UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROCUREMENT, LOGISTICS,
AND READINESS DIVISION

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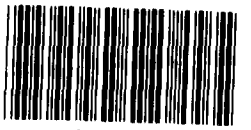

The Honorable Lawrence J. Korb
Assistant Secretary of Defense
Manpower, Reserve Affairs, and
Logistics

Dear Mr. Korb:

Subject: Military Family Housing--Need for DOD Improvements in Policy on Floor Replacements and the Services to Comply with Existing DOD Policy on Their Maintenance (GAO/PLRD-83-19)

We have surveyed major maintenance and repairs to family housing units at five installations. Because our work disclosed a problem relating to wood floor replacement and maintenance, we concentrated our efforts in that area. We observed that installation personnel were generally not performing economic analyses to determine the most cost-effective materials to use when replacing wood floors.

Four of the installations we surveyed had wood floors. One Air Force installation replaced, over a period of years, the original veneer floors with solid oak parquet in 510 of 540 Capehart units constructed in 1960. We estimate that the cost to replace these floors was $1.6 million. Alternative materials, such as vinyl tile, were not considered, even though they could have cost less.

Three other installations replaced hardwood or parquet floors in some of their housing units with vinyl or vinyl asbestos tile. Only one of the four installations performed an economic analysis to determine the most cost effective material to use. That installation selected vinyl tile as its replacement material.

The Department of Defense (DOD) has instructions on sanding and refinishing wood floors, but it does not have a policy on which materials to use when floors need to be replaced. We believe it is essential that economic analyses be made to determine the most cost-effective materials to be used when it becomes necessary to replace these floors.

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Neither DOD nor the services have records on the number of units with wood floors; therefore, the total number of units with the potential for floor replacement could not be determined. Because four of the five locations visited had wood floors in many units, the potential for savings could be significant.

We also observed wood floors were being sanded or refinished more frequently than provided by DOD policy, which states that normally wood flooring should not be sanded or refinished more frequently than 10 years. Although records at two Air Force installations did not show when floors had been sanded or refinished, our discussions with maintenance personnel at one of the installations indicated that sanding in excess of the DOD criterion could have contributed to their premature replacement. Floors in Capehart units constructed at one installation in 1960 began to be replaced in early 1974. In addition, floors at an Army installation were being sanded and refinished more frequently than called for by the DOD policy because the installation followed an Army policy which was inconsistent with the DOD policy.

BACKGROUND

DOD operates and maintains about 400,000 military family housing units under its Real Property Maintenance Activities Program. One specific objective of the Program is to maintain and repair, in the most cost-effective manner, all active real property to a standard which will permit continued use for the designated purposes.

DOD Instruction 4270.21, Policy and Criteria for Operation, Maintenance and Repair of Defense Family Housing, states that wood floors should not be completely sanded or refinished, except when general deterioration has occurred. Normally, an interval of not less than 10 years should elapse before such work becomes necessary. The instruction does not specify what materials should be used when wood floors need to be replaced. DOD leaves the decision to each installation, subject to the approval of its command.

The instruction states that maintenance materials and methods shall generally be selected from those authorized by DOD-wide guide specifications, based on the lowest life-cycle cost of alternatives. The specifications permit architects and engineers to select materials from the specifications which, in their professional judgment, are suitable for specific projects. While the specifications provide for both wood floors and resilient floor covering, which includes vinyl tile, they also state that in selecting the quality standards for materials, consideration should be given to the impact that certain materials may have on the construction and maintenance cost of the project.

In new family housing, DOD allows the contractor, within cost limitations, to decide the materials to use for floor covering. The trend is to use vinyl tile in first floor units and carpeting in second floor units, where soundproofing may be necessary.

DOD has no records on the number of units with wood floors. However, on the basis of our survey, we believe that many units constructed before the mid-1960s have hardwood strip or parquet floors.

OBJECTIVE, SCOPE AND METHODOLOGY

Our objective was to test the cost effectiveness of selected maintenance in military family housing. We examined records, met with officials, and toured family housing units at five locations--McClellan Air Force Base, Travis Air Force Base, and Fort Ord, California, and the Naval Weapons Station and Fort Jackson, South Carolina. We selected these locations because they had a large number of family housing units and would provide coverage of three military services. Our work disclosed a problem relating to wood floor replacement and maintenance, so we concentrated our efforts in that area. Of the five installations, three (McClellan, Fort Ord, and the Naval Weapons Station) had parquet floors in Capehart units; a fourth installation, Travis AFB, had hardwood strip floors in its Capehart units. Fort Jackson did not have housing units with hardwood floors, however, all of its housing units have been constructed since fiscal year 1965.

To compare costs for replacing veneer parquet in McClellan's Capehart housing, we compared the actual cost for solid oak parquet against the actual cost of vinyl asbestos tile, and the estimated cost of vinyl tile as furnished by McClellan and the Corps of Engineers, Sacramento District. The comparison is based on 30 units remaining to be refloored at McClellan and compares costs over a 30 year period adjusted to the present value (See encl. I.)

FLOOR REPLACEMENT COSTS

McClellan Air Force Base began replacing floors in its Capehart housing with solid oak parquet in 1974. The floors in these houses, constructed in 1960, were replaced because the original 5/32-inch veneer had been sanded prior to refinishing to a point where the adhesive was bleeding through and the plywood laminate was exposed.

At the time of our survey, McClellan had replaced floors in 510 of its 540 Capehart units. McClellan used solid oak parquet to permit more sandings before their replacement. Although

records were not available before fiscal year 1976, we estimate that McClellan has spent about $1.6 million to replace the floors in the 510 units. Since fiscal year 1976, the average cost per unit to replace the veneer with solid oak parquet has more than doubled, from $2,440 to $5,031 per unit.

Air Force Regulation 91-1, Operating and Maintaining Air Force Family Housing, states that improved quality materials other than those provided by the original construction are used when the cost can be justified by a corresponding reduction of future operation and maintenance costs. Currently, sanding and refinishing parquet floors at McClellan costs 75 cents per square foot, whereas maintaining vinyl tile is the responsibility of the tenant. The regulation also states that materials and methods are generally selected from those authorized by the Air Force's Guide Specifications for Military Family Housing based on the lowest life-cycle cost of alternatives. The Air Force specifications are the same as the DOD guide specifications.

Air Force Regulation 178-1, Economic Analysis and Program Evaluation for Resource Management, covers the policies and procedures for an economic analysis. It states that an economic analysis must be prepared when a commitment of resources to a new program is planned. In 1974, when McClellan decided to refloor with parquet, it did not consider alternatives that were less costly than wood, such as vinyl tile. At the time, solid oak parquet tile was estimated to cost one-third more than veneer. McClellan decided to use the more expensive solid oak because it would permit more sandings before replacement would be needed. We believe that an economic analysis should have been made comparing the costs to replace the Capehart unit floors with materials, such as vinyl tile, that may have been less costly than veneer or solid oak parquet.

We initially estimated that $103,000 would be saved in replacement and maintenance costs by reflooring the remaining 30 units with vinyl asbestos tile. (See encl. I.) The estimate for vinyl asbestos tile was based on actual replacement costs in Wherry housing units at McClellan and a verbal estimate from McClellan for preparing the floors for vinyl tile.

In May 1982 we advised the Commanding General, McClellan Air Force Base, by letter, of the above and requested his comments on the use of less costly materials in future floor replacements in Capehart as well as other units with parquet or hardwood floors. We also advised him that compliance with DOD guidance on floor sanding and refinishing could reduce the need for prematurely replacing the floors.

In June 1982, McClellan advised us that reflooring the 30 units with vinyl tile rather than parquet would cost $40,237 more. (See encl. I.) The primary differences in the GAO and McClellan cost comparisons were the costs for (1) vinyl tile rather than vinyl asbestos tile and (2) preparing the floors for vinyl tile once the old parquet is removed. McClellan officials told us that they had recently been advised that lower cost vinyl asbestos tile could no longer be used because of health hazards.1/

We subsequently obtained estimates from the Corps of Engineers, Sacramento District, as to the costs for replacing oak parquet with vinyl tile in Capehart houses at McClellan. A comparison of the Corps' estimate for vinyl tile with McClellan's cost for replacing the floors with wood parquet indicates a savings of $41,024 (see encl. I) if vinyl tile is used. However, as discussed below, this savings could be reduced or eliminated depending on the condition of the subsurface once the old parquet is removed.

The McClellan and Corps' estimates differ primarily in the cost to prepare the concrete floors for vinyl tile once the old parquet is removed. An analysis of floor removal, preparation, and modification costs for the two estimates follows.

	Per unit costs	
	McClellan	Corps
Remove and dispose of old floor	$ 436	$300
Prepare concrete floor for vinyl tile	1,500	200
Replace thresholds	50	20
Modify bottoms of exterior doors	40	120
Total	$2,026	$640

The McClellan floor preparation estimate includes cleaning, scraping, repairing cracks, and grinding and leveling the old floor. The Corps' estimate is based on removing the original mastic and sealing the floor deck. It does not include the cost for repairing cracks, which the Corps estimated at $1 per linear foot or for leveling the concrete floors, estimated at $1 per square foot, once the old parquet is removed. The Corps said the extent of this work could not be assessed until the old floor was removed.

1/ The Corps of Engineers, Sacramento District, also stated that its specifications no longer authorized the use of vinyl asbestos tile.

The head of McClellan's Contract Management Section suggested that the only way to obtain a true comparison would be to request an alternative bid for vinyl tile when contracting for floor replacements. Comparative costs for each of the two alternatives depend on the condition of the concrete subsurface, which can be determined only once the old parquet is removed. We believe that at that time the least costly alternative could be determined.

None of the other locations we visited had replaced existing hardwood or parquet floors with the same materials, or planned to.

Travis has 2,167 housing units. Of this number, 1,174 units have hardwood strip floors, of which 1,152 are Capehart units constructed between 1958 and 1962. We were told that there had been no complete floor replacements, except in one or two instances when negligence was involved and the tenant was held accountable. In some units, part of the floors have been replaced with vinyl tile in the entryways because of extensive wear and water damage. The base civil engineer said that repairs and/or replacements of hardwood floors should be done with less expensive materials. However, no comparative cost analyses have been made.

At Fort Ord, we were told that for economic reasons, the installation replaced parquet floors with vinyl asbestos tile in both the Wherry substandard units as well as the Capehart units. However, no economic analyses were available to support the practice. Of 4,172 family housing units at Fort Ord, 1,300 constructed between 1952 and 1962 have solid wood parquet floors. An additional 1,584 units constructed between 1958 and 1961 have hardwood strip floors. The Military Family Housing General Engineer Technician estimated that since 1980, hardwood parquet floors had been completely replaced with vinyl asbestos tile in 75 units and partially replaced in 125 more units. He estimated that 80 percent of the units in which floors had been replaced were Wherry substandard and 20 percent were Capehart.

At the Naval Weapons Station, there were 2,675 family housing units. Forty-six were constructed before 1950 with hardwood strip floors, and 499 Capehart units were constructed in 1962 with solid oak parquet floors. One of the parquet floors, damaged by fire, has been replaced with vinyl tile. We were advised that vinyl tile had been used because a cost analysis showed it to be most cost beneficial. There are no plans to replace floors in other units, but a family housing official felt that if any further replacements became necessary, a cost analysis would preclude use of wood because of its high cost.

While the use of veneer, rather than solid oak parquet, in the McClellan units may have contributed to the early floor replacement, officials at locations with solid oak parquet and

hardwood strip floors estimated that these floors could be sanded only three times before they too would need replacement. Therefore, we believe the potential for floor replacement at installations other than the locations we visited could be significant. For example, at Travis, the foreman of family housing maintenance said that hardwood floors in its housing had been sanded an average of one time. He estimated that 50 percent of the Capehart units would require floor replacement in 15 years. The remaining units would require floor replacement in 20 years.

As noted above, only one installation we surveyed had supported its decision to replace wood floors with vinyl tile with an economic analysis. We believe that the higher cost for vinyl tile may reduce some of the apparent savings offered by a change from hardwood to vinyl asbestos tile. Also, the high cost of preparing the subfloor is a factor to consider. However, alternatives cannot be properly considered without a cost comparison.

WOOD FLOOR MAINTENANCE

Maintenance of hardwood strip and parquet floors includes sanding prior to refinishing. Parquet floors, particularly those that were originally constructed with veneer, are limited as to the number of sandings before they must be replaced.

We noted that (1) sanding of wood floors more frequently than provided by DOD policy and (2) the differing criteria within the Army on the frequency of sanding and refinishing of hardwood floors could result in excessive maintenance and repair costs.

DOD Instruction 4270.21, Policy and Criteria for Operation, Maintenance and Repair of Defense Family Housing, states that wood flooring shall not be completely sanded or refinished except when general deterioration has occurred; normally an interval of not less than 10 years should elapse before such work becomes necessary. The Department of the Air Force has restated the DOD criterion in Air Force Regulation 91-1, which also states that sanding of wood floors must be minimized.

At McClellan and Travis, records did not show when floors had been sanded or refinished. Floor replacements began about 1974 in the Capehart units which had been constructed in 1960. McClellan officials stated that after the floors in the Capehart units had received an average of two sandings, they had to be replaced. McClellan officials were unaware of the 10-year criterion for floor sanding and refinishing. If this criterion had been met, it appears that replacement would not have been necessary until 1990.

At the Naval Weapons Station, sanding and refinishing of floors did not appear excessive. During the past 2 years, hardwood floors have been refinished in 2 of the 46 units constructed before 1950. Prior to October 1980, these units were not the responsibility of the Naval Weapons Station; therefore, records for earlier periods were not available at that location. Floors in 243 of the 499 Capehart units constructed in 1962 have been sanded and refinished.

Inconsistent Army regulations

Army regulations dealing with wood floor maintenance are not consistent. Army Regulation 210-50, Family Housing Management, restates the 10-year floor sanding and refinishing criterion in DOD Instruction 4270.21. Army Regulation 420-70, Facilities Engineering, Buildings and Structures, states that wood floors may be completely refinished only when general deterioration of the surface finish is evident, generally not more often than 6-year cycles.

Fort Ord officials told us they were following the 6-year criterion. According to records for 17 units at Fort Ord, the time between floor sandings ranged from 3 to 13 years. Twelve of the 17 units had been sanded and refinished in less than the 10-year DOD criterion.

CONCLUSIONS AND RECOMMENDATIONS

Sanding of hardwood strip and parquet floors more frequently than provided for in DOD instructions can result in shortening their expected life and therefore require earlier replacement. DOD needs to reemphasize the need for the services to follow its policy and require the Army to adopt procedures consistent with DOD policy.

Replacing wood flooring in military family housing costs several thousands of dollars for each unit. In view of the cost, not only must the services adhere to the DOD policy on sanding to prevent early replacement, but installation personnel must select the most cost-effective materials. There are varying opinions within DOD as to which materials are the most cost effective, but only one installation supported its decision with an economic analysis.

Economic analyses should be required before floors are replaced. However, when replacing hardwood floors with vinyl tile, which is less costly to install and maintain, extensive preparation of the subsurface floor may be necessary. Cost estimates for this preparation vary significantly because estimating these costs prior to removing the old floor is difficult. The amount of costly crack repair and leveling of the

subsurface floor can be determined, on a case-by-case basis, only when the old floor is removed. In some cases, an economic analysis that shows vinyl to be most cost effective may be misleading if the subflooring is in poor condition and if that possibility was not considered in the analysis. Conversely, if an analysis included an estimate for the worst case as far as subsurface is concerned, it may also be misleading if the subsurface is in good condition. In that case vinyl may then be the most cost-effective material to use.

We recommend that you:

--establish a policy which requires the services to perform economic analyses to identify the most economical materials for replacing wood floors in military family housing. Because the condition of the subsurface may be unknown and the analysis may be misleading without knowledge of the condition, the policy should require the services to provide for the option of replacing the flooring with the most cost-effective materials on a case-by-case basis. This can be done by requiring bidders to submit bids on the basis of furnishing wood or vinyl once the condition of each unit's subsurface is determined.

--emphasize to the services the need to follow DOD procedures for maintaining wood floors and stress the need for all services to insure that their procedures are consistent with the DOD policy for maintaining wood floors.

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We would appreciate being advised of any actions taken or proposed on these above recommendations. We are sending copies of this report to the services.

Sincerely yours,

James G. Mitchell

James G. Mitchell
Associate Director

Enclosure

ENCLOSURE I

FLOOR REPLACEMENT COST COMPARISON

OAK PARQUET VERSUS VINYL TILE

	Oak parquet		Vinyl tile					
	McClellan est.		GAO est.a/		McClellan est.		Corps est.	
	Cost	Present value (note b)	Cost	Present value (note b)	Cost	Present value (note b)	Cost	Present value (note b)
Replacement costs:								
Installation of new flooring								
per unit	c/$ 5,031		c/d/$ 1,005		$ 3,850		e/$2,895	
30 units	150,930	$150,930	30,150	$ 30,150	115,500	$115,500	86,850	$ 86,850
Cost to prepare floor for vinyl tile			21,000	21,000	75,000	75,000	15,000	15,000
Cost to refloor at 15-year life	-		f/30,150	4,276	g/57,000	8,575	101,850	15,964
Maintenance costs:								
Sanding and refinishing (1,000 sq. ft. x $0.75 per sq. ft. x 30 units) at:								
10 years	22,500	6,007		(h)		(h)		(h)
20 years	22,500	1,901						
		$158,838		$ 55,426		$199,075		i/$117,814
Difference								
Vinyl tile less				$103,412				$ 41,024
Oak parquet less						$ 40,237		

a/Based on actual costs to install vinyl asbestos tile in Wherry housing units and a verbal estimate from McClellan for preparing the floors.

b/Present value rates are based on the average yield on Treasury obligations as of March 31, 1982,—14.117 percent for 10 years or less and 13.15 percent for more than 10 years.

c/Based on fiscal year 1981 average cost per unit.

d/Vinyl asbestos tile.

e/Includes patching and painting at $170 per unit.

f/Amount includes cost to prepare floor for new vinyl.

g/Cost to refinish floor at 15 year life rather than full replacement.

h/Maintenance is occupant's responsibility.

i/Does not include overhead and profit.