to be inadequate by the Government's project engineer because it would only fix the problem temporarily. The Government advertised for other bids and fixed the roof, without telling A/E, and deducted the cost from A/E's contract. A/E appealed, contending that if it had been notified that the proposed solution of the manufacturer had been rejected, it could have provided a conventional roof at far less cost than the repairs utilized by the Government. The Government responded that under A/E's suggestion hot tar might have penetrated the roof deck and made the ceiling inside unsightly.

6.4 Issues.

Did the contractor install the roof according to A/E's instructions?

Was A/E liable in preparing a design using a product in a manner that is outside the recommendations of the manufacturer's product literature?

Did the Government fail to mitigate the damages by using a more expensive repair than A/E would have provided?

6.5 Holdings.

A/E did not consult with the manufacturer during the design of the roof, but only after the contractor inquired about the roof pitch.

A/E was negligent in designing the roof.

The Government's failure to notifiy A/E that it was obtaining repair elsewhere was irrelevant.

A/E's proposal was reasonable and it would only be liable for the cost of the conventional roof.

Although the conventional roof might have taken longer to install, the Government's delay of 5 months after the cause of the leaks was determined negates any argument that an emergency existed which required installation in the shortest possible time.

6.6 Justification and Legal Theory.

The measure of damages is the actual cost of repair, provided that cost was reasonable.

When an injured party does not make a reasonable effort to mitigate the damages with the result that the harm is greater than it need have been, the injured party cannot recover for the unnecessary and avoidable expense.

6.7 Notes. This case illustrates that an A/E who varies from recommended procedures in product literature may be liable even though the manufacturer provides informal advice about the installation of the product under the varying conditions.

Case 7. Appeal of Giffels

7.1 Citation. Appeal of Giffels Associates, Inc.; ASBCA No. 30821; Armed Services Board of Contract Appeals; 86-1 B.C.A. (CCH) P18,542; October 25, 1985.

7.2 Legal/Procedural Context. A/E appeals assessments of a) damages for construction costs and b) reimbursement of fees previously paid under a modfication order, claimed to be a result of A/E's negligent design.

7.3 Background. A/E designed a new pipe shop for the Navy, and also had responsibility for reviewing contractor's shop drawings. Part of the job involved placing mounting plates on structural steel columns to hold jib cranes which the Navy would later move from the old pipe shop to the new one. The plates were shown on A/E's drawing with notes to "check existing jib installation for elevation of backstay mounting (plates)" and "verify location of ...(plates) with contracting officer." When shop drawings for the mounting plates were submitted to A/E, with a notation to "verify" the location of the mounting plates, the drawings were marked "approved as noted," where a note was added referring to the earlier notes on A/E's drawing. After the contractor fabricated and installed a number of plates using existing elevations, it became clear that installation of the jib cranes would cause physical interference with other elements of the new shop. A/E was given a modification order to re-design the existing jib cranes to fit in the new shop. Later the Government informed A/E that the problem could have been ascertained during early site visits, and claimed reimbursement and damages. A/E contended that the relocation of the jib cranes was the Navy's responsibility, and that included the determination of the proper height for the mounting plates. (The relocation of jib cranes had been removed from the construction contract in order to keep the bids under budget.)

7.4 Issues.

Was there a defect in A/E's design?

Was A/E negligent?

7.5 Holdings.

The contract drawings were deficient and misleading, and negligently prepared because a reasonable reading would lead a construction contractor to believe that the plates should be at the same height as the existing installation.

A/E was also negligent in reviewing the shop drawings, and abdicating its responsibility by referring back to the earlier misleading notes.

7.6 Justification and Legal Theory.

Ambiguous and misleading instructions in a design drawing may constitute negligence and deficient design.

A/Es cannot abdicate their responsibility for technical accuracy and completeness by putting notes on a drawing to "verify with contracting officer."

7.7 Notes. This case illustrates a responsibility of the A/E to design a structure fit for its intended use, if that use is known and if he has the opportunity to determine the requirements for that use. The fact that the contract called for site visits as necessary, and A/E could have visited the old pipe shop to determine the proper location for the mounting plates, was important.

Case 8. Appeal of Gooch

8.1 Citation. Appeal of John B. Gooch Associates; ASBCA No. 22664; Armed Services Board of Contract Appeals; 79-1 B.C.A. (CCH) P13,589; November 27, 1978.

8.2 Legal/Procedural Context. A/E seeks additional compensation, denied by the contracting officer, for design work claimed to be not part of the Scope of Work.

8.3 Background. A/E was awarded a Navy contract (Standard Form 252 - A/E Fixed-Price Contract) which required him to "provide all required services for the preparation of construction contract drawings" for the repair of a 30-year old wooden barracks building. The contract also specified work to be done in accordance with DOD and Navy criteria, which require conformance to the National Electrical Code.

Prior to submitting the proposal, A/E visited the site and discussed the project with the Engineer in Charge, who told him that the building was to be rewired in order to bring it up to Code standards, that receptacles and switches were to be replaced, and that grounding wires were to be used. A revised Scope of Work was sent to A/E, including the following items: a) Completely rewire the building, and b) Insure that all electric circuits are properly grounded. A/E's brief denied that he was informed of these requirements, but the Board believed the Government witnesses.

The A/E submitted drawings that did not include details of any new wiring, and was asked to revise the drawings to indicate circuit wiring, receptacles, and switches which would bring the building up to Code standards, as well as the addition of grounding wires. A/E claimed that these items were outside the Scope of Work, and after performing the work, requested a Change Order for additional services, which was denied. A/E contended that "rewire" means replacing the existing wires with new wires of identical size and configuration. The Government contended that the Scope of Work included a redesign of the wiring, and that the drawings had to show details of the wires, receptacles, etc.

8.4 Issues.

Was the narrow interpretation of "rewire" proposed by A/E justified?

Did "insuring that all electrical circuits were properly grounded" require a design that included ground wires?

Was parol evidence admissible regarding the Scope of Work for the project?

8.5 Holdings.

The claim for additional compensation was denied; the redesign of the wiring and detailed drawings thereof requested by the Government were part of the A/E's responsibility under the original contract.

The provisions of the Electrical Code incorporated into the contract required A/E to redesign the wiring so that it conformed to the Code.

The A/E was on notice prior to submitting his proposal of the Government's requirements for electrical redesign, both through the provisions of the standard A/E contract and the statements made to him during his site visit.

8.6 Justification and Legal Theory.

The A/E contract imposes broad obligations that a design shall be explicit, providing an equitable basis for bids, and not placing on the contractor responsibility for inaccurate and insufficient information.

A/E does not benefit from the implied warranty of U.S. V. Spearin (248 U.S. 132 [1918]) that if he performs according to the specifications his work will be adquate. That warranty applies to construction contractors who receive complete designs.

Although parol evidence should not be allowed to vary the terms of an agreement, it can be considered in order to interpret terms of an agreement which are ambiguous or uncertain.

8.7 Notes. This is a very good case for the Government because it shows the A/E cannot justify a poor or incomplete design by applying an overly literal interpretation to the precise wording of the Scope of Work.

Case 9. Grace V. State

9.1 Citation. John Grace & Company V. State University Construction Fund V. Marvin A. Mass et al., 472 N.Y.S. 2d 757 (A.D. 3 Dept. 1984).

9.2 Legal/Procedural Context. Contractor sued owner for cost of repairs to heat exchangers installed by contractor that later developed leaks. Trial court found plaintiff was not responsible for leakage, and found third party defendant engineer liable to owner.

9.3 Background. A/E was hired to provide services necessary for the design and construction of a hot water distribution system. The design required three types of heat exchangers, manufactured by Aero or equivalent. At owner's request, A/E

approved of other manufacturers, including Taylor, the actual supplier. Taylor submitted shop drawings which A/E disapproved, and revised drawings which A/E later approved. The units soon developed leaks, which were repaired by plaintiff at owner's request. The failure was found to be the use of incompatible metals for the internal parts, a design defect. While the shop drawings did not reveal the material of the particular components that failed, they did show dissimilar metals were to be used for other components, and A/E communicated with the manufacturer concerning internal components before approving the shop drawings. The A/E made no inquiries about Taylor, which went out of business shortly after this project.

9.4 Issues.

Was there sufficient evidence to support trial court's finding that A/E was negligent?

9.5 Holdings.

By approving a design which led to the introduction of dissimilar metals, A/E deviated from good practice.

A/E had a duty to inquire into the qualifications of a manufacturer before specifying it.

9.6 Justification and Legal Theory.

9.7 Notes. A strong dissenting opinion said it was wrong to conclude that A/E should have anticipated or suspected the manufacturer's use of the dissimilar metals in the components that failed, either in the first instance or after the shop drawings were submitted. The dissent also noted that there was no expert testimony to show the duty to inquire about the qualifications of a manufacturer; even admitting the duty to inquire, it would be necessary to show that the inquiry would have disclosed the manufacturer's incompetence, that the failure to inquire was a proximate cause of the damages, and whether there was contributory negligence on the part of the owner in requesting that particular manufacturer.

Case 10. Appeal of Hazen and Sawyer

10.1 Citation. Appeal of Hazen and Sawyer, P.C.; ASBCA No. 29792; Armed Services Board of Contract Appeals; 85-1 B.C.A. (CCH) P17, 919; February 8, 1985.

10.2 Legal/Procedural Context. A/E appeals from a Government demand for damages resulting from additional construction costs due to an alleged design error by A/E.

10.3 Background. A/E had a design contract for remodeling a sewage treatment plant. Large sedimentation tanks were part of the existing plant, and part of the project was to replace a rake arm assembly that scraped the sediment at the tank's bottom. As-built drawings of the tanks were supplied by the Government, and A/E had two occasions on which it or its surveyors could have measured the tanks. The specifications prepared by A/E gave the wrong slope for the bottom of the tanks by a factor of two, due to an error in calculation, and the rake arm assemblies were fabricated using this incorrect slope, so that they did not fit. A/E had approved shop drawings of the rake arm assemblies that perpetuated the error in its specifications. A/E prepared drawings in which the tanks were shown and some of

their dimensions were written, with a note saying "contractor shall field verify all dimensions." However, the drawings did not indicate the slope, and the dimensions that were indicated on the drawings were correct.

10.4 Issues.

Did the contractor have a duty to measure the slope?

Did the contractor rely on the error in the specifications?

10.5 Holdings.

The contractor did not have a duty to measure the slope, since there were no slope dimensions on the drawings for the contractor to verify.

The A/E could have measured the slope itself on two occasions, and could have verified with the contractor whether he had actually measured it when it approved the shop drawings.

The best evidence that the contractor relied on the faulty specifications is the fact that the rake arms were fabricated based on the slope that was indicated there.

A/E was liable for the damages.

10.6 Justification and Legal Theory.

A contractor cannot be held liable for failing to visit the work site if a site visit would not have revealed the problem that led to the damages.

10.7 Notes. This case was distinguished from Clovis because, in Clovis, the Government participated in the design phase.

Case 11. Hull V. Enger

11.1 Citation. Margaret M. Hull V. Enger Construction Co., 15 Wash. App. 511, 550 P. 2d 692 (Wash App, 1976).

11.2 Legal/Procedural Context. Appeal of a jury verdict for defendants, in a personal injury suit against architect and contractor. The judgment was reversed as to architect, and a new trial ordered, due to prejudicial error in the instructions given to the jury.

11.3 Background. Plaintiff fell when her heel became lodged in the threshold of a new faculty lounge at the school where she worked. The architect had selected a type of threshold which was not flat, but which protrudes above the floor surface to protect the inside floor from rain. Plaintiff produced expert testimony that in heavy traffic areas a safer, flatter (saddle) threshold is preferred, that this type of threshold can be modified to reduce the exposure to rain, and that this type of threshold had been recommended by a hardware consultant. Although there was some evidence that the threshold was wobbly or improperly installed, plaintiff's testimony indicated that this was not the reason her heel became caught. The jury was allowed to consider certain contract documents between the defendants and the school district, over the objection of the plaintiff. Parts of those documents,

which were irrelevant to the case, involved indemnity agreements between the school and the architect which might lead the jury to decide that the school district was legally responsible for the injury. The jury instruction did not clearly indicate that these parts of the documents were irrelevant to the determination of negligence.

11.4 Issues.

Was the instruction to the jury prejudicial error?

Was the evidence given sufficient, as a matter of law, for a finding of liability?

Was expert testimony required in order to show that the architect departed from recognized standards of professional practice?

11.5 Holdings.

The documents admitted as evidence could lead the jury to conclude that the school district was legally liable for plaintiff's injury, thus the failure to instruct the jury properly was prejudicial error.

The evidence was sufficient that a jury could find the architect negligent for failing to select a safer threshold.

The contractor cannot be held liable where there is no evidence presented that faulty installation was responsible for the injury.

Once the availability and feasibility of safer designs for the required purpose were established by expert testimony, the jury was capable of judging whether selection of the more dangerous type constituted professional negligence.

11.6 Justification and Legal Theory.

It is not the province of the jury to pass on the admissibility of evidence.

In ruling on a motion that challenges the sufficiency of evidence, it is proper to interpret the evidence most strongly against the moving party.

Even if expert testimony is ordinarily necessary to show professional negligence, it is not required in cases where laymen are capable of recognizing a departure from professional standards.

11.7 Notes. This case illustrates liability of architect for specifying an unsafe material or product. It is important to show that a safer product was available and feasible for the purpose. Another interesting result is that expert testimony regarding the "professional standard of care" was not required, since the court felt the issues were easy to understand. Note, however that expert testimony was presented regarding the availability and feasibility of the alternative product.

Case 12. Italian V. Community

12.1 Citation. Italian Economic Corporation V. Community Engineers, Inc. et al., 514 NY Supp 2d 630 (NY Sup Ct, 1987).

12.2 Legal/Procedural Context. Plaintiff sued architects, engineers, and others for defects in both structural design and mechanical design. Several of the defendants settled before trial. The jury found that the architects and structural engineer were each 50 percent liable for structural repairs and diminution in value. Defendants appealed regarding the court's rulings on the effect of the earlier settlements, the computation of interest, and the propriety of allowing damages for both structural repair and diminution in value.

12.3 Background. An addition to an office building was found to have structural design that was unusually light and shallow and that failed to provide the wind bracing required by the applicable provisions of the Building Code. A Building Department expediter had advised defendants that with respect to wind bracing, pre-1968 Code could be used. There were also defects in the ventilation system. The mechanical engineer, the Building Department expediter, and the structural engineer all settled before trial through their insurance companies. The jury found architects and structural engineers were negligent, and were liable for the cost of repairs, and for diminution in value due to loss of floor space and windows caused by the repairs. The relative liability of each was 50 percent. Architects appealed, claiming the liability should be the lesser of the cost of repairs and diminution in value. They also claimed the settlements of other defendants should be credited toward their liability. There was also an appeal of the date from which interest would be computed.

12.4 Issues.

Should settlements by the mechanical engineer contribute toward liability of architects?

Should settlements by the Building Department expediter be credited toward the liability of architects?

Was it proper to hold architects liable for both structural repairs and diminution in value?

12.5 Holdings.

Since liability of architects was for damage resulting from structural defects only, it could not be reduced by settlement from mechanical engineer for other defects.

Since settlement of claims against structural engineer and Building Department expediter was a lump sum which amounted to less than 50 percent of damages, architect's liability for the other 50 percent should not be reduced.

It was proper to award damages for both repair and diminution of value, where the diminution resulted from the repair and would not have occurred if the original design had not been defective.

12.6 Justification and Legal Theory.

When an architect engages engineers and approves their defective design, the architect may be liable for negligence.

A plaintiff should be "made whole" by the damage award.

One defendant has the right of contribution from the settlement made by another defendant only when they are liable for the "same injury" so that it would be legally possible that the defendant and the settling party can be held jointly or severally liable for the same damages.

12.7 Notes. This case illustrates that an architect may be liable for negligence in failing to follow the Building Code, even if a representative of the Building Department tells him it is not necessary. It also illustrates that when structural repair leaves the building with diminished value, it is proper for damages to include both.

Case 13. Appeal of Leo A. Daly (LADCO)

13.1 Citation. Appeal of Leo A. Daly Company; Eng BCA No. 4463; Corps of Engineers Board of Contract Appeals; 85-1 B.C.A. (CCH) P17,740; November 23, 1984.

13.2 Legal/Procedural Context. A/E appeals contract officer's assessment of damages for cost of correcting work constructed in accordance with A/E's design.

13.3 Background. A/E was hired to design a military complex in Saudi Arabia, including a vehicle maintenance building, under a contract whose provisions included the standard A/E liability clauses. In the drawings prepared by A/E, inadequate splice lengths and improper locations were shown for metal bars reinforcing the concrete roof beams. However, the specifications prepared by A/E stated that splices should be made in conformance with the American Concrete Institute Building Code requirements for reinforcing concrete, ACI 318. A/E reviewed the shop drawings which perpetuated the error in 8 places. Cracks later appeared in the beams where the reinforcing steel bars had been spliced, and the beams deflected excessively. A/E was notified that this was a design defect, and submitted a redesign, but asserted in a letter that the specifications should take precedence and that it was not negligent, while acknowledging the error in its drawing.

13.4 Issues.

Should the specifications stating that reinforcement should be in conformance with the ACI code take precedence over the drawings?

Was the drawing sufficiently ambiguous so that the construction contractor should have asked for clarification?

Was A/E negligent in preparing the drawing?

13.5 Holdings.

The drawings were seriously in error and not ambiguous.

The ACI Code puts the responsibility on the designer to fully specify the reinforcement of concrete, and clearly states that this is not within the expertise of detailers, and that relying on codes and standards to be applied by detailers is careless, unfair and inefficient.

It was not necessary to present expert testimony to show negligence where A/E's drawings clearly violated the standards of the ACI Building Code.

A/E was negligent in preparing the drawings and approving the shop drawings that perpetuated the error.

The structural problems in the building were the result of the incorrect construction according to A/E drawings.

A/E was liable for the cost of correcting the defect in the building.

13.6 Justification and Legal Theory.

Negligence on the part of the A/E constitutes breach of contract, since the contract undertakes to comply with good professional practice.

The standard A/E contract makes A/E liable for damages proximately caused by its negligence.

It is not necessary to provide expert testimony in order to show negligence where published standards exist.

An A/E producing final designs upon which competitive construction bids may be solicited is not merely creating a conceptual design with details to be filled in by the builder.

13.7 Notes. The decision clearly rested on the original error and did not give much importance to the A/E's examination of the shop drawings.

Case 14. Appeal of Lockwood

14.1 Citation. Appeal of Lockwood, Andrews, and Newman, Inc., ASBCA No. 22956; Armed Services Board of Contract Appeals; 80-1 B.C.A. P14,311; February 21, 1980.

14.2 Legal/Procedural Context. A/E appealed decision of contracting officer withholding payment of fees because of alleged deficiencies in the design of a ventilation and incineration system.

14.3 Background. A/E was hired to design an Aircraft Radome Overhaul Facility that included a Paint Strip room, where aircraft nose cones would be stripped using toluene, which is similar to gasoline. A/E was authorized to hire a consultant to design an incineration system for the toxic and explosive fumes which would be drawn from the room by A/E's ventilation system. Specifications provided by the Government indicated that toluene would be pumped into the room at a very high rate, which would cause an explosive condition in the room after each application. A/E informed the Government of this problem in writing, suggested a possible solution, and offered to pursue the problem further. The Government never

answered the letter, and internal memos showed that a meeting was held where the problem was discussed and a decision was made not to make any changes. During testing of the Paint Spray room a series of explosions occurred causing injuries and extensive property damage. A study commissioned by the Government found that a toluene mixture was used that was even more explosive than pure toluene, and various errors in safety procedures were committed by the personnel conducting the test. The study also stated that the solution proposed by A/E should have been implemented.

14.4 Issues.

Was A/E negligent in the design of the Paint Strip room?

14.5 Holdings.

A/E reasonably and prudently informed the Government that its toluene abatement system could not prevent an explosive condition, and suggested a solution that might eliminate the explosive condition.

The Government, when properly alerted by A/E to a potential weakness in the design and to a method for overcoming the weakness, chose to proceed with the original design.

A/E satisfied its contractual obligation by designing a toluene abatement system within guidelines and limitations imposed by the Government.

A/E exercised due care, and was not negligent.

14.6 Justification and Legal Theory.

When the Government is informed by A/E of a weakness in a design made according to its specifications, and chooses to proceed with the design, it cannot later hold A/E liable for negligent design with respect to that weakness.

Case 15. Mount Carmel V. Fox

15.1 Citation. Society of Mount Carmel V. John J. Fox, Jr., 90 Ill App 3d 537, 413 NE 2d 480 (1980).

15.2 Legal/Procedural Context. Plaintiff, a charitable organization, sued architect for bad design that resulted in leaks around a skylight and plaster and masonry cracks and bulging in walls. Originally a summary judgment was granted to defendant on statute of limitations grounds, and this was successfully appealed by plaintiff. Upon remand, a trial court awarded damages to plaintiff and defendant appealed.

15.3 Background. A high school designed by defendant was completed in 1963. Within the first year, defendant received some complaints about leaks around the skylight. When a new business manager arrived at the school in 1966, he noticed cracks and openings in the interior and exterior walls, leaks around the skylights and breaks in various places in the building. Defendant came out to look at his request and stated that the defects were "maintenance problems." After attempting repairs without success the school in 1969 asked the local Contractor's Association to inspect the building and make a report. The report concluded that a design

defect - failure to include expansion joints to accommodate expansion and contraction of the walls - was the cause of the cracking. In 1970 the school brought suit against the defendant. At the trial, five experts, including structural engineers and roofing specialists, testified that the cause of the structural failure was expansion of brick masonry and the shrinkage of the gypsum deck roof, and that the failures should be corrected by placing expansion joints at several locations in the building. Four of them gave the opinion that the exercise of ordinary care in 1962 would have required the use of expansion joints. Witnesses for the defendant testified that the design was not defective, that expansion joints would serve no useful purpose, that the roof had served most of its useful life, and that the standard of care in 1962 was met.

15.4 Issues.

Was the trial court finding of negligent design against the manifest weight of the evidence?

Did the statute of limitations bar recovery?

Did plaintiff meet its burden of proof regarding the date when the defect was discovered?

15.5 Holdings.

There was credible evidence to justify the trial court's finding of negligence. The statute of limitations did not bar recovery.

While plaintiff knew of the cracks and leaks in the building, it neither knew nor had reason to know that these were caused by design defects until 1969. This was the date of "discovery" for the purposes of the statute of limitations.

An error by the trial court placing the burden of proof of the date of discovery on the defendant was not prejudicial since the burden was clearly met by the plaintiff's evidence.

An error by the trial court in refusing to admit a written estimate of damages into evidence was not prejudicial since the same information had already been presented in oral testimony by the same expert.

15.6 Justification and Legal Theory.

An incorrect ruling on the burden of proof or admissibility of evidence is not grounds for appeal if the error clearly did not affect the result.

The date when a design defect is discovered means the date when plaintiff knew or had reason to know that there was a design defect.

15.7 Notes. This case shows the importance of presenting a number of expert witnesses with very strong credentials. It also illustrates a very important common sense result: expert witnesses for the architect are not very convincing when they praise a design and say it is without defect after the structure has failed to perform as intended.

Case 16. Appeal of Notkin

16.1 Citation. Application Under the Equal Access to Justice Act -- Benjamin S. Notkin & Associates; ASBCA No. 29336; Armed Services Board of Contract Appeals; 86-1 B.C.A. (CCH) P18,535; October 28, 1985.

16.2 Legal/Procedural Context. A/E appeals a decision of contracting officer holding it liable for increased costs of construction resulting from alleged design deficiencies.

16.3 Background. A/E was hired to design an environmental control system for the Puget Sound Naval Shipyard. The specification prepared by A/E provided for rigid galvanized steel to be used for conduits for underground connections into buildings. The drawings did not indicate that there was a flammable liquid storage room in one of the buildings. On August 14, 1979 the Government was notified by the contractor that the electrical subcontractor recommended explosion-proof junction boxes and rigid conduits be used in the flammable liquid storage area, and that these could be provided for an additional cost of $150. On September 21, the construction supervisor (from another engineering firm) indicated that the proposed increase of $150 was reasonable. On October 29, the Goverment requested estimates for this and other possible contract modifications, and the estimate was $2,598.89 instead of $150. The increase was attributed to the fact that a nonexplosion-proof box and nonrigid conduits had already been installed; however, there was evidence to indicate that this did not actually occur. The Government's expert agreed with A/E that the explosion-proof junction box was not required, but said it would be good practice to use one since the difference in cost was minimal. He agreed that the rigid conduit was necessary, and that good engineering practice would require the existence of a flammable liquid area to be indicated on the drawings. In March 1980 the contractor was directed to install the rigid conduit and explosion proof junction box, and the appellant was held liable for an increase in construction cost of $1.759.68 plus 13.7 percent overhead.

16.4 Issues.

Did A/E fail to specify proper materials?

Was A/E negligent in not indicating hazardous area on drawings?

Was A/E negligence the proximate cause of increased construction cost?

16.5 Holdings.

The specifications already called for rigid conduits in hazardous areas and galvanized steel conduits underground, and if nonrigid conduit was installed it was the fault of the contractor.

The Government failed to carry its burden of proof that the contractor complied with the specifications as written.

It was not necessary for the Board to decide if an explosion-proof junction box was required or if A/E was negligent.

Installation, if any, of the nonexplosion-proof materials occurred after the Government had been notified of the problem in a timely manner.

The Government failed to resolve this matter in a reasonable time.

The proximate cause of any additional costs caused by having to replace work already done was the Government's delay.

To the extent that the drawings and specifications were deficient in not revealing the presence of a flammable liquid storage room, the error was a patent one which the contractor should have discovered.

Even assuming the A/E was negligent, the record fails to disclose any damage to the Government which resulted from it.

16.6 Justification and Legal Theory. If the contractor fails to comply with A/E's specifications, the A/E is not liable for additional construction costs to redress the contractor's error.

If the Government delays in resolving issues within a reasonable time after it has been notified in a timely manner, the A/E is not liable for damage that could have been avoided by the Government.

Case 17. Appeal of O'Neal

17.1 Citation. Appeal of O'Neal Engineering, Inc.; ASBCA No. 31804; Armed Services Board of Contract Appeals; 86-2 B.C.A. (CCH) P18,906; March 31, 1986.

17.2 Legal/Procedural Context. A/E appealed when $8900 was withheld for damages due to A/E's alleged negligent performance.

17.3 Background. A/E prepared a design for replacing electrical feeders at a Marine Air Corps Station. The Scope of Work required that the size of the cables be increased from 2/0 to 4/0 phrases and from # 2 to 1/0 ground. In preparing the plans and specifications, A/E failed to consider the fact that some of the existing power ducts were 3 inches in diameter, and that the cabling would not fit into the existing conduits. The Government had provided drawings on which the size of the conduits was clearly indicated. A/E claimed that it could not discover the true size of the conduits during a site visit because the manholes providing access to the conduits contained water, the power had not been shut off, and the conduits were sprayed with fireproofing material that made it very difficult to inspect them. On August 20, the contractor advised the Government that there was a problem installing the new cable. On August 27, the Government notified A/E and was advised to install 1/0 cable in those conduits which were too small for 4/0 cable. On September 4, the Government asked the contractor to prepare a change order proposal: appellant was requested to evaluate the proposal a month later. On October 15, the Government notified the contractor to proceed with installation of 1/0 cable, but the contractor, who had demobilized its crew, did not resume work until December. Damages claimed by the Government included demobilization and mobilization cost, freight charges for returning cable, restocking charge, labor lost due to change, labor involved in transporting cable, and extra housing and superintendent's salary. A/E denied all liability, and also advised the Government that the demobilization and mobilization costs could have been avoided, that too many labor hours at an excessive rate were claimed for transporting cable, and that there was excessive supervision and lodging expense.

17.4 Issues.

Was A/E negligent?

Did the contractually defined Scope of Work specifying 4/0 cable implicitly warrant that the existing conduits would accommodate it?

Was the Government negligent in approving the plans and therefore estopped from assessing damages?

Was the Government unduly slow in implementing corrective action?

17.5 Holdings.

A/E had a duty to determine the size of the conduits.

A reasonably diligent examination of the drawings furnished by the Government would have indicated that some ducts were 3 inches in diameter. In failing to adequately review the drawings, A/E was negligent.

A/E knew that the design cable size was increased from 2/0 to 4/0, and had no right to assume, nor did the Government warrant, that the existing conduits would accommodate the larger cables.

According to the terms of the A/E contract, the Government waived no claims when it approved the plans and specifications.

A/E is liable to the Government for damages proximately caused by its negligence in failing to address the conduit size problem.

The Government has the burden of showing that the amounts it withheld were the result of A/E negligence and not of the Government's conduct in dealing with the contractor.

17.6 Justification and Legal Theory.

A/E has no right to assume that an existing structure can accommodate the changes specified in the Scope of Work. The A/E's services are engaged precisely to identify problems of this sort.

Case 18. Appeal of Parsons

18.1 Citation. Appeal of Ralph M. Parsons Company; ASBCA No. 24347; Armed Services Board of Contract Appeals; 85-1 B.C.A. (CCH) P17,787; November 28, 1984.

18.2 Legal/Procedural Context. A/E appealed decision of contracting officer demanding payment of damages representing the cost of repairing a saltwater intake system whose pipe broke, and a building whose roof deflected due to insufficient support beams.

18.3 Background. A/E was hired to design an Ammunition Pier and facilities for the Navy. This included a saltwater intake system for fire prevention and a helo test

line building with a concrete roof. The project was under a Contractor Quality Control program which placed responsibilities on the contractor to make sure the materials and work conformed to the specifications and to provide large amounts of documentation of its quality control checks.

The saltwater intake system included a long plastic pipe connected to an intake structure on the ocean floor at one end and to a pump house on the other end. The pipe was to pass through a sheet pile headwall. A/E's design specified that the pipe was to conform to ASTM D2996 and that shop drawings should be submitted to and approved by the Contractor Quality Control Representative and submitted to the contracting officer for record. It was normal practice to leave the details of the pipe's design to the subcontractor that would supply it. A/E's suggestion that the pipe be UL approved was rejected by the Government. When A/E saw the shop drawings for the pipe it notified the Government that they contained errors and omissions. Requests to the manufacturer for more information were never satisfactorily answered. Later the pipe broke in several places. Tests performed after the failure showed the pipe was not thick enough to bear the loads required by the design. In addition, there was evidence presented that the pipe was not laid properly.

A further problem involved the passage of the pipe through the headwall. A/E's design showed a hold in the headwall 12 inches wider than the diameter of the pipe, and the pipe having a 6 inch concrete collar. The construction contractor assumed the concrete collar was to completely fill the hole, providing a rigid rather than a flexible attachment. One of the Government's charges against A/E was the failure to provide a flexible joint where the pipe met the headwall.

In an unrelated part of the design, a concrete roof was installed on a helo test line building. The drawings called for one type of joist to be used to support the roof, and the specifications called for a different (weaker) type. The contractor followed the specifications, and did not submit shop drawings as the contract required, nor did he consult A/E regarding the discrepancy as the contract required. The contractor and Government inspector, suspecting that the joists were too weak, tried bracing them with 4 by 4 supports, and then poured the concrete roof. Later there was bowing of the 4 by 4 supports and excessive roof deflection, necessitating removing the roof and supports, repairing some damaged steel studs, and re-roofing the structure.

18.4 Issues.

Was A/E's helo test line building roof design defective?

Was A/E negligent in design of the helo test line building roof?

Was A/E's negligence, if any, a proximate cause of the roof's deflection?

Was A/E's design of the saltwater intake system defective?

Was A/E negligent in design of the saltwater intake system?

Was A/E's negligence, if any, a proximate cause of the failure of the saltwater intake pipe?

18.5 Holdings.

A/E modified the roof slope at the Government's request without objection, but did not adjust the strength of the supporting joists as it should have done. A/E was negligent in that it failed to recompute the required joist strength when it approved the change in the roof slope.

If A/E had been asked to resolve a discrepancy between the drawings and the specification with respect to the supporting joists, it might or might not have rectified its earlier failure to adjust for the new roof slope.

A/E was responsible for the cost of installing an adequate roof.

A/E was not responsible for the cost of removing the defective roof and repair of some damaged steel studs, since the need to do this was proximately caused by the Government and the construction contractor's actions.

Even though A/E's design of the saltwater intake system may have been defective, the question of negligence need not be reached since the construction varied substantially from A/E's specifications.

A/E was not liable for the failure of the saltwater intake pipe since neither the pipe itself nor its method of installation conformed to A/E's specifications.

18.6 Justification and Legal Theory.

In assessing the damages for negligence, it is necessary to consider whether the actions of others contributed to the damages. It is proper to consider the duty of care of all involved and the facts of causation relative to conduct of all the actors regarding the design and installation of the roof.

Where alleged negligence of the A/E consists of furnishing defective plans and specifications, it is essential to prove that the builder essentially complied with such plans and specifications and that, in consequence of such compliance, damages were sustained by plaintiff.

The suggestion that A/E warranted its plans and specifications to be defect free is not well taken. The common law states: in the absence of a special agreement, an architect does not guarantee a perfect plan or satisfactory result. He is only liable for a failure to exercise reasonable care and skill.

18.7 Notes. Note that in the case of the roof, a heavier grade of concrete was used than the specifications called for, but the A/E was still liable. So, even though construction varied from A/E's design, A/E was liable. The board justifies this by stating that even if the correct grade of concrete had been used the supports would not have been adequate.

Case 19. Pankow V. Holman

19.1 Citation. Charles Pankow, Inc. V. Holman Properties, Inc. et al., 13 Wash App 537, 536 P 2d 28 (Wash App, 1975).

19.2 Legal/Procedural Context. Contractor sued owner for unpaid balance of contract, and owner countersued for defective work. After trial without jury, judgment was entered for owner. Contractor appealed and owner cross-appealed from the court's failure to award it all of the items of damage it claimed.

19.3 Background. Contractor was hired to design and build a 6-story office building. After the building was largely completed, a dispute arose about whether the work was done properly. The contractor had used glass 1/4 inch thick in the windows of a storefront, instead of 5/16 inch thick as called for in the city Building Code. 15-foot wide concrete stairways on two sides of the building gradually settled or sank into the ground, causing water mains under the stairs to break. In addition, the stair risers were higher than permitted by the Code. There was also water in the basement. As a result of the dispute, contractor left the site and the work was not formally accepted. Contractor sued for unpaid balance of $35,000, and owner countersued for damages of $50,000. At a trial without jury, evidence was presented that the city building department at one time shut down the glass installation work because it was not done in compliance with the Code. Following a confrontation between the contractor's engineer and the head of the city Building Department, the plan with 1/4 inch glass was approved. Because this glass was too thin, under certain wind conditions the glass could, and on a few occasions did, explode into fragments. The trial court found that the settling of the concrete stairs was due to design and construction errors. The court found that any defects in the basement resulted from errors or omissions in a soils report obtained by the owner and presented to the contractor and architect, and denied recovery for the cost of a system to keep the basement dry.

19.4 Issues.

Does the city Building Department or the Building Director have the authority to approve the use of glass in direct contravention to the code?

Was the trial court's decision improper as a collateral attack on an administrative determination?

Was the evidence presented sufficient to support the findings?

19.5 Holdings.

The Building Director does not have discretion in approving plans that violate the Building Code.

Even if the Building Department approval of plans was an administrative determination as claimed by appellant, it does not bind the owner who was not a party to it.

The conclusions of the trial court were supported by substantial evidence.

19.6 Justification and Legal Theory.

The Building Code states: "The issuance or granting of a permit . . . shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of the Code."

An administrative determination does not bind one who was not a party to the proceeding.

19.7 Notes. It is a general rule of law that the determination of an administrative body acting with jurisdiction and under authority of law is not subject to collateral attack in the absence of fraud or bad faith. 2 Am Jur 2d Administrative Law Sec. 493 (1962), 73 C.J.S. Public Administrative Bodies & Procedures Sec. 146 (1951). The contractor was attempting to use this rule to show that the decision of the Building Department could not be challenged, but the court rejected this argument.

Although this case involved a construction contractor, it illustrates points that are equally relevant to the A/E. If the owner provides information that is false or misleading (such as the soils report), the A/E who acts on that information may not be liable. If the A/E is obligated to follow the Building Code, improper exercise of discretion by a Building Department representative does not relieve him of the obligation. Since the contract stated that the work would conform with the Code, it was treated as an promise of specific performance and the question of negligence did not arise.

Case 20. Seiler V. Levitz

20.1 Citation. Seymour Seiler V. Levitz Furniture Company et al., 367 A.2d 999 (Del.Supr. 1976).

20.2 Legal/Procedural Context. Tenant brought action against owner of building and architect/engineer for damages from defective design and costs of repair. After a trial without a jury, the Superior Court entered judgment in favor of tenant and defendants appealed.

20.3 Background. This case involves a two-level furniture store in a shopping mall. The store was constructed pursuant to a lease agreement between the mall owner and the tenant. During construction it became apparent that there were a number of problems, including seepage into the basement and a tilt in one wall of the basement towards a nearby creek. The tenant engaged a structural engineering firm, which concluded that the building was unsuited to its function as a furniture store and warehouse, at which time the tenant sought and received a guarantee from the owner to protect him from loss resulting from structural defects. Later there were two floods and furniture stored in the building was damaged. The trial court found A/E liable for flood damage and for certain nonflood related claims also. The air-conditioning system was inadequate to cool the building in accordance with the specifications, and the A/E was liable for certain electrical repairs because he had mistakenly certified that the electrical work was completed according to his design.

20.4 Issues.

Was A/E liable to a tenant with whom he did not contract?

Did A/E breach the standard of professional care?

Was expert testimony necessary to establish that the standard was breached?

20.5 Holdings.

The claim against A/E was tried on a negligence basis, not a contract basis. In any event, A/E is accountable to the tenant under third-party beneficiary principles. Evidence that a county official advised A/E about flooding in the area supported the conclusion that A/E knew or should have known of the flooding potential of the area. The trial court was justified in concluding that A/E's mistake was so apparent that expert testimony was not required to show that he breached the standard of professional care.

20.6 Justification and Legal Theory. If a layman is as competent as an expert to judge whether a particular design created an unusual risk, evidence by experts is irrelevant.

20.7 Notes. This case states that negligence, if any, on the part of Government officials who give advice or approve plans would not wipe out A/E's obligation as a professional to determine the correct data for himself and bear responsibility for his determinations. Compare with City V. Clark-Dietz.

Case 21. State V. Wilco

21.1 Citation. State of Louisiana et al. V. Wilco Construction Co., Inc. et al., 393 So.2d 885 (La.App. 1981).

21.2 Legal/Procedural Context. State sued architects and contractor for damages due to faulty design and construction. Based on a hearing before a commissioner, a trial court awarded the State various damages against both parties. Architects appealed, contending that they should be liable for only the cost of repairing the defective walls and not demolishing and replacing them as awarded by the trial court.

21.3 Background. Architects designed a vocational technical school for the State. Later the building was discovered to be structurally unsound and had to be vacated. Architects conceded in the appeal that the walls were defectively designed, in that narrow piers of concrete block between the windows were subject to vertical stress far in excess of the allowable limits of the Building Code. It was also undisputed on appeal that the walls did not meet code requirements as to horizontal forces or "wind load." At the trial, two experts presented remedial solutions to the design problem of the walls. However, both stated that their proposals were only "general ideas" whose details would need to be worked out. One of the experts refused to state that his proposal would comply with the Building Code. The State presented experts who rejected both proposed repair solutions as not conforming to the Building Code. These witnesses said that salvaging the walls would be exceedingly difficult and would in effect be a redesign of the building.

21.4 Issues.

Did the evidence presented support the court's decision that the correct measure of damages would be the cost of demolishing and completely rebuilding the walls?

21.5 Holdings.

Repair of the walls, even if theoretically possible, was not practical in this case.

The decision of the trial court was justified.

21.6 Justification and Legal Theory.

In a battle of experts, the trial court is free to rely on the testimony it finds most convincing, and no error can be assigned.

Although the measure of damages is generally held to be the cost of repair, when a defect in design is of such magnitude as to defy a reasonably workable remedy, the decision to replace the defective structure is proper.

21.7 Notes. Other issues decided in this opinion were not relevant to A/E liability.

Case 22. State V. Wolfenbarger

22.1 Citation. State of Kansas V. Wolfenbarger and McCulley, P.A. et al., 690 P.2d 380,236 Kan 183 (1984).

22.2 Legal/Procedural Context. State sued architect and consulting engineers for negligence and breach of contract, asking reimbursement for cost of repairs to correct design defect and cost of expert consultant to determine the cause of the problem. Architect appeals from jury decision in favor of plaintiff.

22.3 Background. Architect was hired to design a clinical science and pathology building for a school of Veterinary Medicine, which required large volumes of circulating fresh air. Consulting engineers hired by architect designed a system of large metal louvers (vents) which were built into the walls of the top floor of the building. The design called for the louvers to have 40 percent free air space, but all but one were installed with only 20 percent free air space. The next winter a large quantity of snow was ingested into the building through the louvers, forming drifts a foot deep above the offices and classrooms and damaging the ceilings. After hiring a consulting engineer to determine the problem, the State eventually moved the vents onto the roof, into large snow chambers.

22.4 Issues.

Did louver construction that varied from architect's design relieve him of responsibility?

Was it error to allow the jury to assess damages for loss of esthetic value when there was no evidence presented to show how much the loss should be?

22.5 Holdings.

The variation from architect's design was shown by expert testimony and by concrete evidence to be irrelevant to the problem.

The jury's award of damages was supported by the evidence.

It was error (although harmless) to allow the jury to assess damages for loss of esthetic value when no evidence was presented to show how much the loss should be.

22.6 Justification and Legal Theory.

If an architect's design is defective, and that defect is the proximate cause of damage to the owner, the fact that construction deviated from the design will not relieve the architect of liability where the deviation was irrelevant to the damage.

The fact that it is difficult to determine the monetary value of an esthetic change to a public building does not relieve the plaintiff of the responsibility of presenting evidence to support its claim.

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