

**HARDWOOD?
CARPET?
or TILE?**

**A Comparison of Flooring Costs
under Residential Conditions**

by David G. Martens

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NORTHEASTERN FOREST EXPERIMENT STATION, UPPER DARBY, PA.
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
WARREN T. DOOLITTLE, DIRECTOR

The Author

DAVID G. MARTENS received his bachelor of science degree in forest products from Iowa State University in 1961 and his master's degree in wood technology from the same institution in 1963. He joined the staff of the Northeastern Forest Experiment Station at the Forest Products Marketing Laboratory, Princeton, West Virginia, in 1963. At the time this report was prepared, he was in charge of flooring research at the Laboratory. At present he is in charge of production-oriented research on secondary manufactured wood products.

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TO SELECT A FLOORING MATERIAL

INITIAL INSTALLATION cost, annual maintenance cost, and total long-term cost are important in the purchase of flooring products. Before deciding on a flooring material, the prudent buyer will consider each of these in relation to his personal desires. From these evaluations, he will then be able to select the flooring material that is best suited to his individual needs.

Unfortunately very little information about these costs has been made available to the potential buyer. Most of the available information is in the form of claims by the manufacturers about their own products. When the buyer attempts to compare these claims, he finds that many of them are conflicting. Consequently he is unable to make the objective comparisons between products to determine the most appropriate material for his individual situation.

In an attempt to help alleviate this problem, we recently conducted a study to obtain unbiased information about the various flooring materials used under residential conditions. From our data we concluded that, when compared with composition tile and wall-to-wall carpeting, hardwood flooring has the lowest annual maintenance cost and lowest long-term cost. From the information contained in this report, the prospective buyer can make his own comparisons to determine the flooring material that suits him best.

THE STUDY

Our study was designed to determine and compare annual and long-term flooring costs based on the initial installation cost, the maintenance cost, and the wear life of the flooring material. We also attempted to determine the time and effort required to maintain each of the principal types of flooring material used under residential conditions.

Although single-family homes constitute the largest percentage of dwelling units, they vary greatly in size, type of structure, and costs. Also, accurate long-term records of wear life and major maintenance costs are very difficult to obtain for single-family homes, because of the relatively rapid owner turnover. Consequently we decided to use apartment buildings for our study because they represent a more standardized and compact unit to work with and because more accurate maintenance information is available for them.

Nine cities—Atlanta, Boston, Chicago, Denver, Houston, Los Angeles, New York, St. Louis, and Washington—were selected for inclusion in the study. We felt that this range of sampling would allow for the variation in flooring materials used throughout the Nation and would help us measure flooring costs and wear under different living and climatic conditions.

In each city, eight apartment buildings were selected for detailed study. We used four high-rise buildings and four garden-type buildings, two of each under 10 years old and two over 10 years old. This sampling procedure took into account different construction methods and newer flooring materials as well as the older types.

The types of flooring materials included were asphalt tile, vinyl asbestos tile, hardwood strip, hardwood block, nylon carpet, and wool carpet. For comparison these were combined into composition tile (asphalt and vinyl asbestos), hardwood (strip and block), and carpet (nylon and wool). The data were collected and analyzed in two phases.

Phase I.—Phase I was a personal interview with the owner or manager of each apartment building, to gather detailed information about their experiences with the various types of

flooring. From this information, we determined the installation costs of the various types of flooring, how often they were maintained by the owner, the cost of this maintenance, and the actual wear life. We also obtained information about room dimensions and flooring specifications.

Phase II.—In phase II, a subsample of individual apartment tenants in each building was selected for interview by mailed questionnaire. From this questionnaire we found out the time and effort the average housewife spends to maintain her floors, the materials required for maintenance, and her opinions of the different flooring materials. From these observations we were able to estimate the time, effort, and materials required to maintain each of the principal types of flooring.

RESULTS

The data were analyzed and evaluated from the standpoint of a single-family-home owner. That is, the data collected from the building owner were combined with the data collected from the apartment tenant to estimate the installation and maintenance costs that the owner of a single-family home would experience.

Apartment Building Owner

Composition tile had the lowest average installation cost—\$35.00 per 100 square feet—and an average wear life of 17.7 years (table 1). Hardwood flooring had the highest average installation cost—\$60.00 per 100 square feet—but had a total wear life of over 50 years. Carpet had an installation cost to that of hardwood—\$58.61 per 100 square feet—but had the lowest average wear life, 7.5 years.

Also included in the reported cost of hardwood flooring was a complete resanding and refinishing every 9.5 years at an average cost of \$11.97 per 100 square feet. The average total annual costs per 100 square feet to the building owners for the various types of flooring materials were: \$2.726 for composition tile, \$3.022 for hardwood, and \$10.458 for carpet.

Table 1.— Apartment owners' long-term cost
of living room floors

[Based on interviews with 72 building managers or owners]

Type of flooring material and cost element	Item
<i>Asphalt tile:</i>	
Installation cost/100 square feet	\$27.50
Wear life, years	16.7
Minor maintenance cost/100 square feet/year	\$ 0.503
Total annual cost/100 square feet	\$ 2.130
<i>Vinyl asbestos tile:</i>	
Installation cost/100 square feet	\$42.50
Wear life, years	18.7
Minor maintenance cost/100 square feet/year	\$ 1.036
Total annual cost/100 square feet	\$ 3.321
<i>Hardwood strip flooring:</i>	
Installation cost/100 square feet	\$60.00
Wear life, years	50+
Major maintenance cost/100 square feet	\$11.97
Average frequency of major maintenance, years	9.5
Minor maintenance cost/100 square feet/year	\$ 0.576
Total annual cost/100 square feet	\$ 3.036
<i>Hardwood block flooring:</i>	
Installation cost/100 square feet	\$60.00
Wear life, years	50+
Major maintenance cost/100 square feet	\$11.97
Average frequency of major maintenance, years	9.5
Minor maintenance cost/100 square feet/year	\$ 0.549
Total annual cost/100 square feet	\$ 3.009
<i>Nylon carpet:</i>	
Installation cost/square yard	\$ 4.49
Installation cost/100 square feet	\$49.88
Wear life, years	6
Major maintenance cost/100 square feet/year	\$ 2.517
Average frequency of major maintenance, years	1.62
Total annual cost/100 square feet	\$10.830
<i>Wool carpet:</i>	
Installation cost/square yard	\$ 6.06
Installation cost/100 square feet	\$67.33
Wear life, years	9
Major maintenance cost/100 square feet/year	\$ 2.606
Average frequency of major maintenance, years	1.75
Total annual cost/100 square feet	\$10.087

Apartment Tenant

Separate information was provided by the housewives for the living room, bedroom, and dining room areas in their apartments. This allowed for comparison of flooring types under different room-use conditions.

Living Room.—Data from the questionnaires indicated that a

Table 2. — Average minor maintenance costs¹ (professional carpet cleaning separate), by type of flooring and rug coverage area
[In dollars/100 square feet/year]

Floor type	Percent of rug coverage				
	0-20	20-40	40-60	60-80	80-100
LIVING ROOM¹					
Composition tile	9.89	3.91	3.56	2.17	2.21
Hardwood flooring	4.21	1.32	4.57	1.82	1.90
Carpet (wall-to-wall)	—	—	—	—	1.63
Professional carpet-cleaning costs	0	1.16	2.20	2.32	6.35
BEDROOM¹					
Composition tile	5.20	(*)	2.60	1.18	2.91
Hardwood flooring	3.24	5.15	1.62	7.63	1.62
Carpet (wall-to-wall)	—	—	—	—	1.36
Professional carpet-cleaning costs	0	1.56	2.26	4.21	4.52
DINING ROOM²					
Composition tile	6.90	(*)	(*)	(*)	1.69
Hardwood flooring	5.06	2.08	0.50	2.65	2.72
Carpet (wall-to-wall)	—	—	—	—	1.92
Professional carpet-cleaning costs	0	1.51	2.41	4.68	9.97

¹ Based on responses from 760 housewives. Minor maintenance costs were calculated from maintenance frequencies and type of maintenance materials used as reported by the housewives together with maintenance materials prices and expected coverage reported by the manufacturing companies.

² Based on responses from 459 housewives.

* Insufficient data

tenant spent \$9.89 per 100 square feet per year for floor maintenance in a living room completely covered with composition tile (table 2). This compared with \$4.21 for maintaining a hardwood floor. Wall-to-wall carpet cost the tenant \$7.98 to \$8.56 per 100 square feet per year, depending on whether it was owned by the tenant or building owner. By far the greatest part of the carpet expense was for professional carpet cleaning, which averaged \$6.35 per 100 square feet per year.

Bedroom.—In general, the maintenance costs for the various floor types were less in the bedrooms than in the living rooms. For wall-to-wall carpet in the bedroom, the tenants spent on the average of \$5.88 to \$7.43 per 100 square feet per year, depending on whether the carpet was owned by the tenant or the building owner. This compared with \$5.20 for maintaining a floor completely covered with composition tile and \$3.24 for maintaining a hardwood floor.

Table 3. — Summary of average minor maintenance costs,¹ by type of flooring and rug-coverage area

[In dollars/100 square feet/year]

Floor type	Percent of rug coverage				
	0-20	20-40	40-60	60-80	80-100
LIVING ROOM					
Composition tile	9.89	5.07	5.76	4.49	8.56
Hardwood flooring	4.21	2.48	6.77	4.14	8.25
Carpet (wall-to-wall)	—	—	—	—	7.98
BEDROOM					
Composition tile	5.20	(*)	4.86	5.39	7.43
Hardwood flooring	3.24	6.71	3.88	11.84	6.14
Carpet (wall-to-wall)	—	—	—	—	5.88
DINING ROOM					
Composition tile	6.90	(*)	(*)	(*)	11.66
Hardwood flooring	5.06	3.59	2.91	7.33	12.69
Carpet (wall-to-wall)	—	—	—	—	11.89

¹ Includes cost of professional carpet cleaning.

* Insufficient data

In the bedrooms, carpet was the most expensive to maintain, but over half of the cost was accounted for by professional cleaning (table 2).

Dining Room.—Average floor maintenance costs in the dining rooms were the highest for wall-to-wall carpet and hardwood. Average maintenance cost for wall-to-wall carpet ranged from \$11.66 to \$12.69 per 100 square feet per year. This was the highest maintenance cost of any floor type in any room. But almost \$10.00 of this was due to professional cleaning cost. The average maintenance cost for hardwood was \$5.06 per 100 square feet per year. This compared with \$6.90 for composition tile (table 2). A complete summary of the tenants' maintenance expenses in each of the three rooms is given in table 3.

Single-Family-Home Owners

Total Annual Costs

We combined the cost to the building owner with the cost to a tenant to estimate total flooring cost for a single-family-home owner. The owner costs were the installation cost in relation to wear life, plus sanding and refinishing costs. Tenant costs were those of maintenance only.

In annual cost per 100 square feet, hardwood floors showed a definite economic advantage when compared to composition tile or wall-to-wall carpet. In the living rooms hardwood floors had an annual cost of \$6.67 compared to \$11.87 for composition tile and \$16.09 for wall-to-wall carpet. In the bedrooms hardwood floors had an annual cost of \$5.70 compared to \$7.18 for composition tile and \$14.20 for wall-to-wall carpet. In the dining rooms annual costs were \$7.52, \$7.88, and \$19.89 for hardwood, composition tile, and wall-to-wall carpet respectively.

A tabulation of estimated costs to a single-family-home owner is given in table 4.

Table 4. — Estimated long-term flooring costs for single-family-home owners, by type of room and type of flooring

Type of flooring material and cost element	Living room	Bedroom	Dining room
<i>Composition tile:</i>			
Installation cost/100 sq. ft.	\$35.00	\$35.00	\$35.00
Wear life, years	17.7	17.7	17.7
Minor maintenance costs/ 100 sq. ft./year	\$ 9.89	\$ 5.20	\$ 6.90
Total annual cost/100 sq. ft./year	\$11.87	\$ 7.18	\$ 7.88
<i>Hardwood flooring:</i>			
Installation cost/100 sq. ft.	\$60.00	\$60.00	\$60.00
Wear life, years	50+	50+	50+
Major maintenance cost/100 sq. ft. every 9.5 years	\$11.97	\$11.97	\$11.97
Minor maintenance cost/100 sq. ft./year	\$ 4.21	\$ 3.24	\$ 5.06
Total annual cost/100 sq. ft./year	\$ 6.67	\$ 5.70	\$ 7.52
<i>Carpet (wall-to-wall):</i>			
Installation cost/sq. yd.	\$ 5.28	\$ 5.28	\$ 5.28
Installation cost/100 sq. ft.	\$58.61	\$58.61	\$58.61
Wear life, years	7.5	7.5	7.5
Minor maintenance cost/100 sq. ft./year (professional cleaning)	\$ 6.35	\$ 4.52	\$ 9.97
Minor maintenance cost/100 sq. ft./year	\$ 1.92	\$ 1.86	\$ 2.10
Total annual cost/100 sq. ft./year	\$16.09	\$14.20	\$19.89

Maintenance Time

Costs alone do not provide a complete picture. The time spent maintaining the different flooring materials is also important.

Living Room.—The questionnaires received from the tenants indicated that the average housewife spent 44.4 hours per 100 square feet per year maintaining composition tile in her living room, compared to 21.8 hours for hardwood flooring and 14.1 to 21.1 hours for wall-to-wall carpet (average 16.0 hours). All times for the living room are shown in table 5.

Bedroom.—Composition tile in the bedrooms required 37.2

Table 5. — Average time spent¹ for floor maintenance, by type of flooring and rug-coverage area
[In hours/100 square feet/year]

Floor type	Percent of rug coverage				
	0-20	20-40	40-60	60-80	80-100
LIVING ROOM					
Composition tile	44.4	34.0	41.6	52.1	21.1
Hardwood flooring	21.8	17.9	34.4	28.2	14.1
Carpet (wall-to-wall)	—	—	—	—	14.1
BEDROOM					
Composition tile	37.2	(*)	31.5	34.0	21.2
Hardwood flooring	23.9	30.7	17.8	41.9	14.2
Carpet (wall-to-wall)	—	—	—	—	16.3
DINING ROOM					
Composition tile	102.0	(*)	(*)	(*)	27.1
Hardwood flooring	36.4	32.3	22.3	52.8	23.5
Carpet (wall-to-wall)	—	—	—	—	36.1

¹ Weighted average of all flooring types with 80-100 percent rug coverage is 16.6 hours/100 square feet/year.

* Insufficient data

hours per 100 square feet per year to maintain as compared to 23.9 hours for hardwood flooring and 14.2 to 21.2 hours for wall-to-wall carpet (average 16.6 hours). All times reported for bedroom floors are shown in table 5.

Dining Room.—Maintenance time requirements for dining room floors were considerably higher than for the other two rooms. Housewives reported 102.0 hours per 100 square feet per year needed to maintain composition tile floors under dining room conditions, compared to 36.4 hours for hardwood flooring and 23.5 to 36.1 hours for wall-to-wall carpet (average 29.9 hours). All dining room times are shown in table 5.

Flooring Preferences

Housewives' relative preferences for the different types of flooring materials were also studied. This was done by analyzing their answers to the question: "If you decided tomorrow

to build a new home, what type of flooring or floor covering would you prefer for the living room, the dining room, and the bedrooms?"

Living Room.—When the answers for the living room were analyzed, it soon became apparent that housewives' preferences between hardwood and carpet were closely associated with the type of flooring material they had been living with. Approximately 65 percent of the people who had hardwood floors said they would prefer hardwood in a new home; the rest preferred wall-to-wall carpet. Of the people who had wall-to-wall carpet, about 67 percent said they wanted carpet; the rest wanted hardwood floors.

But of the people who had composition tile, only 10 percent said they would put it in the living room of a new home. About 40 percent preferred hardwood, and 50 percent preferred wall-to-wall carpet.

Hence 10 percent of all respondents had composition tile but only 4 percent of all respondents would put it in the living room of their new home. Similarly, 66 percent of the respondents had wall-to-wall carpet or a floor more than 60 percent covered with carpet, and 57 percent of the respondents said that they would prefer wall-to-wall carpet in a new home. Hardwood floors were represented by 24 percent of the respondents, but 38 percent of the respondents said that they would prefer hardwood in a new home. All of the preference data for living rooms are presented in table 6.

Bedroom.—Preferences for flooring materials in the bedrooms were similar to those for living rooms. Approximately 65 percent of the people who had hardwood floors said they would prefer hardwood for the bedrooms in a new home; 29 percent preferred wall-to-wall carpet. Of the people who had wall-to-wall carpet, about 68 percent said they wanted carpet; 26 percent wanted hardwood floors. Again, of the people who had composition tile in the bedrooms, only 13 percent said they would put it in a new home. The remaining preferences were split evenly between hardwood and carpet, with 43 percent each. All of the preference data for the bedrooms are presented in table 6.

Table 6. — Preferences for flooring, by type of flooring and rug-coverage area

[In percent]

Type of flooring respondents now have	Percent of total	Floor type preferred in a new home					Total
		Compo- sition tile	Hard- wood flooring	Carpet, wall-to- wall	Other		
LIVING ROOM							
Composition tile (less than 60% covered)	10	10	39	51	0	100	
Hardwood flooring (less than 60% covered)	24	(*)	65	33	2	100	
Carpet (wall-to-wall) (over 60% covered)	66	4	28	67	1	100	
Percent of total	100	4	38	57	1	100	
BEDROOM							
Composition tile (less than 60% covered)	15	13	43	43	1	100	
Hardwood flooring (less than 60% covered)	38	4	65	29	2	100	
Carpet (wall-to-wall) (over 60% covered)	47	4	26	68	2	100	
Percent of total	100	5	43	50	2	100	
DINING ROOM							
Composition tile (less than 60% covered)	12	42	31	27	0	100	
Hardwood flooring (less than 60% covered)	34	18	60	20	2	100	
Carpet (wall-to-wall) (over 60% covered)	54	14	26	56	4	100	
Percent of total	100	19	39	40	2	100	

* Less than 1 percent.

Dining Room.—Housewives' preferences for dining room flooring were considerably different from those for the living room and bedrooms. For the dining room, of the people who had composition tile, 42 percent said they would also put it in a new home, 31 percent would switch to hardwood, and 27 percent preferred carpet.

Of the people who had hardwood floors, 60 percent would

put hardwood in a new home, 20 percent would go to carpet, and 18 percent would prefer composition tile. Similarly, of those who had carpet, 56 percent would prefer to have it in the dining room of a new home, 26 percent would prefer hardwood, and 14 percent would prefer composition tile.

Although 54 percent of all the respondents had wall-to-wall carpet or a floor more than 60 percent covered with carpet, only 40 percent of the respondents said they would prefer carpet in the dining room of a new home. Composition tile floors were represented by 12 percent of the respondents, but 19 percent of the respondents stated they would prefer it in a new home. Similarly, hardwood floors were represented by 34 percent of the respondents, but 39 percent preferred hardwood. All dining room preference data are presented in table 6.

Ease and Expense of Maintenance

We also attempted to obtain the housewives' opinions about the ease and expense of maintaining the various types of flooring. However, the data turned out to be rather inconclusive.

The closest that the respondents came to a consensus was in designating wall-to-wall carpet as the easiest to care for; 59 percent of the respondents so indicated (table 7). For the other types of flooring, no clear pattern of opinion could be found in the response to the question about maintenance ease or expense.

Table 7.—Opinions of housewives about ease and expense of maintaining living room floor surfaces, by type of flooring, in percentage of response

Rating	Compo- sition tile	Hard- wood flooring	Large rug on wood or tile	Wall-to- wall carpet	Total
Easiest	6	20	15	59	100
Most difficult	33	39	14	14	100
Cheapest	28	26	12	34	100
Most expensive	12	32	8	48	100

DISCUSSION

Every attempt was made in this study to obtain typical or representative samples from the real world. We wanted data on the actual costs encountered and the actual procedures used by the average housewife in maintaining different flooring materials. For instance, we found that over 40 percent of the housewives who had hardwood floors wet-mopped them. This procedure, though not recommended by manufacturers, does occur in real life and must be accounted for in any estimate of maintenance time. Waxing was also performed much more frequently than manufacturers recommend or believe to be necessary.

We collected data only on medium-rental apartments because neither luxury nor low-rent housing could be considered typical. We also used both high-rise and garden-type apartments to take into account differences in building construction and flooring types.

Every attempt was made to eliminate bias. We believe the results are representative of the true relative costs for maintaining the various types of flooring materials used under residential conditions.

Apartment Building Owner

The apartment owner is a businessman; so factors affecting operating costs such as installation cost, wear life, and maintenance costs of the floors are important to him.

Installation Costs

The estimates of installation costs used for smooth-surface floors in this report are not those given by the building owner. Since many of these floors were installed over 15 years ago, the quoted costs were unrealistic for today's conditions.

For tile floors the installation costs used were those published by the Wharton School of Finance and Commerce in a recent study (*Parks 1966*).

For hardwood flooring, after consulting with hardwood floor-

ing manufacturers, flooring contractors, and builders, we selected the installed price of \$60 per 100 square feet. We believe this figure represents the majority of installations. Several companies quoted prices in the range of \$45 to \$58.

For wall-to-wall carpet the installed cost is that quoted by the building owners. Because of the relatively short life of this material, these prices were considered to be current. The costs used included carpet, pad, labor, and accessories such as door strips. The total installation cost for nylon carpet averaged \$4.49 per square yard, and the cost for wool carpet averaged \$6.06 per square yard.

Wear Life

The wear-life values reported by the building owners are very close to those expected by the manufacturers. The Asphalt and Vinyl Tile Institute (1963) estimated that wear life is 15 years for asphalt tile and 20 years for vinyl asbestos. These correspond closely with the values found in this study.

The wear life of hardwood flooring is generally considered to be the life of the building. However, the reported frequency of complete resanding and refinishing every 9.5 years is greater than most hardwood flooring manufacturers predict.

The reported wear life for carpet is slightly higher than that predicted by the general rule of thumb of 1 year of wear life per dollar of installation cost per square yard. This additional life may be due to better manufacturing methods, better maintenance methods, or to lower acceptable appearance levels used by the apartment building owners to determine when the carpets need replacement.

Maintenance Costs

Maintenance costs to the building owner generally result from getting a vacated apartment ready for new tenants. So these costs are related to tenant turnover. In general, the turnover is low in the Northeast and parts of the South where hardwood and asphalt tile are the principal flooring materials. In the rest of the Nation, especially the West, turnover is high; in these areas carpet and vinyl asbestos are more commonly

used. The difference in turnover obviously has some effect on the relative maintenance cost for the different types of flooring.

The average maintenance cost for vinyl asbestos flooring was also higher because of the policy of one building owner who periodically waxed and buffed the floors while the tenants were in the apartments. Although his practices were logical, his costs were higher; and they did raise the average. If his costs were not included, the average maintenance cost for vinyl asbestos would have been similar to that for asphalt tile.

Most building owners felt they could clean the carpets and in some cases lift the pile for 4 to 4.5 cents per square foot, and some indicated they could do it for as little as 3 cents. Others hired the cleaning done, and their costs were slightly higher.

In addition to waxing and buffing the floors, the building owners who had hardwood floors had the cost of complete resanding and refinishing. This cost is comparable to the cost for complete replacement of the other types of flooring. It would also occur to the single-family-home owner, so it was included in the estimate of his costs. Note that the 9.5 year frequency was the average for the owners who did refinish their floors. Several owners had hardwood floors much older than 9.5 years but had never resanded or refinished. For example, one building had a stained oak parquet floor that was over 20 years old and had not been refinished.

Although the total flooring cost will differ from building to building, the relative owner costs of the various types of flooring should remain constant—hardwood and composition tile were the least expensive and carpet the most expensive.

Apartment Tenant

The apartment tenant, in contrast to the apartment owner, was not concerned with installation cost or wear life of the flooring material. Her main expense, other than professional carpet cleaning, was the out-of-pocket cost for maintenance materials such as waxes, strippers, shampoos, and spot cleaners. These are the minor maintenance costs.

Minor Maintenance Material Costs

In calculating maintenance cost, we separated cost of minor maintenance materials and cost of professional carpet cleaning (table 2).

The percent of rug coverage was considered the percent of room area covered by rug or carpet. The values for 0 to 20 percent coverage are costs for maintaining only smooth-surface flooring. All times and costs for maintaining any rugs in the 0-to-20-percent class were disregarded because these would be small throw rugs, which could be easily moved and washed in a washing machine. Likewise, the values given in the 80-to-100-percent class pertain only to the cost of maintaining carpet in a room. Any costs reported for smooth-surface floors were disregarded in this class because they would represent a small area around the edge of the room or under furniture.

For example, in table 2, the \$9.89 for composition tile and \$4.21 for hardwood are costs per year to wax and strip 100 square feet of room area having these types of floors. The \$3.91 for composition tile 20-to-40-percent covered is for both wax and other materials used on the floor and for shampoo and spot remover used on the carpet. However, the \$2.21 for composition tile 80-to-100-percent covered is only for shampoo and spot remover used on the carpet at home. None of this cost pertains to composition tile because none or very little of it was showing. All of these costs are based on the frequency of maintenance, the types of products used and their prices, and the coverage obtained from these products.

Professional Carpet-Cleaning Costs

The professional carpet-cleaning costs were the average costs to the tenants for hiring someone to clean their carpet either in their apartment or at a cleaning establishment. A cost of \$8.32 per 100 square feet of carpet per year was the average cost for the housewives who had their living room carpets professionally cleaned, regardless of carpet size.

However, not all housewives had their carpets professionally

cleaned. For instance, the average cost for those living room carpets that were cleaned in the 20-to-40 percent coverage class was \$8.84 per 100 square feet of carpet per year. However, only 44 percent of the living room carpets were professionally cleaned, so the average for all living room carpets was \$3.86 per 100 square feet of carpet per year. In addition, since carpet made up only 30 percent of the living room area in that category, the cost per 100 square feet of room per year was only \$1.16. The 44 percent of the living room carpets in the 20-to-40 percent category that were professionally cleaned compares to 73 percent in the 80-to-100 percent category. This would be expected because the larger carpet is more difficult for the housewife to clean by herself.

Also the fact that these values are given in dollars per year does not mean that every housewife has her carpet professionally cleaned every year. Many were professionally cleaned only once every 2 or 3 years, and were shampooed at home in between. As we noted before, many were never professionally cleaned, especially the smaller rugs.

Combined Minor Maintenance Cost

The combined minor maintenance cost to the tenant was obtained by adding the cost for minor maintenance materials to the cost for professional carpet cleaning (table 3).

Living Room.—The annual maintenance cost of hardwood floors in living rooms (\$4.21 per 100 square feet) is about half that of either of the other two types of flooring; composition tile had a cost of \$9.89 and wall-to-wall carpet (80-to-100-percent covered) averaged \$8.27 per 100 square feet per year.

The maintenance costs for wall-to-wall carpet (80-to-100-percent cover) are the most reliable because approximately 50 percent of the tenants responding had floors in their living rooms that were over 80 percent covered with rug or carpet. The fewest observations were obtained in the low rug-coverage classes for composition tile, and the value of \$9.89 for composition tile 0-to-20-percent covered is based on only 24 respondents. So less confidence can be placed in it than in the values for the other floor types and coverage classes.

Bedroom.—In the bedroom areas, the maintenance cost of hardwood floors (\$3.24 per 100 square feet per year) was about half that of carpet and about 60 percent that of tile; wall-to-wall carpet averaged \$6.38 and composition tile had a cost of \$5.20.

Good confidence can be placed in all three of these values because the composition tile figure is based on 95 observations, the hardwood figure on 235 observations, and the wall-to-wall carpet figure on 267 observations. Although composition tile had fewer observations than the other two, 95 observations should still be enough to give a good estimate of the true average maintenance cost.

Dining Room.—The generally high maintenance costs for the dining room areas were probably caused by the family's frequent use of this area and the chance of spills which would require additional maintenance. Hardwood floors (\$5.06 per 100 square feet per year) were the least expensive to maintain, the cost being about 75 percent that of composition tile and approximately 40 percent that of carpet. Composition tile required \$6.90 per 100 square feet per year for maintenance and wall-to-wall carpet required an average of \$12.07.

Reliability in these values should be good because the number of observations for composition tile, hardwood, and wall-to-wall carpet were 65, 149, and 169 respectively.

Single-Family-Home Owner

The floor costs for a single-family-home owner (table 4) are of course only estimates. We realize that a housewife in an apartment may not care for those floors as well as she might care for the floors in her own home. However, we believe that the relative differences in cost among the various floor types should remain about the same. There is no reason why she should treat one floor type better than another if she owned a home rather than rented, or vice versa. Consequently, all values in table 4 may be lower (or possibly even higher) than would actually occur in a single family home, but the relative ratings of the flooring types should not change.

Total Floor Costs

Hardwood floors have a distinct economic advantage when considering total floor costs. Under the conditions encountered in this study, a homeowner with a three-bedroom home (living room 15-by-20-foot, dining room 9-by-12-foot, and bedrooms 12-by-14-foot each, total for all rooms approximately 900 square feet) would save \$2,111.50 over the period of a 25-year mortgage if he had hardwood floors instead of wall-to-wall carpet; he would save \$586.25 if he had hardwood floors instead of composition tile. Cost savings such as these are worth considering when deciding which flooring material you should buy.

Maintenance Time

The average maintenance time spent on the different types of flooring varied considerably among materials. The high time values for composition tile were the result of frequent wet-mopping, buffing, and waxing. It seems that the housewife takes considerably more time and effort to keep composition tile at the appearance level she wants than she does for the other two types of flooring. Maintenance time for hardwood flooring and wall-to-wall carpet were approximately the same; carpet averaged about 5½ hours less per year.

Living Room.—Maintenance times for the living rooms were generally lower than for the other two room types. This should probably be expected because even though the living room is an area that requires a high appearance level, it is also more open and uncluttered and would be easier to clean.

The same time (14.1 hours/100 square feet/year) required to maintain hardwood floors 80-100 percent covered as wall-to-wall carpet would indicate that housewives do not treat carpet they own differently than carpet owned by the apartment owners.

Bedroom.—The bedrooms maintenance times were similar to those for the living rooms. In general, they were maintained less frequently than the living rooms, but the maintenance times required for each cleaning were about the same. Since bedrooms were only about half the size of the living rooms,

when maintenance time was compared on a per-square-foot basis, they came out about equal.

Here again, the 14.2 hours shown for hardwood floors 80-100 percent covered compared with the 16.3 hours shown for wall-to-wall carpet owned by the apartment building would indicate no bias against flooring material not owned by the tenant.

Dining Room.—In general, the maintenance times required were higher for the dining rooms than for either of the other two rooms. This should not be surprising. Dining rooms have an appearance level similar to that of living rooms and would require maintenance at least as frequently if not more frequently. Also, the dining rooms are small in comparison (averaging 108 square feet for this study) and generally quite congested, thereby making cleaning more difficult. When all these factors are combined, maintenance time on a square foot basis is bound to be higher. As an example, consider a dining room with 100 square feet and a living room with 300 square feet, each having the same frequency of maintenance and each taking 20 minutes per cleaning. On a square-foot basis, the maintenance time for the dining room would be three times as high as that for the living room.

Flooring Preferences

Housewives' flooring preferences (table 6) indicated that in general either the housewives selected and had the type of flooring they prefer, or that they had convinced themselves that the type of floor that they had is really what they would prefer if they were given a choice. Use of these data to predict national or regional preferences would not be valid because preferences seem to depend on what type of flooring material the respondents have at the time the survey is taken. For example, a survey of apartment dwellers in Los Angeles who have hardwood floors would probably indicate a preference for hardwood in that area. Yet Los Angeles has traditionally been predominantly a carpet area. However, the correlation between the type of flooring housewives have and the type they prefer could be an indicator of housewives' satisfaction with the various types of flooring.

Ease and Expense of Maintenance

The portion of the study dealing with housewives' opinions about the ease and expense of maintaining the different types of flooring was included for two reasons. First, we wanted to find out if there were predominant feelings among housewives that certain flooring materials were easiest or most difficult, cheapest or most expensive, to maintain. Second, we wanted to find out how closely these opinions were related to actual time and cost data determined by the study.

On the first point, we found that housewives apparently have no strong feelings about the ease and expense of maintaining the different floor coverings.

And on the second point, their opinions did not agree very well with the figures that they as a group provided. The combined categories of large rug on wood or tile and wall-to-wall carpet received about three-fourths of the votes for easiest to maintain. This does parallel our findings. However, this same combination received about 30 percent of the votes for most difficult, and this does not agree. Likewise, 40 percent of the housewives indicated that hardwood floors were the most difficult to maintain, yet those apparently took less than one-half as much time to maintain as composition tile. Almost 50 percent of the votes for least expensive to maintain went to the large rug or carpet categories, yet these were found to be the most expensive. And over 30 percent of the votes for most expensive went to hardwood, which was actually the least expensive.

CONCLUSION

Data from our study show that, regardless of the room type (living room, dining room, or bedroom), hardwood floors cost less than floors covered with composition tile or carpet. This is true both in terms of yearly cost and long-term cost. Hardwood floors also have a wear life much longer than that of other flooring materials.

Wall-to-wall carpet, although two to three times as expensive

as hardwood, has the advantage of requiring less time to maintain; but the difference is not large.

Composition tile is the cheapest floor material for an apartment owner to have in his building; but tenant maintenance costs are high, and tenant preferences indicate that tile is not as well received as hardwood, which is only slightly higher in total cost. Wall-to-wall carpet is by far the most expensive to the apartment building owner, although it is well received by the tenants.

Single-family-home owners could save more than \$2000 over the period of their mortgage by having hardwood floors throughout their home instead of wall-to-wall carpeting. Likewise, they could save more than \$580 by having hardwood instead of composition tile.

Overall, in yearly cost, long-term cost, wear life, maintenance time, and preference, hardwood floors appear to be the most practical for the single-family-home owner, the apartment tenant, and the apartment building owner.

REFERENCES

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|---|---|
| Asphalt and Vinyl Tile Institute.
1963. SELECTING A FLOOR. Progressive Architecture 44 (12): 146. | TYPES OF RESIDENTIAL FLOORING. USDA Forest Serv. Res. Paper NE-124, 23 pp. |
| Martens, David G.
1968. FLOORING COSTS: A COMPARISON OF INSTALLATION AND MAINTENANCE COSTS FOR THREE | Parks, George M.
1966. THE ECONOMICS OF CARPETING AND RESILIENT FLOORING: AN EVALUATION AND COMPARISON. Univ. Pa. Wharton School Indust. Res. Unit. 87 pp. |



APPENDIX I

Table 8. — Number of observations in each cell

Type of flooring	Rug coverage, in percent					Total
	0-20	20-40	40-60	60-80	80-100	
LIVING ROOM						
Composition tile	24	9	39	32	105	209
Hardwood flooring	60	37	88	86	185	456
Carpet (wall-to-wall)	—	—	—	—	95	95
Total	—	—	—	—	—	760
BEDROOM						
Composition tile	95	4	12	25	67	203
Hardwood flooring	235	19	32	71	117	474
Carpet (wall-to-wall)	—	—	—	—	83	83
Total	330	23	44	96	267	760
DINING ROOM						
Composition tile	65	0	3	1	45	114
Hardwood flooring	149	16	29	27	51	272
Carpet (wall-to-wall)	—	—	—	—	73	73
Total	214	16	32	28	169	459

Table 9. — Range¹ of average times spent for maintenance, by type of flooring and rug-coverage area
[In hour/100 square feet/year]

Floor type	Range	Percent of rug coverage				
		0-20	20-40	40-60	60-80	80-100
LIVING ROOM						
Composition tile.....	Low	17.6	24.3	33.5	22.6	17.8
	Mean	44.4	34.0	41.6	52.1	21.1
	High	74.4	38.7	49.8	68.3	24.9
Hardwood flooring.....	Low	8.7	13.6	20.4	16.7	9.0
	Mean	21.8	17.9	34.4	28.2	14.1
	High	25.1	38.5	49.2	38.0	14.7
Carpet (wall-to-wall).....	Low	—	—	—	—	10.4
	Mean	—	—	—	—	14.1
	High	—	—	—	—	14.6
BEDROOM						
Composition tile.....	Low	14.7	—	21.3	22.1	13.6
	Mean	37.2	(*)	31.5	34.0	21.2
	High	62.4	—	36.1	48.0	40.7
Hardwood flooring.....	Low	15.6	21.2	16.4	24.0	10.5
	Mean	23.9	30.7	17.8	41.9	14.2
	High	30.2	39.2	18.8	52.0	18.1
Carpet (wall-to-wall).....	Low	—	—	—	—	8.8
	Mean	—	—	—	—	16.3
	High	—	—	—	—	17.6
DINING ROOM						
Composition tile.....	Low	36.3	—	—	—	25.1
	Mean	102.0	(*)	(*)	(*)	27.1
	High	241.2	—	—	—	32.0
Hardwood flooring.....	Low	22.3	14.1	13.0	25.8	14.3
	Mean	36.4	32.3	22.3	52.8	23.5
	High	44.7	48.9	32.7	122.2	28.1
Carpet (wall-to-wall).....	Low	—	—	—	—	21.4
	Mean	—	—	—	—	36.1
	High	—	—	—	—	38.4

¹ Range of average regional values

* Insufficient data

APPENDIX II

Basic Assumptions in Conducting the Study

The main assumption in this study was that the housewife would provide the most objective information about maintenance procedures used, materials required, equipment needed, and when the floors were in need of maintenance to keep them at an acceptable appearance level. If it were possible to conduct the study under controlled conditions, we would have had to define these criteria, and therefore they would have been subjective and subject to bias. Although we eliminated the subjectiveness, we did so at the expense of greater variability. By using housewives' opinions, we did not get the smooth curves obtainable through controlled studies.

The only criteria we specified was a standard of minimum maintenance. We insisted that some method of removing the dust must be performed, that smooth-surface flooring materials must be waxed, and that carpets must be spot-cleaned. How the housewives performed these duties or how often was not specified. In theory then, a housewife may wax smooth-surface floors once a year and never wet-mop, buff, or remove wax buildup. Likewise, she may spot-clean her carpets and never need to shampoo or lift the pile. However, the study showed that most housewives were better homemakers than that.

Another assumption, discussed in the text, was that the apartment housewives would provide maintenance information indicative of that obtained from housewives in a single-family home. Although it is possible that housewives in an apartment do not take as good care of their floors as housewives in a single-family home, there is no reason to believe they would take better care of one flooring material than another. Therefore the relative differences between flooring materials would remain the same.

Another assumption was that average minor maintenance costs could be determined by combining (1) the information from the housewives on how frequently they performed their various maintenance functions and the types of materials they used with (2) the information from the materials manufacturers on the suggested retail prices of the various materials and the coverage areas they expected from them.

The major categories of waxes and wax removers used in calculating minor maintenance costs on smooth-surface floors included: (1) solvent-type waxes (liquid, buffable); (2) solvent-type waxes (paste, buffable, including paste wax emulsions); (3) wax emulsions (liquid self-polishing, cleaning, or non-cleaning); and (4) commercial wax removers. The major categories of shampoos and cleaners used for carpets and rugs included: (1) liquid shampoos; (2) dry rug cleaners; (3) detergents and other cleaners, which are mixed with water; and (4) commercial spot cleaners.



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