United States General Accounting Office

GAO

Report to the Honorable
William Proxmire, U.S. Senate

October 1988

ARMY CONSTRUCTION

Some Vehicle Wash Facility Designs Can Be Modified to Save Money

RELEASED

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Executive Summary

Purpose

Since 1979, the Army has constructed centralized vehicle wash facilities at a number of installations to clean the exterior of tactical vehicles and treat the polluted waste water that results. These facilities ranged in cost from about $2 million to more than $9 million. By the end of calendar year 1987, 12 wash facilities had been completed at a cost of about $44 million. Twenty-two more facilities and two major modification projects were under construction or planned at an estimated cost of $133 million.

Because of allegations that the Army had overdesigned some facilities, Senator William Proxmire asked GAO to evaluate the Army's process for developing and approving centralized vehicle wash facilities. GAO focused its work on determining whether the Army had provided the guidance necessary to help planners design facilities that meet the needs of Army installations at the lowest possible cost.

Background

During normal operations trucks and tracked vehicles can pick up large amounts of soil. At most installations, soldiers wash the vehicles at a number of wash racks located throughout the motor-pool areas. Because soldiers often conduct other activities at the wash racks, such as changing engine oil and cleaning engine compartments, large volumes of polluted waste water are frequently produced. To solve this pollution problem, the U.S. Army Corps of Engineers developed a standard centralized vehicle wash facility to be located outside the motor-pool area. This facility enables soldiers to wash large numbers of vehicles rapidly and includes water treatment and recycling systems. The standard wash facility configuration, adopted in 1982, is made up of various features, some of which are optional and are not needed at all installations.

Results in Brief

Incorporating unneeded standard design features in wash facilities can significantly increase their cost. While design guidance indicates that all standard features may not be needed at every installation, the Corps of Engineers has provided little guidance to assist planners in deciding which features to choose. Elimination of unnecessary features can result in substantial savings: for example, over three-quarters of a million dollars was saved at one installation by eliminating a prewash bath. Definitive guidance appears feasible and could assist planners in adapting the standard wash facility design to meet the unique needs of installations and, at the same time save construction and operating costs.

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-231227

October 27, 1988

The Honorable William Proxmire
United States Senate

Dear Senator Proxmire:

This report responds to your June 15, 1987, letter concerning allegations that the U.S. Army Corps of Engineers had overdesigned the vehicle wash facilities constructed at various Army installations. During discussions with your office, we agreed to focus our work on determining whether the Army had provided the guidance necessary to help planners design facilities that meet installations' needs at the lowest possible cost.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report for 30 days. At that time we will send copies to the Secretaries of Defense and the Army; the Director, Office of Management and Budget; and other interested parties. Copies will also be made available to others upon request.

Sincerely yours,

Frank C Conahan

Frank C. Conahan
Assistant Comptroller General

Contents

Abbreviations

CERL	Construction Engineering Research Laboratory
CVWF	Centralized Vehicle Wash Facility
GAO	General Accounting Office
OVEST	Office of Chief of Engineers Value Engineering Study Team

Principal Findings

Value engineering studies have demonstrated that modified designs that are less costly than the standard design are sometimes feasible. For example, study teams estimated that modifications recommended to facilities planned at three Army installations will save almost $5 million.

The Corps is developing a new technical manual to guide the design of vehicle wash facilities; however, like current guidance, it does not clearly specify the conditions under which optional features should be included in a project. For example, while the manual describes different types of water treatment systems that might be used, it offers little definitive guidance for determining which type of system would best meet the needs of an installation.

According to engineers both in and out of the Army, it is feasible to develop definitive guidance to assist designers in identifying what features should be included in wash facilities at specific installations. Most engineers GAO interviewed said that guidance could be based on objective criteria such as soil and weather conditions, numbers and types of vehicles supported, and the mission of units. For example, engineers said that tests measuring the adhesive characteristics of soil not only can indicate whether a prewash bath is needed to loosen soil but also can guide in the design of the water treatment system. Generally, soils with a high clay content will not only be more adhesive but also will remain suspended in the wash water for a longer time, therefore requiring either larger detention lagoons or installation of sand filters for removal of small soil particles.

Recommendation

GAO recommends that the Secretary of the Army direct the Chief of Engineers, in developing the Corps' new technical manual, to incorporate definitive guidance, based on objective criteria, that facilitates the design of centralized vehicle wash facilities that meet the needs of military installations at the lowest possible cost.

Agency Comments

As requested, GAO did not obtain formal agency comments on a draft of its report; however, GAO discussed the report with responsible agency officials and included their comments where appropriate.

Introduction

To prevent premature wear and facilitate required maintenance, the Army's practice is to periodically wash tactical vehicles such as trucks and tracked vehicles. During normal operations, these vehicles can pick up large amounts of soil. On large tracked vehicles, such as main battle tanks, as much as 1,000 pounds of soil can accumulate.

At most installations, soldiers wash the vehicles at a number of wash racks located throughout the motor-pool areas. Because soldiers conduct other activities at the wash racks, such as changing engine oil and cleaning engine compartments, large volumes of highly polluted waste water are frequently produced. This waste water can pollute the environment or overload installations' sewage treatment systems.

Centralized Wash Facility Features

In mid-1975, the U.S. Army Corps of Engineers' Construction Engineering Research Laboratory (CERL) began research to find solutions to water pollution problems resulting from vehicle wash facilities. Research indicated that separating the exterior wash and maintenance functions and centralizing the wash function at one or two vehicle wash facilities per installation could reduce the cost of controlling water pollution. The centralized facilities would produce less-polluted waste water and therefore require fewer and simpler water treatment systems. Researchers also believed that consolidated wash facilities would conserve water and manpower.

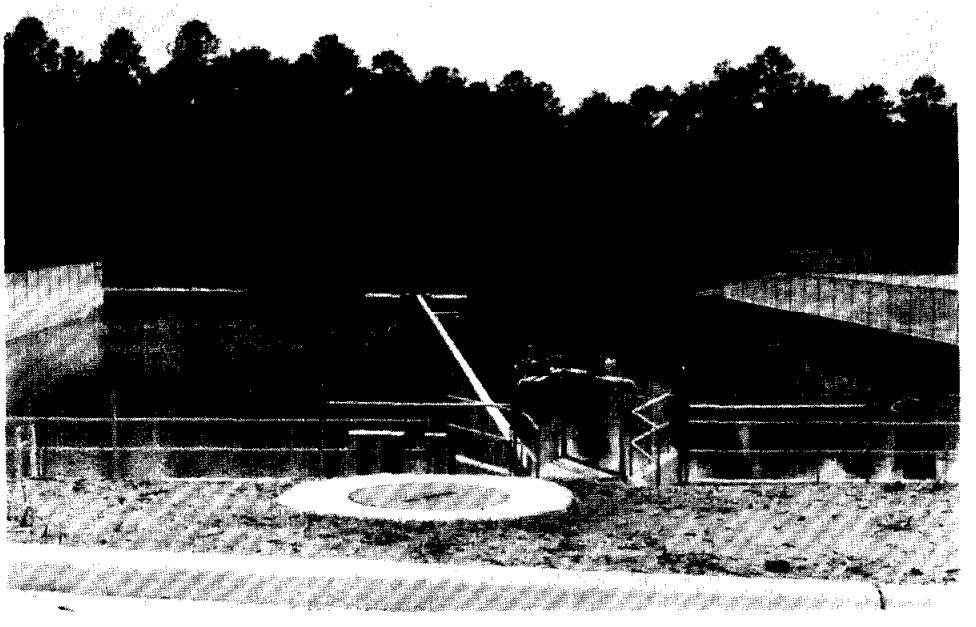
Between 1979 and 1981, the Army built seven centralized vehicle wash facilities (CVWF). According to an Army official, five of these facilities—two at Fort Lewis, Washington; one at Yakima Firing Range, Washington; and two at Fort Polk, Louisiana—generally performed satisfactorily. However, the official told us that neither the wash facilities nor the water treatment systems constructed at Fort Carson, Colorado, and Fort Riley, Kansas, were designed properly or functioned adequately. As a result, the Army is replacing the Fort Carson facility and has extensively modified the Fort Riley facility.

In 1982, based on the experience gained from construction of these seven facilities, CERL developed a standard CVWF configuration that incorporated what it considered to be the best features of the Fort Lewis and Fort Polk facilities. The standard CVWF includes a prewash bath, wash stations, and a water treatment system.

In the prewash bath, vehicles are sprayed with high-pressure water from water cannons as they are driven into the bath in which they

Figure 1.2: Wash Station With Hose Towers

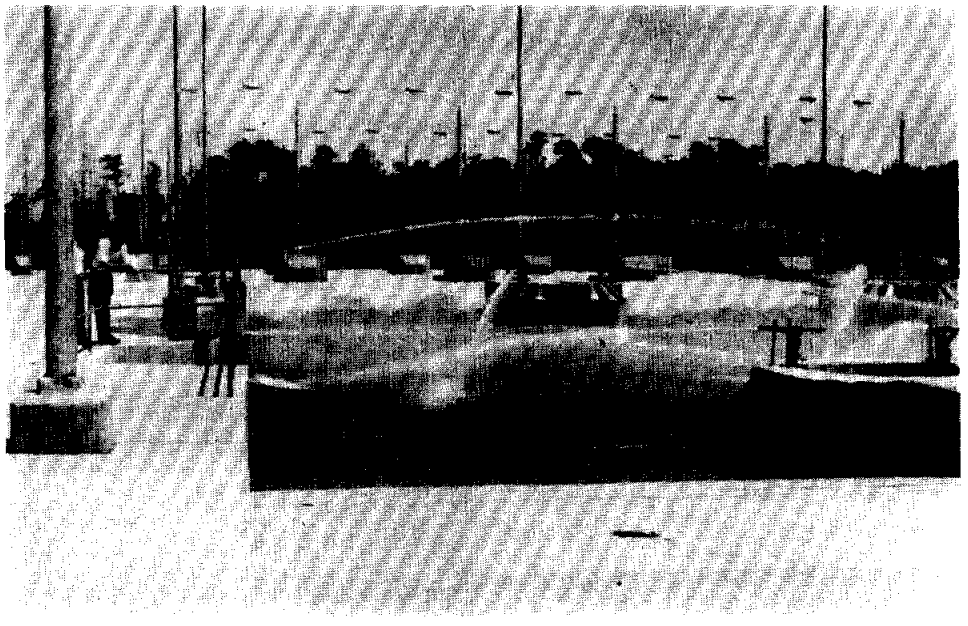
Figure 1.3: Double Chamber Sedimentation Basin (Primary Treatment) - For Removing Suspended Solids and Oil



or planned at an estimated cost of $133 million. The cost of completed facilities ranged from $1.8 million at Fort Irwin, California, to $9.3 million for the Fort Carson facility.

become partially submerged. The bottom of the bath contains a series of large ridges, or flexors, that flex the vehicle's track and suspension system and create turbulence in the water to further aid in the cleaning process. The wash stations consist of water hoses suspended from towers that allow vehicle crews to wash off any soil remaining after the vehicle exits the prewash bath. A typical prewash bath and wash station are illustrated in figures 1.1 and 1.2.

Figure 1.1: Prewash Bath With Water Cannon



The water treatment systems provide for primary treatment to remove polluting materials from the waste water and secondary treatment if the water is to be recycled to the wash facility. Primary treatment is accomplished through the use of sedimentation basins with oil skimmers. Secondary treatment involves further processing of the water through sand filters or detention lagoons (holding ponds). Sand filters screen out small particles of soil from the water, whereas lagoons hold the water for an extended period of time, allowing the particles to settle to the bottom by gravity. The major components of a typical wash water treatment system are illustrated in figures 1.3 and 1.4.

By the end of calendar year 1987, the Army had constructed 12 CVWFs in the continental United States at a cost of $44 million. Twenty-two more facilities and two major modification projects were under construction

Engineers established the Office of Chief of Engineers Value Engineering Study Team (OVEST) to perform value engineering studies of selected projects.

Objective, Scope, and Methodology

Because of allegations that the Army may have overdesigned some CVWFs and incurred unnecessary costs, Senator William Proxmire asked that we examine the Army's process for developing and approving CVWF projects. In conducting our work, we focused on determining whether the Army had provided the guidance necessary to help planners design facilities to meet the needs of Army installations at the lowest possible cost.

We interviewed officials at Corps of Engineers Headquarters, Washington, D.C.; U.S. Army Forces Command Headquarters, Fort McPherson, Georgia; and selected field locations, including CERL, Champaign, Illinois; and OVEST, Savannah, Georgia. We examined existing CVWF design guidance developed by CERL and discussed proposed revisions with CERL officials. We also interviewed engineers in the Corps of Engineers, U.S. Army Forces Command, and two private sector architect and engineering firms involved in the design of CVWFs to obtain their opinions on the adequacy of current design guidance and the feasibility of developing more definitive guidance.

We visited three Corps of Engineers district offices—Fort Worth, Texas; Savannah, Georgia; and Louisville, Kentucky. There, we examined documentation related to the planning and review and approval process for CVWFs. We also observed the CVWF at Fort Hood, Texas, and talked to personnel about its operation. We toured the facilities being constructed at Fort Hood and Fort Stewart, Georgia, and talked to installation engineers about the planning of these facilities.

At OVEST, we reviewed and discussed the four value engineering studies it performed for facilities being planned or constructed at Fort Carson; Fort Stewart; Fort McCoy, Wisconsin; and Fort Indiantown Gap, Pennsylvania.

We conducted our review from August 1987 through April 1988 in accordance with generally accepted government auditing standards. The views of responsible agency officials were sought during the course of our work and are incorporated where appropriate. As requested, we did not obtain formal agency comments.

Figure 1.4: Sand Filter (Secondary Treatment) -Showing Water Distribution Pipes

Responsibility for Facility Design

Design of CVWFs is the responsibility of the Corps of Engineers' district offices. The working plans for each facility are developed by the district office responsible for the geographic area in which the facility is to be built.

Until 1987, CERL was responsible for developing CVWF design standards and for reviewing and approving all plans. In October 1987, the Corps' Chief of Engineers transferred responsibility for review and approval of plans to the Louisville and Sacramento district offices, with CERL retaining responsibility for research. The Louisville district office is also responsible for development of design standards and Sacramento for completion of a new technical manual.

Most CVWF plans should be subjected to value engineering studies. According to 1984 guidance by the Deputy Assistant Secretary of Defense for Installations, all construction projects costing more than $2 million are required to have a value engineering study. A value engineering study is done to identify alternative methods of meeting the user's needs through improved design at lower cost. According to the Chief of Engineers, a value engineering study should be conducted when the design phase of a project is 35 percent complete. Each Corps of Engineers district has a value engineering officer. Also, in 1985, the Chief of

standard CVWF configuration. Based on information available for 19 of the 30 CVWFs constructed or planned in the continental United States since the Corps adopted a standard configuration in 1982, 16 have included prewash baths and 15 have included standard sand filter-type water treatment systems, instead of lagoon systems.

The impact of insufficiently defined guidance for designing CVWFs can be illustrated at Fort Hood. There, two facilities have been designed, each with a different water treatment system. During the design of the first facility constructed, the engineers at both the design district and the installation expressed a preference for a lagoon-type water treatment system, stating that such a system would not only cost less but also require less maintenance than a sand filter system. However, CERL did not approve this deviation; instead, it required the use of sand filters. These filters cover about 3.3 acres and cost about $2.4 million.

When designing Fort Hood's second CVWF, installation engineers again expressed a preference for the lagoon-type water treatment system. An installation engineer told us that in his opinion, the sand filters represent a potential maintenance problem. He said that as fine particles of soil from the vehicles collect in the sand, the surface must be scraped to allow the continued filtration of water through the sand. He said that eventually the filter will become completely blocked and the sand will have to be replaced. This presents a particularly costly problem at Fort Hood as locally available sand will not meet the CERL specifications for use in sand filters without special processing. After the design district completed a cost analysis which showed that a lagoon system was less costly, the Chief of Engineers approved construction of a lagoon system.

Value Engineering Studies Show Potential for Savings

Value engineering studies have demonstrated that modified CVWF configurations which are less costly than the standard configuration are sometimes feasible. Value engineering teams, headed by OVEST and made up of representatives from various Army commands and commercial architect and engineering firms, identified potential savings of over $1 million for each of the following facilities: Fort Stewart, Fort Indiantown Gap, and Fort McCoy. Table 2.1 shows the estimated savings for each facility.

Need for More Definitive Design Guidance for Vehicle Wash Facilities

Although all features of the standard CVWF configuration may not be needed at every installation, the Corps of Engineers has provided little guidance to assist planners in deciding what features to choose. Eliminating unnecessary features can result in substantial savings; for example, over three-quarters of a million dollars was saved by eliminating the prewash bath at one installation. Generally, engineering judgment rather than objective criteria has been the basis for decisions on whether costly design features, such as prewash baths and sand filters, were included in a facility. Professional engineers we interviewed said that development of definitive design guidance based on objective criteria, such as soil and weather conditions, is feasible.

Existing Design Guidance Is Insufficiently Defined

Design guidance for CVWFs states that certain major design features are optional. However, there is little definitive guidance to assist planners in determining what design features are needed at given installations and, as indicated by the results of value engineering studies, the CVWFs proposed for some installations have included unnecessary design features.

Currently, design guidance is contained in a series of draft technical letters the Corps developed during the early 1980s. Although the guidance indicates that CVWFs should include only those features required to meet each installation's needs and identifies certain design features as optional, the conditions under which options should be included in a project are not defined clearly. For example, prewash baths are identified as optional; however, guidance about the circumstances under which they should be included in a facility is generally subjective. While prewash baths are recommended at installations with heavy soiling conditions, high demands for washing, and limited washing time, no guidance is given for identifying heavy soiling conditions or determining the most economical means of achieving the desired rate of washing vehicles (prewash bath versus additional hose towers).

The Corps is developing a new draft technical manual that it recently submitted to field locations for comment. However, like the draft technical letters, it does not clearly specify conditions under which options should be included in a project. For example, while the draft manual describes different types of water treatment systems that might be used, it offers little definitive guidance for determining which type of system would best meet the needs of an installation.

According to the engineers interviewed, the problems encountered with the facilities constructed at Forts Carson and Riley led to adoption of a

with a high clay content will not only be more adhesive but also will remain suspended in the wash water for a longer time and require larger detention lagoons or installation of sand filters for removal of small soil particles. In addition, adhesive soil conditions are aggravated by a wet climate that causes the vehicles to collect more soil. In contrast, sandy soil does not readily adhere to the vehicles and what does adhere is easier to remove. Sandy soil also settles out of the wash water more quickly, thereby reducing the size of detention lagoons required to treat the water.

Engineers also told us that a prewash bath may not be needed at installations that primarily support wheeled vehicles. They said that a bath is most beneficial for washing tracked vehicles because they tend to collect more soil and are generally more difficult to clean. The types of vehicles supported were reflected in the design of the two CVWFs at Fort Campbell, Kentucky. At first, the installation proposed to build both wash facilities with prewash baths. However, because Fort Campbell has relatively few tracked vehicles, the bath was omitted from one of the facilities.

Another factor that can affect the design and size of a wash facility is the type of units that an installation supports. For example, engineers told us that installations supporting active component units with short deployment response times or reserve component units with limited availability for training may require a higher throughput rate, and therefore a prewash bath, in order to reduce washing times.

Conclusions

Incorporating unneeded standard design features in CVWFs can significantly increase their cost. While design guidance indicates that all standard design features may not be needed at every installation, the Corps has provided little definitive guidance to assist planners in deciding what features should be incorporated at specific installations. Definitive guidance appears feasible and could assist planners in developing initial designs to adapt the standard CVWF configuration to meet the needs of installations and, at the same time, save construction and operating costs.

Recommendation

We recommend that the Secretary of the Army direct the Chief of Engineers, in developing the Corps' new technical manual, to incorporate definitive guidance, based on objective criteria, that facilitates the

Table 2.1: Estimated Savings From Value Engineering Studies

Dollars in millions

	Original estimated cost	Estimated savings
Fort Stewart	$7.7	$1.7
Fort McCoy	6.0	1.7
Fort Indiantown Gap	5.3	1.3
Total	**$19.0**	**$4.7**

A portion of the estimated savings at Fort McCoy resulted from eliminating the prewash bath. The study team recommended eliminating the bath because of soil and weather conditions at Fort McCoy. First, the soil is sandy and, according to the study, this generally reduces the amount of soil that adheres to a vehicle and makes the vehicle easier to clean. Second, the study report pointed out that it would not be feasible to use the wash facility during the cold winter months. The alternative design recommended installation of additional hose towers in the final wash area so that the vehicle wash rate would remain the same as with the prewash bath. This recommendation was adopted with estimated savings of $780,000.

At Forts Stewart and Indiantown Gap, a portion of the estimated savings resulted from the study team's recommendation to use unfiltered water to fill the prewash baths and to flush sedimentation from the drain trenches. This modification was possible because the use of filtered water for these purposes was determined to be unnecessary. Adoption of the design change saved an estimated $733,000 at Fort Indiantown Gap as the result of a reduction in the size of sand filters and other components of the water recycling system. Information on savings achieved by the design change at Fort Stewart was not available.

Development of More Definitive Design Guidance Appears Feasible

According to engineers, both in and out of the Army, it is feasible to develop definitive guidance to assist designers in identifying necessary features of CVWFs at specific installations. Most engineers we interviewed said that definitive guidance could be developed based on objective criteria such as soil and weather conditions, numbers and types of vehicles supported, and the mission of the units. For example, engineers told us that tests measuring the adhesive characteristic of soil not only can indicate whether a prewash bath is needed to loosen soil but also can guide in the design of the water treatment system. Generally, soils

design of CVWFs that meet the needs of military installations at the lowest possible cost. The criteria should (1) cover peculiarities such as soil and weather conditions and numbers and types of vehicles supported by an installation and, (2) reflect lessons learned from value engineering studies done on earlier projects.

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