



# **The Army's Costs to Eliminate Its Deferred Maintenance Backlog and to Renovate and Modernize Its Buildings**



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# At a Glance

The Army has more than 500,000 buildings and other structures on its bases in the United States and other countries. Those facilities cost billions of dollars each year to maintain, but the condition of some of them has degraded because funding to maintain them has been persistently less than the amount that would have kept them in working order according to the Army's standards. The additional costs of renovating and modernizing them for future use may be significant.

In this report, the Congressional Budget Office analyzed roughly 49,000 buildings in use on Army bases in the United States that the Army's active component is responsible for maintaining. CBO then estimated two types of costs:

- The cost of eliminating the maintenance backlog and returning the buildings to standards matching the Department of Defense's goals would be about \$19 billion (in 2020 dollars), and
- The cost of renovating and modernizing the buildings within their current footprint (the area they cover on the ground) to fully provide users with the capability to fulfill their missions would be an additional \$34 billion.

CBO based its estimates on the most recent data available from the Army, which were current as of September 2020. Since then, the prices of goods and services have risen considerably in the United States, so the costs have probably increased as well—and may continue to rise, especially if inflation persists. In addition, CBO's estimates do not incorporate any effects that the Army's ongoing efforts to develop new weapon systems may have on its facilities, which may need to be upgraded or modernized to accommodate those systems.

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# Notes

All years referred to in this report are federal fiscal years, which run from October 1 to September 30 and are designated by the calendar year in which they end.

Numbers in the text, table, and figures may not add up to totals because of rounding.

Funding and costs are expressed in 2020 dollars, unless stated otherwise.

The Congressional Budget Office used data from the Army in the Department of Defense's *Real Property Information Model, Version 10.0*, to produce all the exhibits in this report.

On the cover: Fort Hood, Texas. Photo provided courtesy of the Army.

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# The Army's Costs to Eliminate Its Deferred Maintenance Backlog and to Renovate and Modernize Its Buildings

The Department of the Army—which includes the active Army, Army Reserve, and Army National Guard—has hundreds of thousands of real property assets in various states of use on its bases, such as buildings, land, and other structures. Although that infrastructure supports military forces by providing facilities for training, maintaining equipment, housing troops, and other activities, it competes for funds with other purposes, such as procuring equipment for combat forces, which the Army often considers a higher priority. Persistently insufficient funding for the maintenance of the Army's real property could degrade its condition and have implications for the Army's budget in the future.

As of September 2020, the Army, its components, and other organizations were responsible for maintaining more than 500,000 pieces of used or unused real property assets on Army bases worldwide. That portfolio included more than 200,000 buildings of various types, such as administrative headquarters and hospitals, with about 1.3 billion square feet of space and a replacement value of roughly \$470 billion. It also included about 300,000 nonbuilding structures, such as pipelines, roads, runways, utility lines, dams, and storage tanks. In addition, the Army had more than 44,000 tracts of land covering about 18.8 million acres.

For this report, the Congressional Budget Office focused on buildings—a subset of the Army's real property—and analyzed their age, condition, and capacity to support users' missions. The agency then estimated the costs of performing deferred maintenance—that is, maintenance that has not been carried out that the Army would need to undertake to meet its goals for the condition of facilities. It includes regular preventive maintenance and repairs that would get the property into a condition that met the Army's standards. CBO also analyzed the costs of renovating and modernizing those buildings to match the stated goals of users.

CBO's analysis focused on about 49,000 buildings in use on 88 bases in the United States that the Army's active component is responsible for maintaining. The agency estimated that the total cost to eliminate the deferred maintenance backlog and to renovate and modernize buildings to match their users' goals would be \$54 billion (measured in 2020 dollars).<sup>1</sup> In particular:

- The cost of eliminating the deferred maintenance backlog and returning the buildings to the Army's standards would be about \$19 billion, and
- The cost of renovating and modernizing the buildings within their current footprint to meet users' goals would be about \$34 billion.<sup>2</sup>

Those estimates were current as of September 2020. Since then, the prices of goods and services have risen considerably in the United States, so the costs in those estimates have probably increased as well—and may continue to rise. CBO attributes that upward pressure on prices in part to supply chain disruptions from the coronavirus pandemic, as well as high overall demand for goods and services in the U.S. economy. In addition, municipalities around the country have received funding under the Infrastructure Investment and Jobs Act (Public Law 117-58). Their use of those funds may further increase construction costs in those areas. CBO projects that, during the next few years, the price index for nonresidential structures, a substantial portion of which includes the price of building materials, will be 20 percent to 25 percent higher than it was in 2020.<sup>3</sup>

The Army has ongoing programs to develop new weapon systems and may need to upgrade or modernize its facilities to accommodate those systems. CBO's estimates do not incorporate those effects. In addition, CBO's estimates are uncertain because the criteria the Army uses to assess the condition of its buildings could change, and some time has passed since the assessments were made.

The Army data that CBO used for this analysis are from 2020, but the condition of most of the buildings was assessed at least one year earlier. The condition of those buildings could now differ.

The estimated costs vary by type of building and base and depend on the number, size, and condition of the buildings. Buildings used for administrative functions, such as headquarters offices, accounted for the largest share of the total cost, mostly because that category accounted for

more buildings than other categories. Cost per building was highest for buildings used for troop housing and food services because, on average, they were larger and in slightly worse condition.<sup>4</sup> Costs for deferred maintenance and for renovation and modernization were significantly larger at two bases than at other locations because those two bases each accounted for a larger share of the Army's total building inventory than a typical base, and they had buildings in worse repair.

## The Department of the Army's Real Property

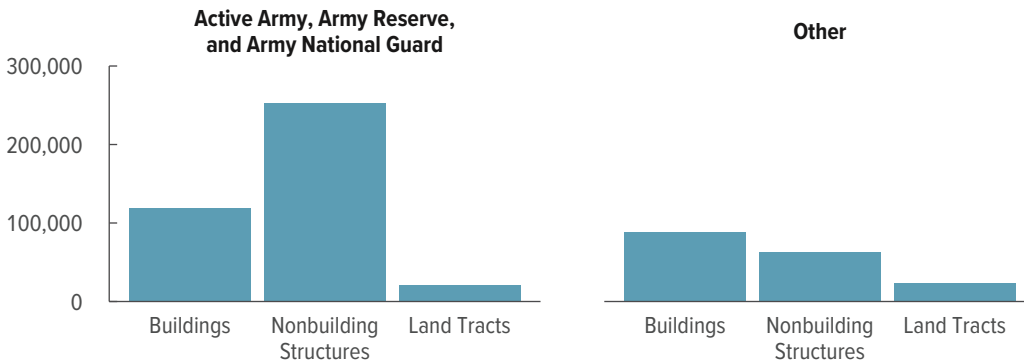
More than 500,000 buildings and nonbuilding structures, such as pipelines and storage tanks, are located on Army bases worldwide. The active Army, Army Reserve, and Army National Guard are responsible for maintaining roughly 70 percent of all that real property. Other organizations—defense agencies such as the Defense Logistics Agency, other federal agencies such as the Department of Justice, and private entities—have assets on Army bases and are responsible for maintaining about 30 percent of that real property.

CBO grouped the real property on Army bases into three categories: property in active use for six or more months in 2020; excess property that was not required for the Department of Defense's (DoD's) current or future plans and that was being evaluated for, or already conveyed to, other federal or nonfederal organizations; and property in other inactive statuses, such as buildings or structures that were closed, disposed of, or not in use because of environmental concerns.

About 75 percent of all buildings, nonbuilding structures, and land tracts were actively used; about 1 percent were considered excess; and 24 percent were in other inactive statuses.

### Real Properties on Army Bases, by Organization Responsible for Maintenance and Type, September 2020

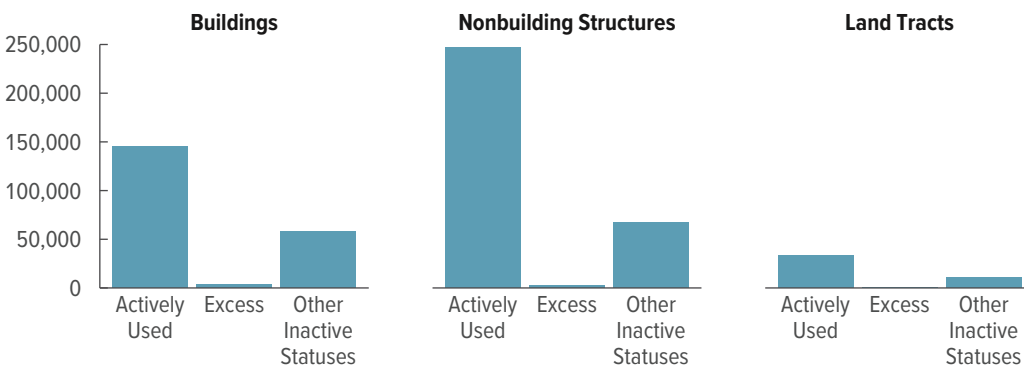
Number of Real Properties



The active Army and its reserve components are responsible for maintaining most real property on Army bases, but other organizations have a role as well.

### Real Properties on Army Bases, by Type and Operational Status, September 2020

Number of Real Properties



Most real property assets on Army bases are actively used.

## Real Property Assets Considered in CBO's Analysis

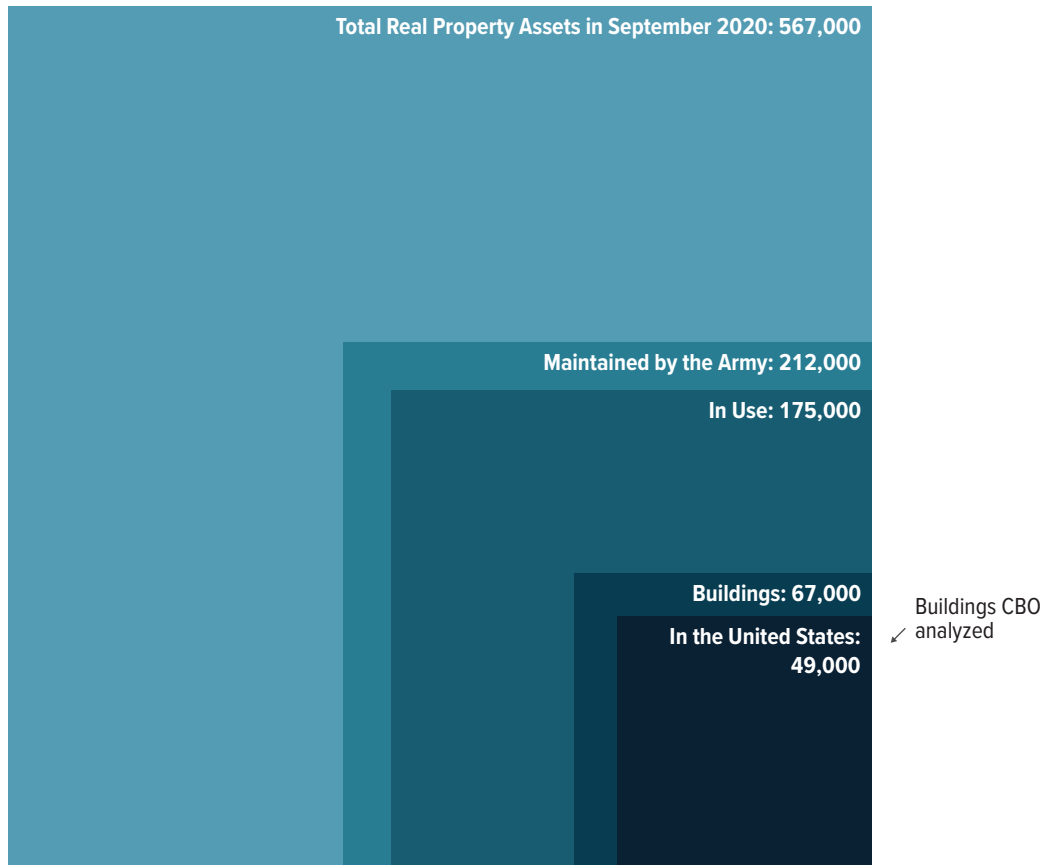
For this analysis, CBO used several criteria to identify a subset of about 49,000 buildings from the Army's inventory of real property as of September 2020.

First, CBO identified real property that the Army's active component was responsible for maintaining. The agency excluded real property that was the responsibility of the reserve components of the Army (the Army Reserve and Army National Guard) and other entities, such as the Defense Logistics Agency and the Department of Justice. The Army's three components have separate budgets to operate and maintain their real properties, so it is appropriate to analyze those properties separately.

Next, CBO selected real properties that were in active use and omitted those that were not in use or that were in various stages of dormancy. The agency then included buildings but excluded nonbuilding structures, such as pipelines and storage tanks. Lastly, CBO identified buildings that were located on Army bases in the United States (88 bases in all) and excluded those on Army bases outside the United States.

Although some entries in the overall database were missing, the subset of data in CBO's sampling criteria was more complete and was sufficient to estimate costs and provide averages for the basic characteristics, such as the age and patterns of use of buildings, that the agency analyzed.

### Army Buildings Considered in CBO's Analysis



Of the 567,000 real properties located on Army bases worldwide in 2020, CBO focused on 49,000, or nearly 9 percent. Those buildings were in use in the United States and were maintained by the Army's active component.



**Characteristics of the Army Buildings Considered in CBO’s Analysis**

According to the Army, the cost to replace the 49,000 buildings considered in CBO’s analysis with buildings of similar type and quality—the replacement value—was about \$169 billion in 2020. The original cost excluding the accumulated depreciation of those buildings—the book value—was about \$34 billion.<sup>5</sup> The buildings accounted for about 438 million square feet of space.

On average, those buildings exceeded their estimated useful life—the number of years a real property is depreciated in financial statements—by more than a decade: Although the Army’s estimate of the buildings’ intended useful life was about 36 years, their average age was 47 years in 2020.<sup>6</sup> (Separately, DoD has expressed a goal to restore, modernize, or replace facilities once every 67 years. Although the Army’s buildings, on average, are not that old, a large cluster is significantly older than DoD’s goal.)

On average, the utilization rate in those buildings was 95 percent. DoD defines that rate as the ratio of space used when operating at full capacity to space available in the buildings.<sup>7</sup>

**Characteristics of the Army Buildings Considered in CBO’s Analysis**

Replacement Value (Cumulative)	\$169 billion
Book Value (Cumulative)	\$33.5 billion
Area (Cumulative)	438 million square feet
Intended Useful Life (Average)	36 years
Age (Average)	47 years
Share of Buildings Exceeding Their Intended Useful Life (Average)	41 percent (20,000 of 49,000)
Utilization Rate (Average)	95 percent

The replacement value of the buildings CBO analyzed was roughly five times their book value (that is, their original cost minus accumulated depreciation), reflecting their age and longer term of use, on average, than was originally planned.

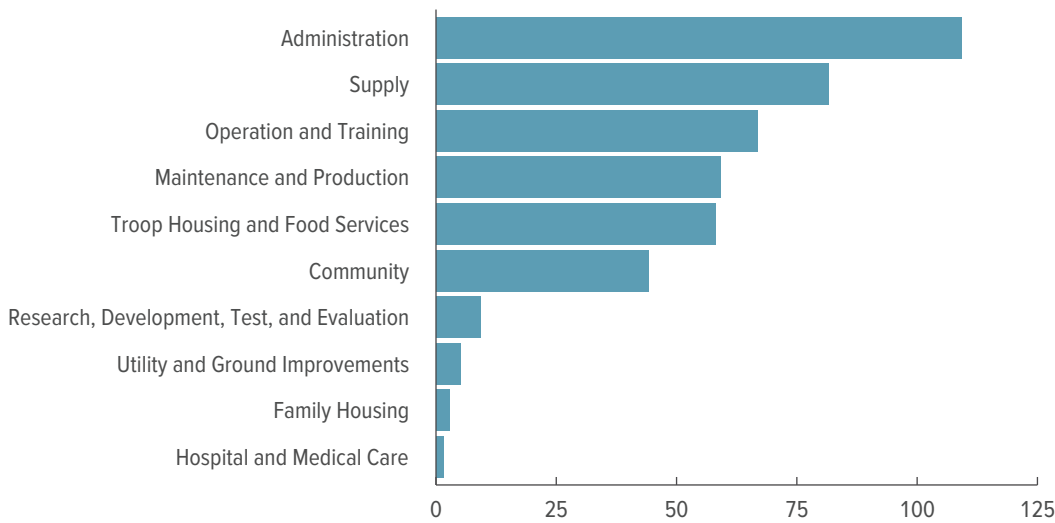


### Functions of the Army Buildings Considered in CBO's Analysis

CBO's analysis includes a broad range of building types, which the agency grouped into 10 categories according to the functions they provide. Five of those categories (administration, supply, maintenance and production, troop housing and food services, and research, development, test, and evaluation) generally support military units; four (community, utility and ground improvements, family housing, and hospital and medical care) support the quality of life of the people on a base; and one (operation and training) is most directly related to unit readiness.<sup>8</sup> The administration, supply, and operation and training categories accounted for the three largest amounts of space in buildings on the 88 bases that CBO analyzed. Because DoD's Military Health System is responsible for most of the buildings devoted to medical functions (such as hospitals) on Army bases, CBO's analysis covers only a small portion of those buildings.

### Total Space Occupied by the Army Buildings Considered in CBO's Analysis, by Function

Millions of Square Feet



Buildings used for administration, supply, and operation and training accounted for over half of the space in the buildings that CBO analyzed.

## Analysis of Basic Measures of Performance

CBO used the Army’s data to examine the age and physical condition of the buildings it analyzed, as well as whether they were configured for the functions they were serving, to better understand how those measures affect maintenance costs and how well the buildings match the stated goals of users. Previous research has indicated that older buildings are more likely to be costlier to maintain and could require more renovation than newer ones.<sup>9</sup> Similarly, regardless of age, buildings in poor physical condition probably have larger maintenance costs and diminished capability to efficiently support users.

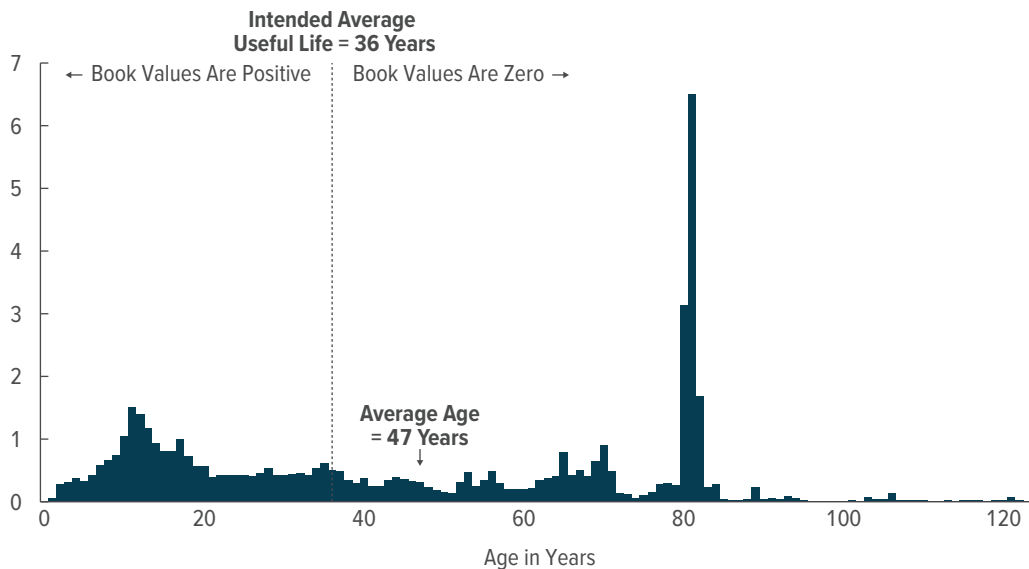
### Age and Useful Life

The average age of the buildings in CBO’s analysis was 47 years in 2020, a decade longer than the active Army’s average 36-year intended useful life that is recorded in its real property database. The roughly 20,500 buildings that are older than their intended useful life (about two-fifths of all the buildings CBO examined) have a book value of zero. Thousands of those buildings, some of which are probably designated as historic, were 75 years old or older.

That outcome could be the result of policies that have historically prioritized funding for combat forces over funding for support areas such as real property. For example, CBO found that spending by the Army’s active component for new construction as a percentage of the replacement value of all of its real property (including buildings and nonbuilding structures) decreased from about 2.7 percent in 2008 to 0.4 percent in 2020.<sup>10</sup> Those percentages imply that the number of years it would take to fully replace the active Army’s real property portfolio increased from 37 years in 2008 to more than 200 years in 2020, if all else remained unchanged.

### Age of the Army Buildings Considered in CBO’s Analysis, September 2020

Thousands of Buildings



On average, the buildings CBO analyzed were in use 10 years longer than the Army had intended. The group of buildings around 10 years of age reflects construction initiated during the early 2000s to support the wars in Iraq and Afghanistan. The peak around 80 years of age reflects buildings constructed during the World War II era that are still in service.

## Physical Condition

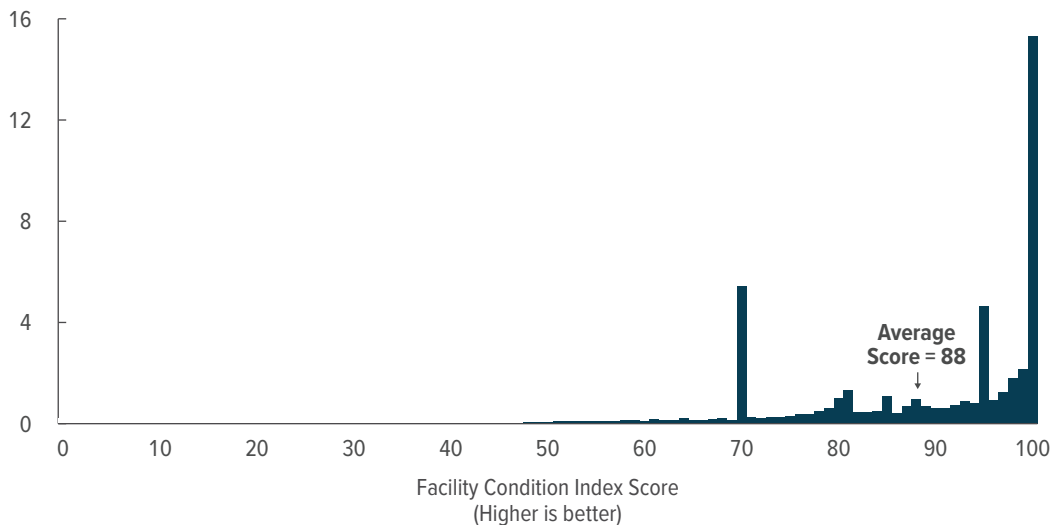
Physical condition indicates the extent of decay in a building's basic structure and systems. The Army summarizes the results of physical-condition assessments in the facility condition index (FCI). The service calculates the FCI on a scale from 0 to 100; higher scores indicate better condition. A score of 100 indicates that a building's condition meets the Army's standards with no concerns. Scores of less than 100 indicate that some expenditures are necessary to address deterioration resulting from deferred maintenance and to restore buildings to a fully functioning condition.<sup>11</sup> For example, a score of 95 indicates that the amount of deferred maintenance equals 5 percent of the replacement value of the building; a score of zero indicates that the amount of deferred maintenance equals the replacement value of the building.

Analyzing the Army's data, CBO found that, as of September 2020, the average physical-condition score of the active Army's buildings was 88, and the median score was 95. (That is, half of the buildings had a score lower than 95, and half had a score higher than 95.) The average is less than the median because the distribution of scores is asymmetric, with a significant fraction less than 90 and none greater than 100. CBO also found that average FCI scores were similar for all building types, indicating that buildings of one type were not typically in much better or worse condition than those of other types. However, older buildings tended to be in slightly worse condition than younger ones: FCI scores decrease by about 1 to 3 points for every 10 years of age. For example, buildings that were 1 to 10 years old, 11 to 20 years old, and 21 to 30 years old had average FCI scores of 95, 94, and 91, respectively. Continuing that trend, buildings that were 31 to 40 years old, 41 to 50 years old, and 51 to 60 years old had average FCI scores of 88, 86, and 84, respectively.

CBO's further analysis of the spikes in FCI scores at 70 and 95 showed no apparent pattern by age. The spikes were clustered around buildings used for supply (55 percent) and administration (50 percent), respectively, but information that might explain that distribution was not available to CBO.

### Facility Condition Index Scores of the Army Buildings Considered in CBO's Analysis

Thousands of Buildings



Most of the buildings in the data set that CBO analyzed were in good physical condition.

**Capability to Support Users' Goals**

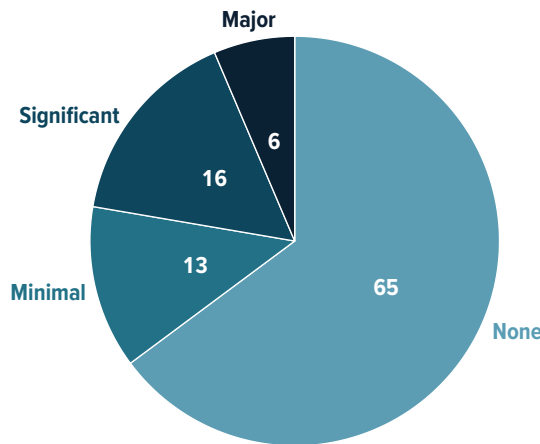
The Army conducts functional-capability assessments of its real property. Unlike an assessment of condition focused on the physical integrity of real property, an assessment of functional capability is primarily concerned with its capacity to support users' goals. Specifically, DoD defines functional capability as a property's overall ability to perform its mission or function given its current size, configuration, condition, and siting at the time of the assessment. A property's maintainability, location, access, and comfort are also considered in the assessment.

A real property's functional-capability assessment is assigned one of four possible scores: none, minimal, significant, and major. Those scores reflect the extent of the renovation and modernization expenditures that would make the real property capable of supporting its current use or function.

The Army's data indicate that, as of September 2020, about two-thirds of the active Army's buildings did not require any renovation or modernization to effectively support the goals of current users. The remaining one-third required minimal, significant, or major work. CBO's analysis of the Army's data found that, on average, buildings that were older or that received lower physical-condition scores tended to require more renovation or modernization.

**Functional-Capability Assessment Scores of the Army Buildings Considered in CBO's Analysis**

Percent



Most of the Army's buildings do not require any renovation or modernization to support the functions for which they are being used.

## Costs of Eliminating the Deferred Maintenance Backlog

Deferred maintenance is maintenance that the Army's real property managers want to undertake to meet their goals but that has not been carried out. It includes regular preventive maintenance and repairs that would get the property's condition to meet the Army's standards. If not carried out, such maintenance could accelerate the natural degradation of property and lead to substantial renovation expenditures in the future. As of September 2020, roughly 34,000, or 70 percent, of the Army buildings that CBO analyzed had some deferred maintenance. Using the Army's data, CBO estimated that undertaking that deferred maintenance for the active Army's buildings would cost about \$19 billion. By comparison, the active Army spent about \$2.5 billion annually, on average, during the past three years (2020 to 2022) to sustain all of its real property, including buildings and nonbuilding structures.

The Army and the other services use a facilities sustainment model to estimate the funding that would result in all real property meeting their standards. The model incorporates DoD's goal of recapitalizing its facilities every 67 years, but that funding target has not been met for at least the past 10 years. DoD has directed the services to cover only 80 percent of the sustainment goal in their recent budgets. As a result, funding for the sustainment of real property in the active Army's budget ranged from 62 percent to 92 percent of the requirement during the 10 years from 2013 to 2022, averaging 79 percent during that period.

CBO analyzed deferred maintenance costs both per building and per square foot. Because the results were similar in their ordering of functional categories, CBO focused on the results for costs per building, because buildings are more visually recognizable as discrete units on military bases.

In CBO's estimate, the distribution of the total cost of deferred maintenance by category of function largely reflects the share of the inventory of buildings in each category. That is, the administration, supply, operation and training, maintenance and production, and troop housing and food services categories that accounted for about 85 percent of total building space also accounted for roughly the same share of total deferred maintenance costs. Those categories include buildings that support military units (administration, supply, maintenance and production, and troop housing and food services) and are most directly related to unit readiness (operation and training).

On the basis of costs per building, however, categories with the largest deferred maintenance costs include those that support military units (troop housing and food services and maintenance and production) or the quality of life of the people on base (hospital and medical care), indicating that those buildings were larger and in slightly worse condition, on average. The cost per building for the category most directly related to unit readiness (operation and training) was similar to the average for all buildings in CBO's analysis.

Fort Bragg in North Carolina and U.S. Army Garrison Hawaii accounted for significantly higher amounts of deferred maintenance costs than other Army bases.

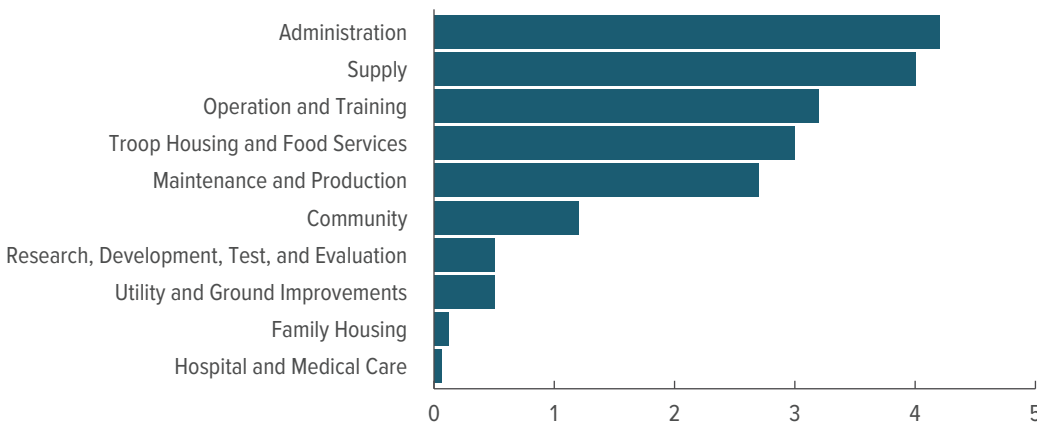
**Costs of Deferred Maintenance, by Function**

CBO found that categories of Army buildings with large amounts of space had large total deferred maintenance costs, as expected. The categories with more than \$2 billion in total deferred maintenance were administration, supply, operation and training, troop housing and food services, and maintenance and production. In terms of deferred maintenance costs per building, the categories troop housing and food services, hospital and medical care, and maintenance and production had the three largest amounts (\$1.7 million, \$1.4 million, and \$1.0 million per building, respectively, well above the overall average of \$0.6 million). Those three categories support military units or the quality of life of the people on base.

Deferred maintenance costs were higher largely because those buildings were larger, on average, than the buildings in all other categories and were in worse condition. For example, the average size of the buildings used for troop housing and food services was 25,000 square feet, whereas the average size for all buildings was 9,000 square feet. Similarly, the average FCI score of that category was 85, slightly lower than the FCI score of 88 for all buildings.<sup>12</sup>

**Costs to Eliminate the Deferred Maintenance Backlog for the Army Buildings Considered in CBO's Analysis, by Function**

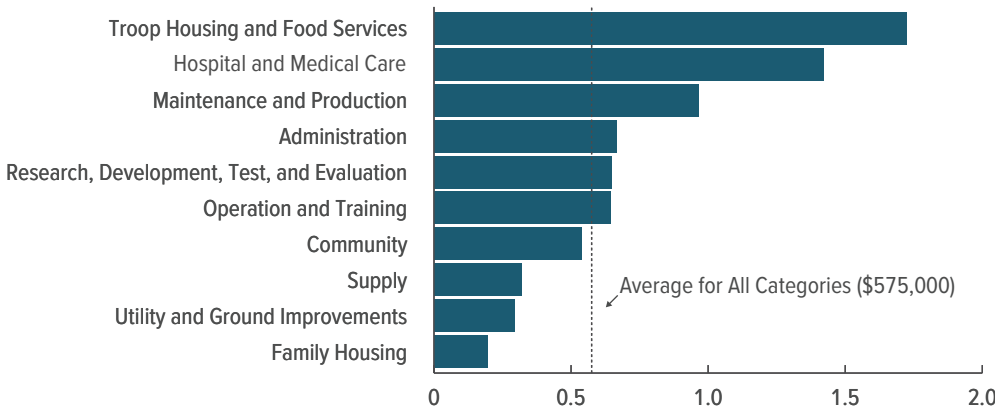
Billions of 2020 Dollars



Buildings in the largest five categories accounted for \$17 billion, or 89 percent, of the estimated \$19 billion cost to eliminate the deferred maintenance backlog.

**Costs per Building to Eliminate the Deferred Maintenance Backlog for the Army Buildings Considered in CBO's Analysis, by Function**

Millions of 2020 Dollars



Buildings in the largest three categories had deferred maintenance costs per building that were significantly larger than those for all buildings.

**Costs of Deferred Maintenance, by Base**

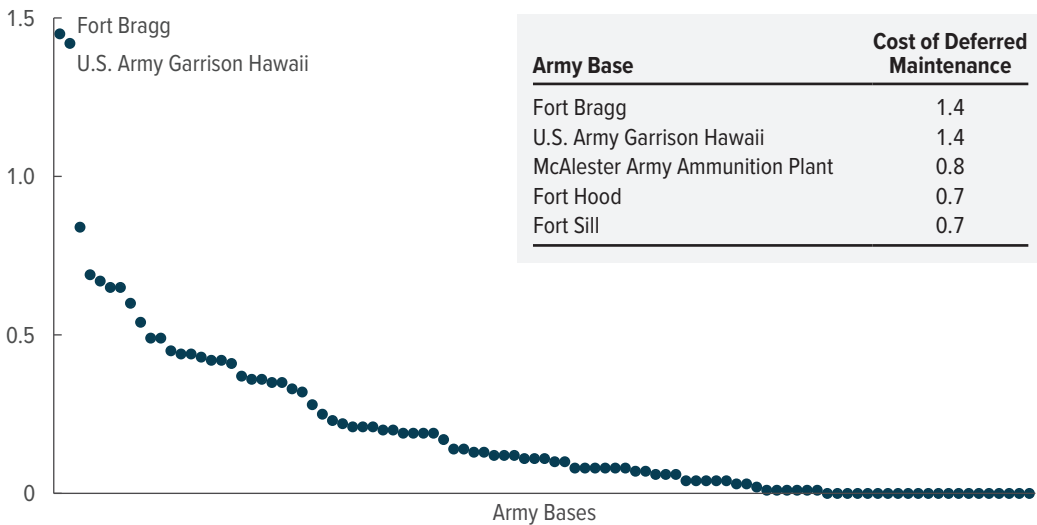
CBO also examined the distribution of deferred maintenance costs by base, as reflected in data that the Army provided to CBO.<sup>13</sup> Fort Bragg and U.S. Army Garrison Hawaii each accounted for about \$1.4 billion of the total. (U.S. Army Garrison Hawaii includes Schofield Barracks, Fort Shafter, and Tripler Army Medical Center.) The sum of the deferred maintenance costs for those two bases, \$2.9 billion, represents about 15 percent of the total estimate of \$19 billion for the Army.

Some bases had relatively large deferred maintenance costs because they accounted for larger than average shares of the Army’s total building inventory, some had buildings in worse repair, and some had a combination of both situations. For instance, although the buildings at Fort Bragg were in better than average physical condition and had an average FCI score of 91 (compared with 88 for all bases), the base had much more building space than is typical—seven times the average share of all bases, or about 7 percent of the total building square footage in CBO’s analysis (compared with a 1 percent average for all bases).

At U.S. Army Garrison Hawaii, however, the buildings were in worse physical condition, on average, and accounted for more total building space than is typical (three times the average share of all bases). The average FCI score for buildings at U.S. Army Garrison Hawaii was 82 (compared with 88 for all buildings), and the base accounted for about 3 percent of the Army’s total building square footage (compared with a 1 percent average for all bases).

**Costs to Eliminate the Deferred Maintenance Backlog for the Army Buildings Considered in CBO’s Analysis, by Base**

Billions of 2020 Dollars



Fort Bragg and U.S. Army Garrison Hawaii had significantly higher deferred maintenance costs than other Army bases. Both bases had much more building space than average, but the condition of the buildings at U.S. Army Garrison Hawaii was worse than average.





## Costs of Renovating and Modernizing Buildings to Better Match Users' Goals

Unlike normal maintenance and repair, work done to renovate and modernize Army buildings is related to the extent of the degradation of the buildings and the mismatch between the goals of a building's occupants and its capability to support those goals. Renovation and modernization can be used to improve the condition of a degraded building or to modernize it for a different purpose. For example, converting a building designed for an infantry unit to one suitable for an armored unit with tanks would require some renovation and modernization.

CBO's analysis focused on the costs to renovate and modernize buildings within their current footprint. The costs to rectify functional deficiencies in buildings that involve expansion beyond their existing structure must be paid from the military construction appropriation and are not discussed in this report.

Because certain tasks could address both renovation and modernization requirements, the total costs for those activities would be smaller if they were performed concurrently instead of separately. In CBO's projections, the Army would conduct the renovation and modernization work concurrently to reduce costs. Using data reflecting such synergies obtained from the Army, CBO estimated that renovating and modernizing the Army's buildings to fully match the goals of occupants would cost an additional \$34 billion. By comparison, the active Army spent roughly \$1.3 billion annually, on average, during the past three years (2020 to 2022) to renovate and modernize all of its real property, including buildings and nonbuilding structures. Not meeting the Army's sustainment funding target could accelerate the long-term degradation of its buildings and increase restoration and modernization costs in the future.

Mismatches between buildings' design capabilities and occupants' goals could occur if Army units and organizations changed more rapidly than the real property infrastructure. In addition, the Army could change the required capabilities of certain types of buildings, such as company headquarters, creating a demand for renovation and modernization. Nevertheless, fewer renovation and modernization projects could be required if units' needs were better matched to building capabilities. To the extent possible, the Army could also construct buildings that are more generic, with multipurpose capabilities that could be more easily converted if occupants' goals changed.

CBO's analysis of renovation and modernization costs focused on costs per building for the same reasons given above for deferred maintenance costs. As with deferred maintenance, the five largest categories (administration, supply, operation and training, troop housing and food services, and maintenance and production), which collectively accounted for about 85 percent of total building space in CBO's analysis, also accounted for 88 percent of total renovation and modernization costs.

For costs per building, CBO's finding for renovation and modernization was also similar to the agency's results for deferred maintenance. The categories with significantly larger renovation and modernization costs included those that support military units (troop housing and food services and maintenance and production) or the quality of life of the people on base (hospital and medical care), indicating that those buildings were, on average, larger, a poorer match for units' needs, or both. The renovation and modernization costs per building for operation and training, the category that is most directly related to unit readiness, were similar to the average for all buildings in CBO's analysis. Like CBO's findings for deferred maintenance, the estimated renovation and modernization costs for Fort Bragg and U.S. Army Garrison Hawaii were much higher than those costs for other Army bases.

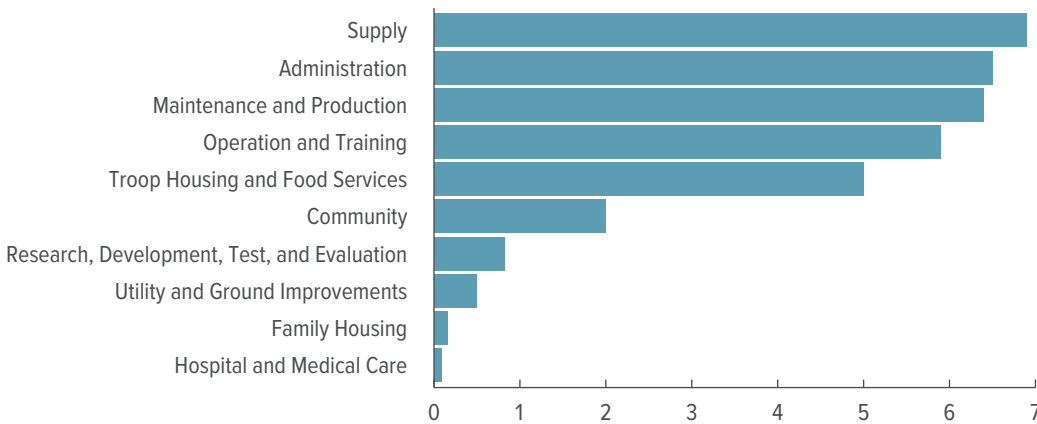
### Costs of Renovating and Modernizing Buildings, by Function

Categories of Army buildings with large amounts of square footage also had large total renovation and modernization costs, but the categories with the largest costs differed slightly from those with the largest costs for deferred maintenance. The categories with roughly \$5 billion or more in total renovation and modernization costs were supply, administration, maintenance and production, operation and training, and troop housing and food services. On the basis of costs per building, troop housing and food services, maintenance and production, and hospital and medical care—the categories that support military units or the quality of life of the people on base—accounted for the three largest amounts (\$2.6 million, \$2.0 million, and \$1.8 million, respectively), which were also significantly larger than the average for all buildings (\$0.9 million). Those three categories had the largest costs because buildings in those categories were larger, on average, than buildings in other categories and had less capacity to support users' goals.

The renovation and modernization costs per building for operation and training, the category most directly related to unit readiness, were similar to the average for all buildings.

### Costs to Renovate and Modernize the Army Buildings Considered in CBO's Analysis, by Function

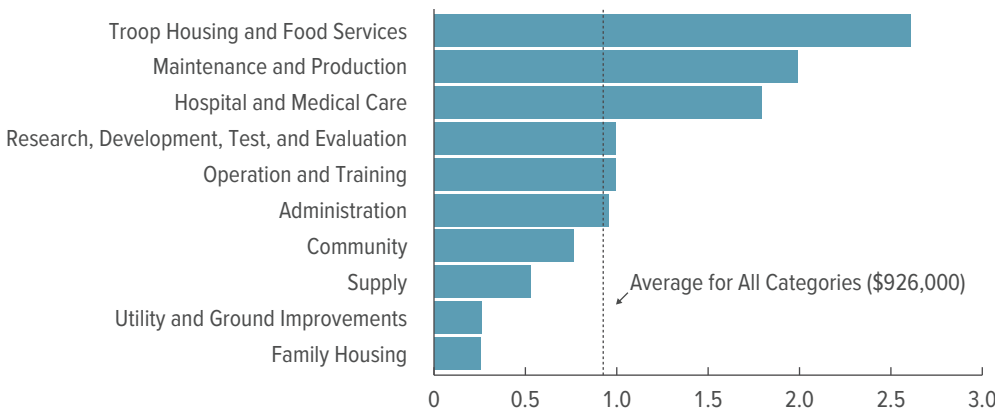
Billions of 2020 Dollars



Buildings in the five largest categories accounted for about \$31 billion, or 91 percent, of the \$34 billion cost to renovate and modernize Army buildings to fully match users' goals.

### Costs per Building to Renovate and Modernize the Army Buildings Considered in CBO's Analysis, by Function

Millions of 2020 Dollars



Buildings in the three largest categories had renovation and modernization costs per building that were significantly larger than the average renovation and modernization costs per building for all buildings.



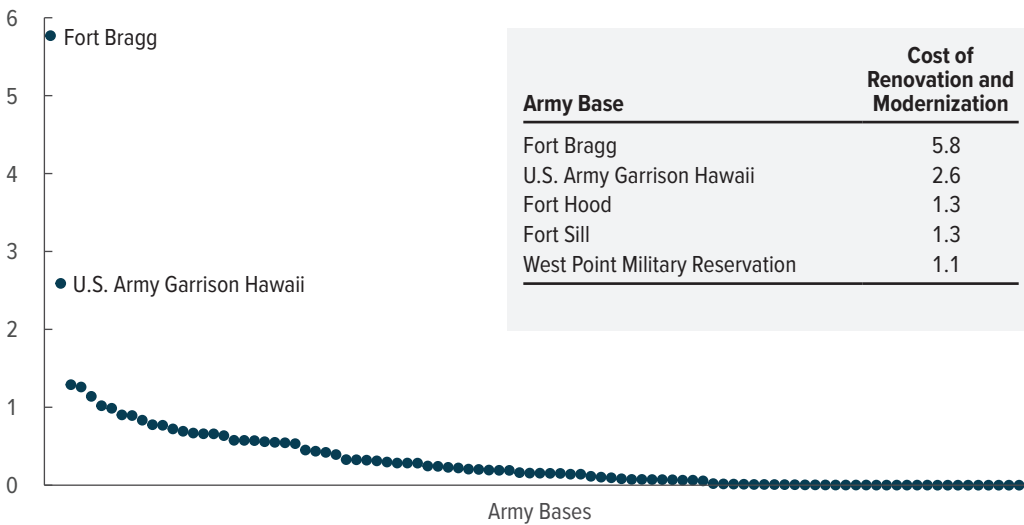
### Costs of Renovating and Modernizing Buildings, by Base

CBO’s findings for the distribution of renovation and modernization costs by base were similar to the agency’s findings for deferred maintenance costs. According to the Army’s data, Fort Bragg and U.S. Army Garrison Hawaii had significantly larger renovation and modernization costs than other bases, at about \$5.8 billion and \$2.6 billion, respectively. The sum of the renovation and modernization costs for those two bases, \$8.4 billion, represents about 25 percent of the \$34 billion total cost of renovating and modernizing the Army’s buildings.

Renovation and modernization costs were larger for Fort Bragg than for other bases primarily because it accounted for a relatively large share of the Army’s building inventory, including buildings that would not support occupants’ goals without major or significant renovation. For example, in CBO’s analysis, about 3 percent of such buildings were located on Fort Bragg, whereas the average for all bases was 1 percent. For U.S. Army Garrison Hawaii, which is larger in size than an average base, the proportion of buildings that would not support occupants’ goals without significant or major renovation was 40 percent, whereas the average for all bases was 22 percent.

### Costs to Renovate and Modernize the Army Buildings Considered in CBO’s Analysis, by Base

Billions of 2020 Dollars



Total renovation and modernization costs were significantly larger for buildings located on Fort Bragg and U.S. Army Garrison Hawaii than for buildings on other bases.



## Combined Costs of Deferred Maintenance and Renovation and Modernization

In CBO's estimate, which is based on the Army's data, the combined cost to eliminate the deferred maintenance backlog and to renovate and modernize the active Army's buildings to fully match the goals of users is roughly \$54 billion (\$19 billion for deferred maintenance and \$34 billion for renovation and modernization, in 2020 dollars). That amount represents about one-third of the active Army's base budget of \$160 billion for 2022.

The pattern of combined costs by function mirrors the results from CBO's separate analyses of the costs of deferred maintenance and of renovation and modernization. The five largest categories accounted for \$48 billion, or 89 percent, of the \$54 billion cost of combined deferred maintenance and renovation and modernization. The categories with significantly larger combined costs per building include those that support military units (troop housing and food services and maintenance and production) or the quality of life of the people on base (hospital and medical care).

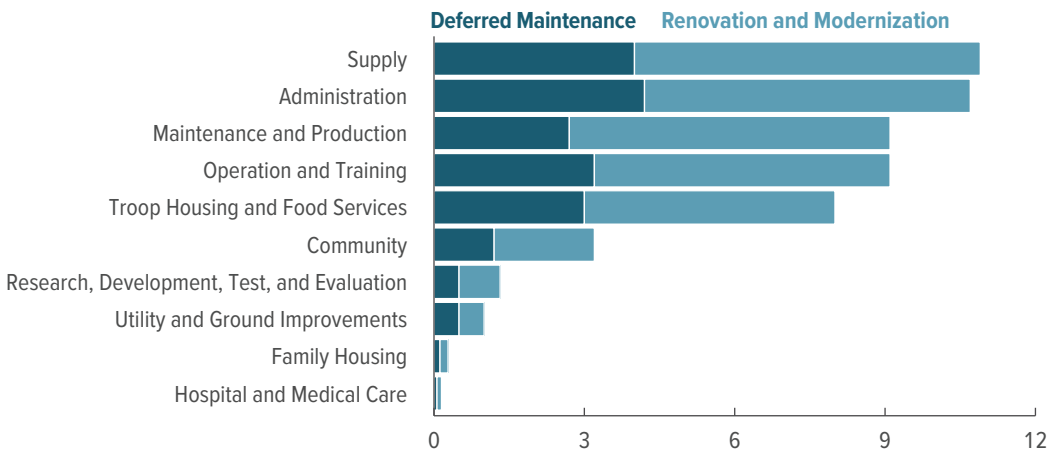
The deferred maintenance and renovation and modernization costs per building for operation and training, the category most directly related to unit readiness, were similar to the average for all buildings in CBO's analysis. Combined costs for deferred maintenance and renovation and modernization at Fort Bragg and at U.S. Army Garrison Hawaii were at least twice the amount for each of the other Army bases.

### Combined Costs of Deferred Maintenance and Renovation and Modernization, by Function

The categories with roughly \$8 billion or more in combined deferred maintenance and renovation and modernization costs are supply, administration, maintenance and production, operation and training, and troop housing and food services. The categories for troop housing and food services, hospital and medical care, and maintenance and production—the categories that support military units or the quality of life of people on base—had the three largest combined costs per building (\$4.3 million, \$3.2 million, and \$3.0 million, respectively), which were also significantly larger than the average for all buildings (\$1.5 million). Those three categories had the largest costs because buildings in those categories were larger, on average, than buildings in other categories, were in worse condition, and had less capacity to support users' goals. The combined costs per building for operation and training, the category most directly related to unit readiness, were similar to the average for all buildings.

### Combined Costs to Eliminate the Deferred Maintenance Backlog and to Renovate and Modernize the Army Buildings Considered in CBO's Analysis, by Function

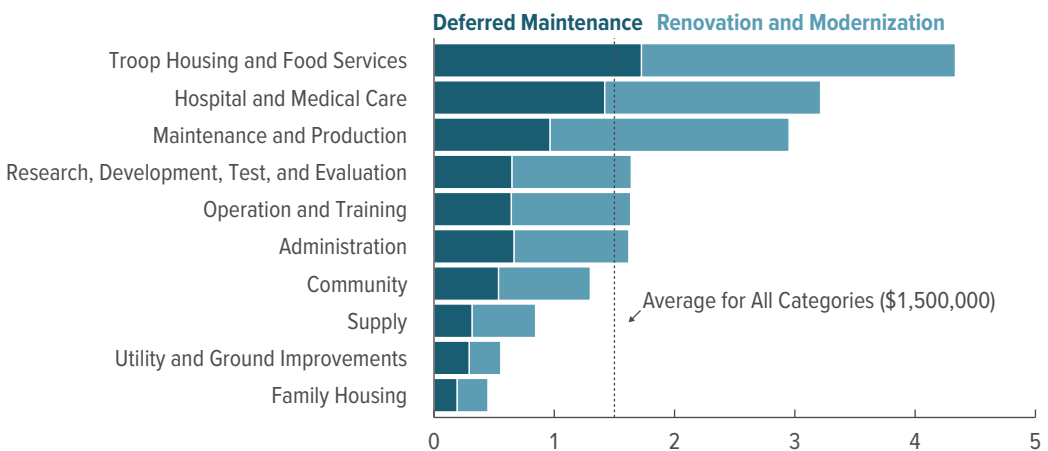
Billions of 2020 Dollars



Buildings in the five largest categories accounted for about \$48 billion, or 91 percent, of the \$54 billion combined cost to eliminate the deferred maintenance backlog and to renovate and modernize Army buildings.

### Combined Costs per Building to Eliminate the Deferred Maintenance Backlog and to Renovate and Modernize the Army Buildings Considered in CBO's Analysis, by Function

Millions of 2020 Dollars



Buildings in the three largest categories had costs per building for combined deferred maintenance and renovation and modernization that were significantly larger than the corresponding average costs per building for all buildings.

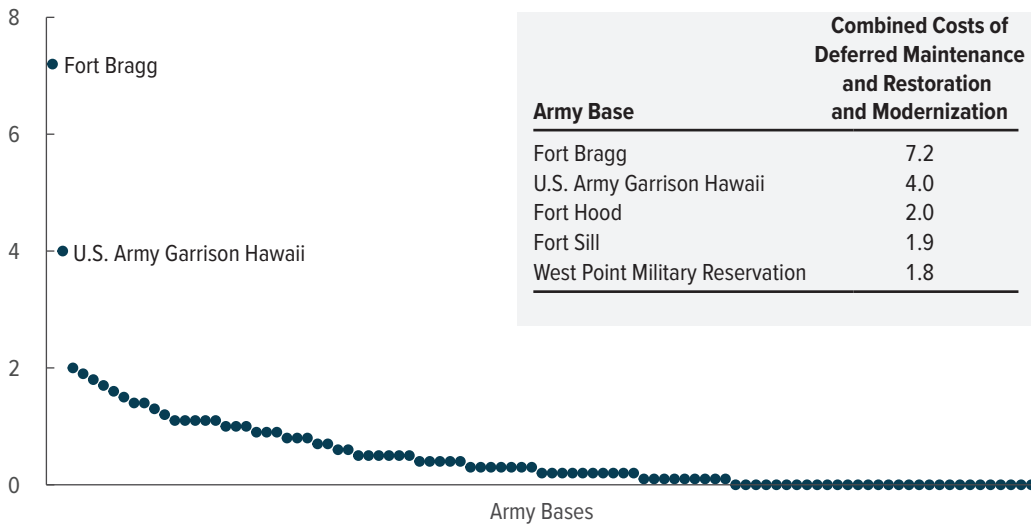


### Combined Costs of Deferred Maintenance and Renovation and Modernization, by Base

As with the findings earlier in this report, CBO found that the bases with the two largest combined costs for deferred maintenance and renovation and modernization in the Army's data set were Fort Bragg, at \$7.2 billion, and U.S. Army Garrison Hawaii, at \$4.0 billion. The total costs of deferred maintenance and renovation and modernization for those two bases, \$11.2 billion, represents about 21 percent of the total estimate of \$54 billion for the Army.

### Combined Costs to Eliminate the Deferred Maintenance Backlog and to Renovate and Modernize the Army Buildings Considered in CBO's Analysis, by Base

Billions of 2020 Dollars



Total combined costs for deferred maintenance and renovation and modernization were significantly larger for buildings located on Fort Bragg and U.S. Army Garrison Hawaii than for buildings on other bases.

## Costs Relative to Replacement Value

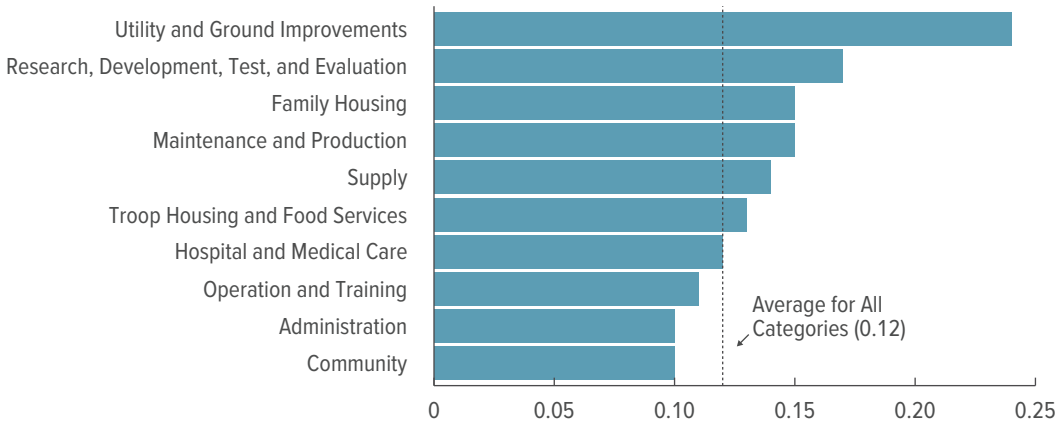
CBO compared the costs of deferred maintenance and renovation and modernization with the replacement value of the buildings considered in its analysis. That ratio indicates, for example, whether deferred maintenance costs are more or less than the costs to replace a building.

### Costs of Deferred Maintenance Relative to Replacement Value

The ratio of deferred maintenance costs to the replacement value of the buildings is linked to the FCI: Buildings with higher values would be in worse repair and therefore have lower FCI scores. So, at the upper limit, a ratio of 1.0 indicates that the costs of eliminating the deferred maintenance backlog for an existing building equal the costs of constructing a new building for the same function. (Accordingly, that building's FCI score would be zero.)

CBO found that the costs of eliminating the deferred maintenance backlog amounted to about one-eighth of the replacement value, on average, for all buildings. CBO also found that the deferred maintenance costs relative to the replacement value were higher for buildings used for utility and ground improvements than for other functions; buildings used for administration and community functions had the lowest value for that ratio.

### Ratio of Deferred Maintenance Costs to Replacement Value per Building for the Army Buildings Considered in CBO's Analysis, by Function

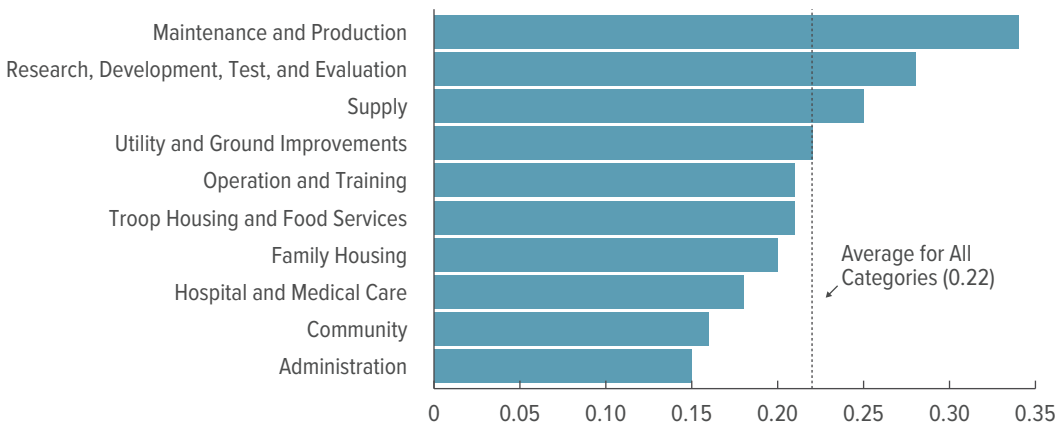


At roughly one-quarter, the ratio of the costs of deferred maintenance to the replacement value per building was highest for buildings dedicated to utilities.

**Costs of Renovation and Modernization Relative to Replacement Value**

When the costs of renovating and modernizing the Army's buildings are compared with the buildings' replacement value, a ratio of 1.0 indicates that the costs of renovating and modernizing an existing building equal the costs of constructing a new building for the same function. CBO found that the renovation and modernization costs amounted to about one-fifth of the replacement value for all buildings, on average. CBO also found that the renovation and modernization costs relative to the replacement value was higher for buildings used for maintenance and production than for other functions; buildings used for administration had the lowest value for that ratio.

**Ratio of Renovation and Modernization Costs to Replacement Value per Building for the Army Buildings Considered in CBO's Analysis, by Function**

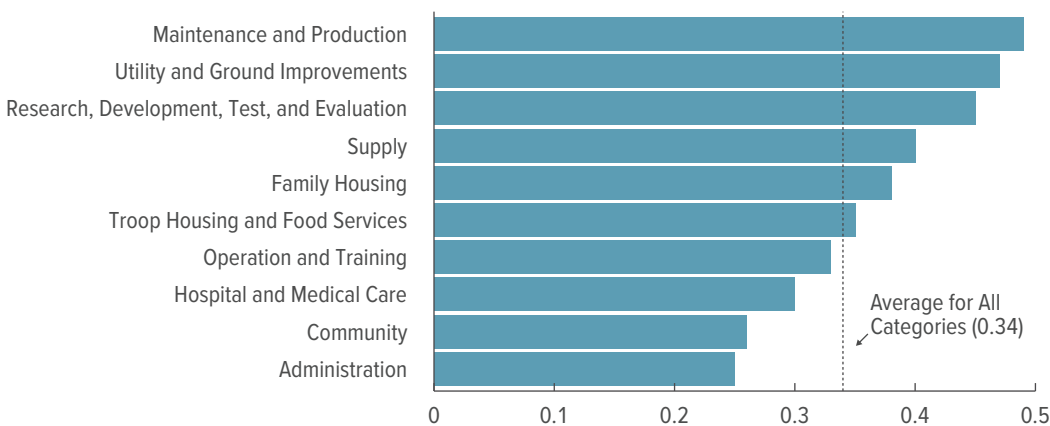


At roughly one-third, the ratio of renovation and modernization costs to the replacement value per building was highest for buildings used for maintenance and production functions.

**Combined Costs of Deferred Maintenance and Renovation and Modernization Relative to Replacement Value**

When the combined costs of deferred maintenance and costs to renovate and modernize the active Army's buildings are compared with their replacement value, a ratio of 1.0 indicates that those combined costs equal the costs to construct a new building. CBO found that the combined costs amounted to about one-third of the replacement value for all buildings, on average. The agency also found that the ratio was higher for buildings used for maintenance and production than for other functions; buildings used for administration had the lowest value for that ratio.

**Ratio of Combined Costs of Deferred Maintenance and Renovation and Modernization to Replacement Value per Building for the Army Buildings Considered in CBO's Analysis, by Function**



At almost one-half, the ratio of the combined costs of deferred maintenance and renovation and modernization to the replacement value per building was highest for buildings used for maintenance and production functions.





1. A separate breakdown by deferred maintenance costs and renovation and modernization costs may not add up to this total because of rounding.
2. Those costs would be higher if renovating the buildings required expanding them by adding square footage. For example, a building designed for an infantry battalion would probably need to be expanded to properly accommodate an armored battalion. If the cost of such expansion exceeded the statutory limit for the Department of Defense's operation and maintenance appropriation as stipulated in 10 U.S.C. §2811(e)(2), that work would be carried out using the department's military construction appropriation.
3. CBO used the price index for nonresidential fixed investments in the private sector, excluding the farming and mining sectors. That estimate is based on the economic forecast published in Congressional Budget Office, *The Budget and Economic Outlook: 2022 to 2032* (May 2022), [www.cbo.gov/publication/57950](http://www.cbo.gov/publication/57950).
4. In calculating deferred maintenance costs per building, CBO excluded buildings that do not have deferred maintenance or require renovation and modernization.
5. The book value did not reflect capital improvements to extend a property's useful life that were not yet recorded when CBO conducted its analysis.
6. CBO's finding about usage relative to the life span of buildings is based on about 70 percent of the buildings in its analysis because data about the Army's initial estimate of useful life were missing for about 14,000 buildings.
7. DoD's utilization rate would overstate the actual occupancy of buildings if units were not fully staffed. For instance, the utilization rate for a building with space for 100 people that was occupied by a unit designed to be staffed with 100 people would be recorded as 100 percent, even if the unit actually operated with no more than 70 people. Nevertheless, it is probably unusual for a building on an Army base to not be used in some manner.
8. Buildings with a production function include those used to produce ammunition or assemble combat vehicles. A large share of the active Army's family housing properties have been privatized, so contractors are responsible for their maintenance, and the properties would not be included in the data as the Army's responsibility.
9. Previous research has shown that, on average, an increase in age of the Navy's buildings was associated with larger annual maintenance and repair costs. See Henry L. Eskew, Bobby Jackson, and Joseph S. Domin, *A Study of Selected Issues in Military Construction and Base Operating Support*, CRM 86-267 (Center for Naval Analyses, December 1986), <https://apps.dtic.mil/sti/pdfs/ADA182899.pdf>. In addition, CBO's research shows that buildings that require major or significant renovation to fully meet the needs of users are older, on average, than buildings that require minimal or no renovation.
10. Funding for new construction includes funding for family housing and construction related to DoD's base realignment and closure program.
11. See the appendix for more information about the facility condition index and how CBO used that measure to estimate deferred maintenance.
12. The Government Accountability Office reported that DoD focuses its limited sustainment funding primarily on mission-critical facilities such as command-and-control facilities and runways instead of on facilities such as living quarters that it considers lower priority. That could explain CBO's finding that buildings used for troop housing and food services were in worse condition than other buildings. See Government Accountability Office, *Defense Infrastructure: DoD Should Better Manage Risks Posed by Deferred Facility Maintenance*, GAO-22-104481 (January 2022), <https://tinyurl.com/2p87945d>.
13. CBO's analysis of costs by base reflects the Army's data, but CBO did not independently verify those data. They may be accurate, but another possibility is that personnel at Fort Bragg and U.S. Army Garrison Hawaii used different criteria in assessing the condition of the buildings on their bases.



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# Appendix: How CBO Estimated the Army's Costs to Eliminate Its Deferred Maintenance Backlog

The Congressional Budget Office's estimate of deferred maintenance is based on the facility condition index, which is the measure the Army uses to assess the physical condition of buildings and other real property. That index accounts for deferred maintenance as in the following expression:

$$I = \left[ 1 - \left( \frac{dm}{rv} \right) \right] * 100$$

where  $I$  = index,  $dm$  = deferred maintenance, and  $rv$  = replacement value.

Deferred maintenance is derived from the formula above as follows:

$$dm = \left[ 1 - \left( \frac{I}{100} \right) * rv \right]$$

The sum of  $dm$  across all categories of buildings provides an estimate of the costs of eliminating the deferred maintenance backlog and restoring buildings to the Army's standards.

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# About This Document

This report was prepared at the request of the Chairman and Ranking Member of the Subcommittee on Readiness of the House Armed Services Committee. In keeping with the Congressional Budget Office's mandate to provide objective, impartial analysis, the report makes no recommendations.

Adebayo Adedeji and Kathryn McGinnis prepared the report with assistance from Humza Hussaini (formerly of CBO) and with guidance from David Mosher and Edward G. Keating. Adam Talaber fact-checked the report.

Brendan McGarry of the Congressional Research Service and Ellen Pint of the RAND Corporation provided expert insights. The assistance of external reviewers implies no responsibility for the final product; that responsibility rests solely with CBO.

Mark Doms and Robert Sunshine reviewed the report. Rebecca Lanning edited it, and Casey Labrack and R. L. Rebach created the graphics and prepared the text for publication. The report is available at [www.cbo.gov/publication/58220](http://www.cbo.gov/publication/58220).

CBO seeks feedback to make its work as useful as possible. Please send comments to [communications@cbo.gov](mailto:communications@cbo.gov).



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November 2022