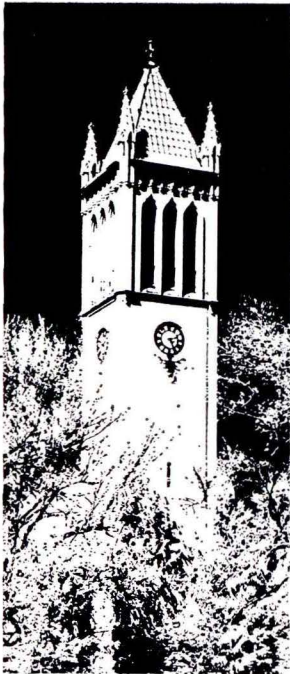


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Least-Cost Wall and Floor Constructions for Limiting Transmission of Noise



by Dean R. Prestemon

Department of Forestry

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SUMMARY

The in-place costs per square foot of 74 wall constructions and of 54 floor-ceiling constructions have been estimated for 12 selected cities in the United States. These wall and floor constructions—all previously rated for transmission of airborne and (or) impact sound—are ranked from lowest to highest cost for several minimum levels of insulation against noise.

The ranking of the wall and floor constructions relative to costs is the same for all cities. Costs for particular types of constructions, however, varied widely from city to city.

Wood-frame walls and floors proved the most economical for several minimum sound-transmission ratings, but other types of construction proved least expensive for some sound-transmission ratings. Construction cost, however, was not necessarily an indicator of relative protection against noise transmission.

The rankings, ratings and cost data presented in this report should be useful to designers and builders in selecting the least-cost wall and floor constructions to provide a required or desired minimum level of sound isolation.

Least-Cost Wall and Floor Constructions For Limiting Transmission of Noise¹

by Dean R. Prestemon²

Controlling or suppressing transmission of noise in homes, offices and apartments costs money and usually requires special types of construction. Designers and builders, therefore, need to know the kinds of constructions or assemblies that provide a specified or desired level of sound isolation at a minimum cost.

Satisfactory acoustical privacy depends on many factors. These include level of background noise, noisiness and sensitivity to noise of dwelling inhabitants or office workers, extent of dweller or worker satisfaction desired and how well the walls and floors limit transmission of noise. Transmission of both airborne and impact noise is important in evaluating floor-ceiling constructions. For wall constructions, transmission of airborne noise is the more important.

The degrees of sound protection or isolation "best" for homes, offices, apartments, etc., are not well defined. But **Minimum Property Standards for Multifamily Housing**, published by the Federal Housing Administration in 1963, established minimum FHA requirements to control transmission of airborne noise through walls and floors and recommended limitations for controlling impact noise through floors.

The objective of the work reported in this publication was to identify the least-expensive wall and floor-ceiling constructions that would limit transmission of airborne sound and (or) impact sound to certain minimum levels. In all, 74 wall constructions and 54 floor-ceiling constructions were considered. These were rated according to procedures and sources described in the following sections. Finally, in-place costs per square foot of selected wall and floor-ceiling constructions were estimated for 12 cities: Atlanta, Chicago, Dallas, Denver, Des Moines, Detroit, Los Angeles, Miami, Minneapolis, New York City, Seattle and St. Louis.

COST ESTIMATES

Construction costs for the wall and floor-ceiling assemblies were estimated by considering each construction operation performed and all materials used. Wage rates, production rates and ma-

terial costs appropriate to each city were used. All labor and material costs required to job-fabricate and erect a given assembly were totaled to give the unit price. Hourly wage rates for construction workers in the different cities were obtained from the U. S. Department of Labor, "Engineering News Record" magazine and The Associated General Contractors of America.

Prices for construction materials were obtained from "Engineering News Record" magazine, **The Building Estimator's Reference Book** by Frank Walker, **Building Construction Cost Data** by R. S. Means, and from individual manufacturers. Labor production rates were taken from the Walker and Means sources. Wage rates and material costs used were based on data published for 1966.

USE OF RESULTS

The analysis originally centered on least-cost wall and floor constructions for limiting transmission of noise in apartments. This was because FHA data that established minimum FHA requirements and recommended limits for multifamily housing was readily available. The ratings for multifamily housing, however, and the least-cost constructions determined in this study can also be used as guidelines for other dwellings or for offices where given levels of noise isolation are necessary or desired.

The results and conclusions reported for walls and floors in the following sections and tables relate only to the constructions and assemblies specifically considered and which had been previously rated for transmission of airborne and (or) impact noise. No attempt is made to define what ratings are "best" for walls and floors in homes, apartments or other buildings. Similarly, no evaluation is made of the adequacy of current testing methods or rating systems for sound transmission.

WALL CONSTRUCTIONS

The FHA minimum "Sound Transmission Class" (STC) ratings required for multifamily housing range from 40 to 60, depending on location of the wall assembly in the building and on a measure of potential background noise. Sound transmission class (STC) is a single-number rating for airborne sound isolation and is measured according to procedures outlined in ASTM Standard E-90-61T. The higher the numerical rating, the more effective is the assembly in limiting transmission of airborne noise.

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To identify the least-expensive wall constructions that would limit transmission of airborne sound to each of five minimum levels, STC ratings of 40, 45, 50, 55 and 60 were used in this study. The FHA requires a rating of 40, 45 or 50 for walls between living units in multifamily housing, with higher ratings often required for other separations.

The 74 wall constructions considered (table 1) represent a wide variety of construction and material combinations. All had been tested for transmission of airborne sound and have STC ratings ranging from 36 to 63, with most rated from 40 to 55. The major source of data for sound-transmission ratings is a recent compilation made by the National Bureau of Standards for the Technical Studies Program of the Federal Housing Administration.

Wall constructions are ranked, by cost index, from lowest to highest cost for different STC ratings in table 1. Ranking of wall constructions relative to cost for each minimum STC value was the same for all 12 cities, although estimated dollar costs for a particular wall varied widely among cities (table 2). Construction costs were highest for New York and Chicago, lowest for Miami and Dallas.

The cost indexes listed in table 1 were calculated by using estimated cost figures for Des Moines, with a base of \$0.68/sq. ft. = 100 for the least-expensive wall considered. The relative cost indexes vary from 116 to 265 for the minimum STC of 40, from 121 to 337 for the minimum STC of 45, from 147 to 275 for the minimum STC of 50, and from 169 to 426 for the minimum STC of 55. Relationships among costs of the different walls are similar for all 12 cities, and the estimated 1966 dollar costs per square foot for each wall in each city are shown in table 2.

Wood-frame walls provide the least-cost construction for achieving STC ratings of 40 and 45, and steel-framing construction meets minimum ratings of 50 and 55 at lowest cost. Only one wall considered had a rating of 60 or more—a solid masonry wall more than 16 inches thick.

Increasing ratings from 40 to 45 is not as costly as going from 45 to 50 or from 50 to 55. The highest-cost wall construction providing an STC of at least 40 is more expensive than the lowest-cost wall offering a minimum STC of 55. Thus, expensive construction does not necessarily insure good protection against the transmission of airborne noise.

FLOOR CONSTRUCTIONS

Both airborne and impact noise must be considered in evaluating floor-ceiling constructions.

A new rating system, developed by the National Bureau of Standards for part of the FHA Technical Studies Program and designed to evaluate floors for transmission of impact noise, uses "Impact Insulation Class" (IIC) ratings. These are similar to the STC ratings for transmission of airborne noise; i.e., the higher the IIC number, the more effective is the assembly in limiting transmission of impact noise.

STC and IIC ratings of 40, 45, 50 and 55 were used in this study to identify the least-expensive floor-ceiling constructions that would limit transmission of airborne and impact noise to each of those four minimum levels. Each floor construction had to meet both the minimum STC and IIC ratings specified.

The 54 floor-ceiling constructions considered (table 3) include a wide range of constructions and materials combinations previously tested for transmission of noise. The floor constructions considered have STC ratings of from 29 to 55 and IIC ratings of from 29 to 85.

Floor-ceiling constructions are ranked, by cost index, from lowest to highest cost in table 3 for the specified levels of isolation against both airborne and impact noise. This ranking assumes that isolation against airborne and impact noise are equally important and that similar STC and IIC ratings are appropriate for this purpose.

Ranking of floor-ceiling constructions from lowest to highest cost was the same for all 12 cities, although as for walls, estimated dollar costs for a particular assembly vary widely among cities (table 4). Construction costs again were highest for New York and Chicago and lowest for Miami and Dallas.

The cost indexes listed in table 3 were calculated by using estimated cost figures for Des Moines, with a base of \$1.24/sq. ft. = 100 for the least-expensive floor considered. The relative cost indexes vary from 110 to 230 for minimum ratings of 40, from 128 to 265 for minimum ratings of 45, and from 160 to 269 for minimum ratings of 50. Relationships among costs of the different constructions are similar for all 12 cities, and the estimated 1966 dollar costs per square foot for each construction in each city are shown in table 4.

There is considerable overlap in costs among different minimum ratings. For example, the most-expensive floor construction with a minimum rating of 40 is more expensive than the assembly with a minimum rating of 55. Improving minimum ratings from 40 to 45 is less costly than an increase from 45 to 50 or from 50 to 55.

Wood-frame floor constructions proved the least expensive for minimum STC and IIC ratings of 40 and 50, and concrete-slab construction meets minimum ratings of 45 and 55 at lowest cost. Only one

floor-ceiling assembly considered had both STC and IIC ratings of at least 55.

The least-expensive floor constructions for minimum ratings of 40, 50 and 55 all feature wood finish flooring. The least-expensive floor providing a minimum rating of 45 has a finish floor of concrete. Floor-ceiling constructions with

carpeting as the finish floor covering are relatively expensive, assuming a basic installed price of \$1 per square foot for the carpet and pad in making the cost estimates.

As for wall constructions, expensive floor-ceiling assemblies do not necessarily insure good insulation against transmission of noise.

TABLES

Table 1. Wall constructions ranked from lowest to highest cost index for specified minimum Sound Transmission Class (STC) ratings.

Wall no.	Description	Relative cost index ^a	STC rating
Minimum STC = 35			
1	Steel frame partition: 1 5/8" metal channel studs @ 24" o.c. w/floor and ceiling channels; 5/8" gypsum wallboard screwed 12" o.c., both sides; joints reinforced and finished; painted both sides.....	100	38
2	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 1/2" gypsum wallboard nailed to studs both sides; joints reinforced and finished; painted both sides.....	101	39
3	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 5/8" gypsum wallboard nailed to studs both sides; joints reinforced and finished; painted both sides.....	106	36
4	2" solid plaster partition: 3.4 lb. diamond mesh metal lath attached to floor and ceiling, gypsum sand plaster on both sides; painted both sides.....	116	36
5	Solid gypsum core movable partition: two piece metal floor and ceiling tracks; 24" wide panels constructed of 1" gypsum coreboard with 5/8" vinyl-faced gypsum wallboard laminated each side with a 1 1/2" off-set to form a tongue and groove edge on both sides set-in and anchored to floor and ceiling tracks; joints reinforced and finished; painted both sides.....	121	36
6	2 1/2" solid plaster partition: 3/8" gypsum lath attached to floor and ceiling; 1 1/16" gypsum sand plaster both sides; painted both sides.....	128	38
7	2" solid plaster partition: 3/4" cold-rolled steel channels @ 16" o.c. w/3.4 lb. diamond mesh metal lath wire-tied with gypsum sand plaster both sides; painted both sides.....	137	37
8	2" solid plaster partition: 3/4" cold-rolled steel channels @ 12" o.c. w/3.4 lb. diamond mesh metal lath wire-tied to channels with gypsum sand plaster both sides; painted both sides.....	140	36
9	2 1/2" solid plaster partition: 3/4" cold-rolled steel channels @ 12" o.c. w/3.4 lb. diamond mesh (flat expanded) metal lath wire-tied to channels with gypsum sand plaster both sides; painted both sides.....	144	39
10	Steel frame partition: 2 1/2" open truss steel studs @ 16" o.c. w/floor and ceiling channels; 3/8" gypsum lath attached with		

^aRelative cost indexes were calculated by using the cost figures for Des Moines, with a base of \$0.68/sq. ft. = 100 for the least-expensive wall considered. Similar relationships between costs of wall constructions existed in the other cities studied. (See table 2 for 1966 estimated dollar costs per sq. ft. in 12 cities.)

Table 1. Continued

Wall no.	Description	Relative cost index ^a	STC rating
	galvanized wire clips, 7/16" gypsum vermiculite plaster w/ 1/16" white-coat finish both sides; painted both sides.....	149	38
11	Steel frame partition: 3 1/4" open truss steel studs @ 16" o.c. w/floor and ceiling channels; 2.5 lb. diamond metal lath wire-tied; 7/8" gypsum sand plaster both sides; painted both sides.....	159	39
Minimum STC = 40			
12	Slotted wood stud frame partition: 2x4 slotted studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 1 1/2" blanket insulation stapled between studs; 1/2" gypsum wallboard nailed to studs both sides; joints reinforced and finished; painted both sides.....	116	43
13	Staggered studs, wood frame partition: staggered 2x3 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 5/8" gypsum wallboard nailed @ 7" o.c. to studs both sides; joints reinforced and finished; painted both sides.....	118	44
14	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; double layer of 5/8" gypsum wallboard both sides, 1st layer nailed to studs and second laminated to first; exposed joints reinforced and finished; painted both sides.....	124	40
15	Steel frame partition: 1 5/8" open truss steel studs @ 16" o.c. w/floor and ceiling channels; 3/8" gypsum lath screwed to studs and 1/2" gypsum sand plaster both sides; painted both sides.....	138	41
16	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; double layer of 5/8" gypsum wallboard both sides, 1st layer nailed to studs 7" o.c. and the second layer @ 14" o.c.; exposed joints reinforced and finished; painted both sides.....	140	41
17	Solid lightweight block partition: 4" x 8" x 14" solid lightweight block, 3 coats masonry painted both sides.....	146	44
18	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 1/2" wood fiber board nailed at 3" o.c. along edges to studs; 1/2" gypsum sand plaster both sides; painted both sides.....	147	42
19	Hollow gypsum block partition: 3" hollow gypsum blocks w/3/8" mortar joints, 1/2" gypsum sand plaster both sides; painted both sides.....	147	40
20	Steel frame partition: 1 5/8" open truss steel studs @ 16" o.c. w/floor and ceiling channels; 3/8" gypsum lath attached w/resilient clips; 1/2" gypsum sand plaster both sides; painted both sides.....	153	43

Table 1. Continued

Wall no.	Description	Relative cost index ^a	STC rating
21	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; resilient clips @ 16" o.c. (horizontal and vertical) nailed to studs and holding 3/8" gypsum lath; 1/2" gypsum sand plaster w/white coat finish both sides; painted both sides.....	156	44
22	Staggered studs, wood frame partition: staggered 2x3 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; two layers of 5/8" gypsum wallboard nailed to studs both sides, first layer nailed 7" o.c.; second layer 16" o.c.; joints reinforced and finished; painted both sides.....	156	44
23	Hollow gypsum block partition: 4" hollow gypsum block w/ 3/8" mortar joints, 1/2" gypsum sand plaster both sides; painted both sides.	157	42
24	Steel frame partition: 3 1/4" open truss steel studs @ 16" o.c. w/floor and ceiling channels; 3/8" gypsum lath attached one side w/resilient clips and to the other side w/galvanized wire clips; 1/2" gypsum sand plaster both sides; painted both sides.	160	43
25	Solid gypsum core partition: 1" gypsum coreboard attached to the floor and ceiling track with 5/8" gypsum wallboard laminated to coreboard and on the other side 1/8" sheet lead (7 lbs./sq. ft.) and 1/2" gypsum laminated to coreboard; joints reinforced and finished; painted both sides.	265	44
Minimum STC = 45			
26	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; resilient channels nailed to studs @ 24" horizontally; 5/8" gypsum wallboard screwed to channels @ 12" o.c. both sides; joints reinforced and finished; painted both sides.	121	47
27	Concrete block wall: 6" x 8" x 16" hollow concrete block laid-up with vertical joints staggered; painted both sides.....	129	45
28	Steel frame partition: 3 1/4" open truss steel studs @ 16" o.c. w/floor and ceiling channels; 3/8" gypsum lath attached w/galvanized wire clips both sides; 3/8" gypsum wallboard laminated to gypsum lath; joints reinforced and finished; painted both sides.	131	48
29	Steel frame partition: 3 5/8" metal channel studs @ 37 3/4" o.c. w/floor and ceiling channels set on beads of nonsetting resilient caulking compound; 2 layers of 1/2" gypsum wallboard screwed 12" o.c. to metal channel studs on both sides, screws staggered or offset 6" both sides; joints of wallboard staggered 24"; perimeter caulking w/nonsetting resilient caulking compound; joints reinforced and finished; painted both sides.....	132	47
30	Steel frame partition: 2 1/2" open truss steel studs @ 24" o.c. w/floor and ceiling channels; 3/8" gypsum lath attached with galvanized wire clips and 1/2" gypsum sand plaster both sides; painted both sides.	138	47
31	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 1/2" wood fiber sound deadening board nailed to studs both sides; 5/8" gypsum wallboard laminated to sound deadening board; joints reinforced and finished; painted both sides.....	141	49

Table 1. Continued

Wall no.	Description	Relative cost index ^a	STC rating
32	Steel frame partition: 3 5/8" metal channel studs @ 24" o.c. w/floor and ceiling channels; 2 layers of 5/8" gypsum wallboard, first layer screwed to studs, second layer laminated to first; joints reinforced and finished; painted on both sides.....	141	47
33	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 3/8" gypsum lath nailed to studs both sides; 1/2" gypsum sand plaster w/white coat finish both sides; painted both sides.	141	46
34	Steel frame partition: five layers of 3/4" cold-rolled steel channel, wire-tied together to form core of panel. The center layer consists of two pieces of channel 2" long placed vertically 40" apart acting as spacers for two horizontal length of channel with vertical channels @ 16" o.c. wire-tied to vertical channels and joints held by sheet metal clips and 1/2" gypsum sand plaster w/white coat finish both sides; painted both sides.....	144	48
35	Steel frame partition: 2 1/2" metal channel studs @ 24" o.c. w/floor and ceiling channels isolated w/ 1/2" continuous resilient gasket; 2" mineral fiber blanket insulation (2.5 lbs./cu. ft.), stapled between studs; first layer 1/2" gypsum lath screwed 8" o.c. at edges and 12" o.c. in field area to metal studs second layer laminated and screwed 36" o.c. @ edges and 48" o.c. in field to first, and 1/16" finish plaster both sides; painted both sides.....	146	48
36	Staggered studs, wood frame partition: staggered 2x3 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 1/2" sound deadening board nailed to both sides; 1/2" gypsum wallboard laminated to sound deadening board both sides; joints reinforced and finished; painted both sides.	149	47
37	Double panel, coreboard and gypsum wallboard partition: 2 1/2" metal channel floor and ceiling track; 1" T & G gypsum coreboard attached to both sides of channel; 2" mineral wool batt insulation glued to inside surface of coreboard; 1/2" gypsum wallboard laminated to the outside faces of the coreboard; joints reinforced and finished; painted both sides.....	157	45
38	Staggered studs, wood frame partition: staggered 2x4 studs @ 16" o.c. w/single 2x6 floor plate and double ceiling plate; 1 1/2" blanket insulation woven between studs; 1/2" gypsum wallboard nailed to both sides; joints reinforced and finished; painted both sides.....	159	49
39	Slotted wood stud frame partition: 2x4 slotted studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 3" mineral fiber blanket insulation stapled between studs; 3/8" gypsum lath nailed @ 7" o.c., 1/2" gypsum sand plaster w/white coat finish both sides; painted both sides.	160	45
40	Steel frame partition: 2 1/2" open truss steel studs @ 16" o.c. w/floor and ceiling channels; 3/8" gypsum lath attached w/resilient clips and 1/2" gypsum sand plaster both sides; painted both sides.....	160	45
41	Steel frame partition: 2 1/2" open truss steel studs @ 16" o.c. w/floor and ceiling channels isolated w/ 1/4" thick continuous resilient gasket; 3/8" perforated gypsum		

Table 1. Continued

Wall no.	Description	Relative cost index ^a	STC rating
	lath attached w/resilient clips @ 16" o.c. and 1/2" gypsum sand plaster w/white coat both sides; perimeter caulking w/non-setting resilient caulking compound; painted both sides, one face primed with a pigment sealer and the other with shellac	169	47
42	Steel frame partition: 3/4" cold-rolled steel channels @ 33" o.c. vertically; 3/4" channels @ 26" o.c. horizontally wire-tied on each side of vertical channel and off-set 6" o.c. with perimeter channels, all channels placed with 3/4" dimension parallel to panel so as to bridge a 1 1/2" air space; 1/2" gypsum lath wire-tied and set into groove of wood floor runner and 3/4" gypsum sand plaster both sides; painted both sides	171	46
43	Staggered studs, wood frame partition: staggered 2x4 studs @ 16" o.c. w/single 2" x 4 1/2" floor plate and double ceiling plates (cut from 2x6's); stud spaces filled with vermiculite masonry fill insulation with a density of 6.3 lbs./cu. ft.; 1/2" gypsum vermiculite plaster, machine-applied, and hand-applied white coat finish; painted on both sides	172	48
44	Steel frame partition: 3/4" open truss steel studs @ 16" o.c. w/floor and ceiling channels isolated with 1/2" continuous resilient gasket material; 3/8" gypsum lath attached w/resilient clips and 1/2" gypsum sand plaster w/white-coat finish one side; 2" mineral fiber blanket insulation stapled in stud space, 3/8" gypsum lath attached w/galvanized wire clips and 1/2" gypsum sand plaster w/white-coat on other side; perimeter caulking w/nonsetting resilient caulking compound; painted both sides	174	47
45	Cinder block partition: 4" x 8" x 16" hollow cinder block with 5/8" gypsum sand plaster both sides; painted both sides	175	46
46	Double wall, solid plaster leaves: double wall with 4 1/2" between leaves consisting of 3/4" cold-rolled metal channels 12" o.c. stiffened by a 1" horizontal metal channel halfway between floor and ceiling; 3.4 lb. diamond mesh metal lath and 3/4" gypsum sand plaster both sides; painted both sides	185	47
47	Hollow gypsum block partition: 3" x 12" x 30" hollow gypsum blocks w/ 1/2" mortar joints; 7/16" gypsum sand plaster one side, other side, resilient clips @ 24" o.c. horizontally and @ 28 1/4" o.c. vertically stapled, 3/4" cold-rolled metal channels wire-tied @ 28 1/4" o.c. to clips, 1/2" "V" edge long-length gypsum lath wire-tied to channels and 11/16" gypsum sand plaster w/ 1/16" white-coat finish applied to both sides; painted both sides	191	45
48	Hollow gypsum block partition: 4" x 12" x 30" hollow gypsum block w/ 1/2" mortar joints; 7/16" gypsum sand plaster w/ 1/16" white-coat finish one side, on the other side slotted resilient channels nailed @ 25" o.c. horizontally, 1/2" long-length gypsum lath wire-tied to channels with 11/16" gypsum sand plaster, 1/16" white-coat finished; painted both sides	197	49
49	Hollow gypsum block partition: 3" x 12" x 30" hollow gypsum block w/ 1/2" mortar joints; 7/16" gypsum sand plaster w/ 1/16" white-coat finish on one side, other side resilient clips @ 18" o.c. vertically and @ 16" o.c. horizontally, 3.4 lb.		

Table 1. Continued

Wall no.	Description	Relative cost index ^a	STC rating
	diamond mesh lath wire-tied to channels and 11/16" gypsum sand plaster with white-coat finish; painted both sides	199	46
50	12" concrete block wall: one tier 8" x 8" x 16" block, other 4" x 8" x 16"; painted both sides	225	48
51	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; 1/2" gypsum wallboard w/layer of lead (3 lbs./sq. ft.) laminated to wallboard and nailed to studs both sides; joints reinforced and finished; painted both sides	229	47
52	Steel frame partition: 1 5/8" open truss steel studs @ 16" o.c. w/floor and ceiling channels; 3/8" gypsum lath screwed to studs, layer of lead (3 lbs./sq. ft.) laminated to each side and 1/2" gypsum sand plaster both sides	285	48
53	Brick cavity wall: 12" cavity wall with two tiers of brick masonry separated by a continuous air space and connected with metal ties, 1/2" gypsum sand plaster on exposed faces; painted both sides	337	49
Minimum STC = 50			
54	Steel frame partition: 2 1/2" metal channel studs @ 24" o.c. w/floor and ceiling channels; 1/2" vinyl-coated gypsum wallboard adhesively attached and screwed to studs both sides, 2" mineral fiber blanket insulation hung in stud space, joints sealed with caulking and aluminum battens and trim accessories both sides; painted both sides	147	50
55	Steel frame partition: 2 1/2" metal channel studs @ 24" o.c. w/floor and ceiling channels set on beads of nonsetting resilient caulking compound; 3 1/2" glass fiber blanket insulation (2 lbs./cu. ft.) stapled between studs, two layers of 1/2" gypsum wallboard screw attached @ 12" o.c. w/staggered joints, perimeter caulking w/nonsetting resilient caulking compound, joints reinforced and finished; painted both sides	153	52
56	Steel frame partition: 3 5/8" metal channel studs @ 24" o.c. w/floor and ceiling channels set on beads of nonsetting resilient caulking compound, 1/2" mineral fiber sound deadening board screwed to studs both sides and 5/8" gypsum wallboard laminated and screwed to sound deadening board, perimeter caulking w/nonsetting resilient caulking compound, joints reinforced and finished; painted both sides	154	50
57	Wood frame partition: 2x4 studs @ 16" o.c. w/single 2x4 floor plate and double ceiling plates; resilient clips @ 16" o.c. (horiz. and vert.) nailed to studs and holding 3/8" gypsum lath; 1/2" gypsum sand plaster w/white-coat finish both sides; painted both sides	156	52
58	Steel frame partition: 3 5/8" metal channel studs @ 24" o.c. w/floor and ceiling channels isolated with continuous beads of nonsetting resilient caulking compound; 1/2" mineral fiber sound deadening board screwed @ 24" o.c. to both sides, on one side 1/2" gypsum wallboard laminated and screwed, on the other side, two layers of 1/2" gypsum, both attached in same manner; joints reinforced and finished; painted both sides	159	52
59	Staggered studs, steel frame partition: two rows of 2 1/2" metal channel studs @ 24"		

Table 1. Continued

Wall no.	Description	Relative cost index ^a	STC rating
	o.c. w/floor and ceiling channels separated by 1/2" gypsum wallboard screwed @ 12" o.c. to both rows of studs; 2" mineral fiber blanket insulation hung on both sides; 1/2" gypsum wallboard screwed and laminated to outside face of metal channel studs on both sides; joints reinforced and finished; painted both sides.....	165	54
60	Hollow gypsum block partition: 3" x 12" x 30" hollow gypsum block with 1/2" mortar joints, resilient clips stapled @ 16" o.c. vertically and horizontally, 3/8" gypsum lath and 1/2" gypsum sand plaster with white-coat finish one side, on the other side, 1/2" gypsum sand plaster with white-coat finish; painted both sides.....	169	52
61	Steel frame partition: 3 5/8" metal channel studs @ 12" o.c. w/floor and ceiling channels isolated w/continuous beads of nonsetting resilient caulking compound; 1/2" mineral fiber sound deadening board screwed @ 24" o.c. to alternate studs; 1/2" gypsum wallboard laminated and screwed to sound deadening board @ 8" o.c. @ edges and 12" o.c. in the field area both sides; joints reinforced and finished; painted both sides.....	169	50
62	Steel frame partition: 2 1/2" metal channel studs @ 24" o.c. w/floor and ceiling channels; 1/4" x 1" cork strips laminated to studs both sides; first layer 5/8" gypsum wallboard screw attached on both sides; on one side the second layer of 5/8" gypsum wallboard laminated to first; on the other side 1/4" thick layer of cork laminated to gypsum wallboard and the second layer of 5/8" gypsum wallboard laminated to cork; joints reinforced and finished; painted both sides.....	171	53
63	Steel frame partition: 3 5/8" metal channel studs @ 24" o.c. w/floor and ceiling channels; 3" mineral fiber blanket insulation hung in stud space; 5/8" gypsum wallboard screwed to studs both sides; on one side resilient channels screwed horizontally @ 24" o.c. and 3/8" gypsum wallboard screwed to channels; on the other side, 5/8" gypsum laminated to first layer; joint reinforced and finished; painted both sides.....	172	51
64	Steel frame partition: 3 1/4" open truss steel studs @ 16" o.c. w/floor and ceiling channels; resilient clips attached to studs, 1/4" metal rods (pencil rods) wire-tied to clips, 2.5 lb. diamond mesh metal lath wire-tied to rods and 3/4" gypsum sand plaster both sides; painted both sides.....	176	54
65	Double wall, gypsum drywall leaves: double wall of 5/8" gypsum wallboard attached to 1 5/8" metal channel runners at floor and ceiling reinforced on the inside face with 1" x 6" gypsum ribs laminated @ 24" o.c. with joints staggered; second layer 5/8" gypsum wallboard laminated to first layer with joints staggered; joints reinforced and finished; painted on both sides.....	191	51
66	Double wall, hollow-core movable gypsum partition: double wall with 2 1/8" airspace and 2" mineral fiber blanket stapled to one leaf. Each leaf consisted of 24" wide panels of 5/8" gypsum coreboard strips, 7 1/2" and 4 3/8" wide, offset 1 1/2" at edges to form tongue and groove. 5/8", vinyl-faced, gypsum wallboard laminated to both sides of coreboard strips. Panels		

Table 1. Continued

Wall no.	Description	Relative cost index ^a	STC rating
	screwed 12" on centers to 1 1/4" x 1" angle floor and ceiling runners. 1/4" perimeter clearance closed with a nonsetting resilient caulking compound. Vertical face layer joints sealed with joint compound; painted both sides.....	194	50
67	Poured concrete wall: 6" poured concrete wall, 1/2" gypsum sand plaster applied both sides; painted both sides.....	196	53
68	Double leaf, gypsum drywall insulated partition: floor and ceiling runners consisting of a pair of 1" x 1 1/2" 22 gage steel angles isolated from floor and ceiling with 1/2" resilient gasket with a 3" separation between runners; leaves consisting of 1" x 24" T & G gypsum coreboard attached to floor and ceiling angles with vertical joints staggered; 1 1/2" mineral fiber blanket insulation stapled to one inside surface of coreboards; 1/2" gypsum lath laminated and screwed to coreboard with joints offset 3" and 1/16" plaster finish coat applied to both sides; perimeter caulking w/nonsetting resilient caulking compound; painted both sides.....	197	54
69	Hollow gypsum block partition: 3" x 12" x 30" hollow gypsum block w/ 1/2" mortar joints isolated around perimeter with 1/2" thick continuous resilient gasket, 2 x 2 wood furring strips wire-tied @ 16" o.c. horizontally, 1 1/2" mineral fiber blanket insulation stapled between furring strips, 3/8" plain gypsum lath attached with resilient clips nailed to furring strips, 1/2" gypsum sand plaster with white-coat finish. On other side, 5/8" gypsum sand plaster with white-coat finish applied directly to gypsum block, perimeter caulking with nonsetting resilient caulking compound; painted both sides.....	235	52
70	Clinker block cavity wall: 11" cavity wall with two tiers of block masonry separated by a continuous air space (no ties between tiers), 1/2" gypsum sand plaster on exposed faces; painted both sides.....	275	52
Minimum STC = 55			
71	Steel frame partition: 3 5/8" metal channel studs @ 24" o.c. w/floor and ceiling channels isolated with continuous bead of nonsetting resilient caulking compound; 1 1/2" mineral fiber blanket insulation stapled between studs; two layers of 5/8" gypsum wallboard attached to both sides, first layer screwed @ 8" o.c. at edges and @ 12" o.c. in the field area, second layer screwed @ 24" o.c. and laminated to first layer, joints staggered or offset 24"; perimeter caulking w/nonsetting resilient caulking compound; joints reinforced and finished; painted both sides.....	169	55
72	Double leaf, gypsum drywall insulated partition: floor and ceiling runners consisting of a pair of 3/4" x 1" 22 gage steel angles isolated from floor ceiling on continuous beads of nonsetting resilient caulking compound with a 3" separation between runners; leaves consisting of 1"x24" T & G gypsum coreboard attached by screws 12" o.c. to floor and ceiling angles with vertical joints staggered 12"; 1 1/2" mineral fiber blanket insulation stapled to one inside surface of coreboards; 1/2" gypsum wallboard laminated to coreboard with joints staggered; perimeter caulking w/nonsetting resilient caulking compound;		

Table 1. Continued

Wall no.	Description	Relative cost index ^a	STC rating
	joints reinforced and finished; painted both sides.		
73	Brick wall: 12" solid brick wall, 3 tiers of standard brick, flemish bond.	184	56
		426	56
	Minimum STC = 60		
74	Solid concrete block wall: 16" solid concrete block wall, block sizes 4" x 8" x 16", 6" x 8" x 16" and 8" x 8" x 16" stack bond rotating block sizes, 1/4" to 1/2" gypsum sand plaster both sides; painted both sides	276	63

Table 2. Estimated in-place costs per square foot of different wall constructions in 12 selected U. S. cities.

Wall no.	Sound transmission class (STC)	City											
		Atlanta	Chicago	Dallas	Denver	Des Moines	Detroit	Los Angeles	Miami	Minneapolis	New York	Seattle	St. Louis
		(Dollars)											
1	38	0.65	0.78	0.63	0.66	0.68	0.73	0.72	0.63	0.68	0.85	0.71	0.74
2	39	0.65	0.78	0.63	0.66	0.69	0.74	0.72	0.63	0.69	0.88	0.71	0.74
3	36	0.68	0.81	0.72	0.70	0.72	0.77	0.76	0.66	0.72	0.90	0.75	0.78
4	36	0.75	0.90	0.73	0.77	0.79	0.85	0.83	0.73	0.79	0.99	0.82	0.86
5	36	0.78	0.93	0.76	0.80	0.82	0.88	0.86	0.76	0.82	1.02	0.85	0.89
6	38	0.82	1.00	0.80	0.84	0.87	0.93	0.91	0.80	0.87	1.09	0.91	0.94
7	37	0.88	1.06	0.86	0.90	0.93	0.99	0.97	0.86	0.93	1.18	1.03	1.07
8	36	0.90	1.09	0.87	0.92	0.95	1.02	1.00	0.87	0.95	1.20	0.99	1.03
9	39	0.93	1.12	0.90	0.95	0.98	1.06	1.03	0.90	0.98	1.23	1.02	1.06
10	38	0.96	1.15	0.93	0.98	1.01	1.08	1.06	0.93	1.01	1.26	1.05	1.09
11	39	1.02	1.23	0.99	1.05	1.08	1.15	1.13	0.99	1.08	1.35	1.12	1.17
12	43	0.75	0.90	0.73	0.77	0.79	0.85	0.83	0.73	0.79	0.99	0.82	0.85
13	44	0.76	0.91	0.74	0.78	0.80	0.86	0.84	0.74	0.80	1.00	0.83	0.86
14	40	0.83	1.02	0.80	0.85	0.84	0.92	0.92	0.80	0.87	1.05	0.93	0.95
15	41	0.89	1.07	0.86	0.91	0.94	1.01	0.99	0.86	0.94	1.18	0.93	1.02
16	41	0.90	1.08	0.87	0.92	0.95	1.02	1.00	0.87	0.95	1.19	0.99	1.03
17	44	0.94	1.13	0.91	0.96	0.99	1.06	1.04	0.91	0.99	1.24	1.03	1.07
18	42	0.95	1.14	0.92	0.97	1.00	1.07	1.05	0.92	1.00	1.25	1.04	1.08
19	40	0.95	1.14	0.92	0.97	1.00	1.07	1.05	0.92	1.00	1.25	1.04	1.08
20	43	0.99	1.19	0.96	1.00	1.04	1.11	1.09	0.96	1.04	1.30	1.08	1.12
21	44	1.02	1.21	0.97	1.03	1.06	1.13	1.11	0.97	1.06	1.32	1.10	1.15
22	44	1.02	1.21	0.97	1.03	1.06	1.13	1.11	0.97	1.06	1.33	1.10	1.15
23	42	1.02	1.22	0.98	1.04	1.07	1.14	1.12	0.98	1.07	1.34	1.11	1.16
24	43	1.03	1.24	1.00	1.06	1.09	1.16	1.13	1.00	1.09	1.36	1.13	1.18
25	44	1.71	2.06	1.66	1.75	1.80	1.92	1.89	1.66	1.80	2.24	1.87	1.94
26	47	0.78	0.94	0.76	0.80	0.82	0.88	0.86	0.76	0.82	1.03	0.85	0.88
27	45	0.84	1.00	0.81	0.85	0.88	0.94	0.92	0.81	0.88	1.10	0.92	0.95
28	48	0.85	1.02	0.82	0.86	0.89	0.95	0.93	0.82	0.89	1.11	0.93	0.96
29	47	0.85	1.03	0.83	0.87	0.90	0.96	0.94	0.83	0.90	1.12	0.94	0.97
30	47	0.90	1.07	0.87	0.91	0.94	1.01	0.99	0.87	0.94	1.18	0.98	1.01
31	49	0.91	1.09	0.88	0.93	0.96	1.02	1.01	0.88	0.96	1.20	1.00	1.04
32	47	0.91	1.10	0.88	0.93	0.96	1.03	1.01	0.88	0.96	1.20	1.00	1.04
33	46	0.91	1.10	0.88	0.93	0.96	1.03	1.01	0.88	0.96	1.20	1.00	1.04
34	48	0.93	1.12	0.90	0.95	0.98	1.05	1.03	0.90	0.98	1.23	1.02	1.06
35	48	0.94	1.13	0.91	0.96	0.99	1.06	1.04	0.91	0.99	1.24	1.03	1.07
36	47	0.96	1.15	0.93	0.98	1.01	1.07	1.06	0.93	1.01	1.26	1.05	1.09
37	45	1.01	1.22	0.98	1.04	1.07	1.14	1.12	0.98	1.07	1.34	1.11	1.15
38	49	1.04	1.23	0.99	1.05	1.08	1.16	1.13	0.99	1.08	1.35	1.12	1.17
39	45	1.04	1.25	1.00	1.06	1.09	1.17	1.15	1.00	1.09	1.37	1.14	1.18
40	45	1.03	1.24	1.00	1.05	1.09	1.17	1.14	1.00	1.09	1.36	1.13	1.18
41	47	1.09	1.39	1.06	1.12	1.15	1.23	1.21	1.06	1.15	1.44	1.20	1.24
42	46	1.10	1.32	1.07	1.12	1.16	1.24	1.22	1.07	1.16	1.45	1.20	1.25
43	48	1.11	1.33	1.07	1.13	1.17	1.25	1.23	1.07	1.17	1.46	1.22	1.26
44	47	1.12	1.34	1.08	1.14	1.18	1.27	1.24	1.08	1.18	1.47	1.23	1.27
45	46	1.13	1.35	1.09	1.15	1.19	1.27	1.25	1.09	1.19	1.49	1.24	1.28
46	47	1.20	1.44	1.16	1.22	1.26	1.35	1.32	1.16	1.26	1.58	1.31	1.36
47	45	1.23	1.48	1.20	1.26	1.30	1.39	1.36	1.20	1.30	1.62	1.35	1.40
48	49	1.27	1.53	1.24	1.31	1.34	1.43	1.40	1.24	1.34	1.66	1.39	1.44
49	46	1.28	1.54	1.25	1.31	1.35	1.44	1.41	1.25	1.35	1.68	1.40	1.45
50	48	1.45	1.74	1.41	1.48	1.53	1.64	1.61	1.41	1.53	1.91	1.59	1.65
51	47	1.52	1.82	1.47	1.55	1.60	1.71	1.68	1.47	1.60	2.00	1.67	1.73

Table 2. (Continued)

Well no.	Sound transmission class (STC)	City											
		Atlanta	Chicago	Dallas	Denver	Des Moines	Detroit	Los Angeles	Miami	Minneapolis	New York	Seattle	St. Louis
		(Dollars)											
52	48	1.84	2.21	1.78	1.88	1.94	2.08	2.04	1.78	1.94	2.42	2.02	2.10
53	49	2.18	2.61	2.10	2.22	2.29	2.44	2.40	2.10	2.29	2.76	2.38	2.47
54	50	0.95	1.14	0.92	0.97	1.00	1.07	1.05	0.92	1.00	1.25	1.04	1.08
55	52	0.99	1.18	0.96	1.01	1.04	1.11	1.09	0.96	1.04	1.29	1.08	1.12
56	50	1.00	1.20	0.97	1.02	1.05	1.12	1.10	0.97	1.05	1.30	1.09	1.14
57	52	1.02	1.21	0.97	1.03	1.06	1.13	1.11	0.97	1.06	1.32	1.10	1.15
58	52	1.02	1.23	0.99	1.05	1.08	1.15	1.13	0.99	1.08	1.35	1.12	1.16
59	54	1.06	1.28	1.03	1.08	1.12	1.20	1.18	1.03	1.12	1.40	1.17	1.21
60	52	1.09	1.31	1.06	1.11	1.15	1.23	1.20	1.06	1.15	1.44	1.20	1.24
61	50	1.09	1.31	1.06	1.11	1.15	1.23	1.21	1.06	1.15	1.43	1.19	1.24
62	53	1.10	1.32	1.07	1.12	1.16	1.24	1.22	1.07	1.16	1.45	1.20	1.25
63	51	1.11	1.33	1.08	1.13	1.17	1.25	1.23	1.08	1.17	1.46	1.21	1.26
64	54	1.14	1.37	1.10	1.06	1.20	1.28	1.26	1.10	1.20	1.50	1.25	1.30
65	51	1.23	1.48	1.20	1.26	1.30	1.39	1.36	1.20	1.30	1.62	1.35	1.40
66	50	1.25	1.50	1.21	1.28	1.32	1.41	1.38	1.21	1.32	1.65	1.37	1.42
67	53	1.26	1.50	1.16	1.29	1.33	1.42	1.39	1.22	1.33	1.64	1.38	1.43
68	54	1.27	1.52	1.17	1.30	1.34	1.43	1.40	1.23	1.34	1.66	1.39	1.44
69	52	1.52	1.82	1.47	1.55	1.60	1.71	1.68	1.47	1.60	2.00	1.66	1.72
70	52	1.77	2.13	1.72	1.81	1.87	2.00	1.96	1.72	1.87	2.34	1.94	2.02
71	55	1.09	1.31	1.06	1.11	1.15	1.23	1.21	1.06	1.15	1.43	1.19	1.24
72	56	1.19	1.43	1.15	1.21	1.25	1.34	1.31	1.15	1.25	1.56	1.31	1.35
73	56	2.76	3.30	2.68	2.80	2.90	3.10	3.05	2.68	2.90	3.62	3.02	3.13
74	63	1.78	2.14	1.72	1.82	1.88	2.01	1.97	1.72	1.88	2.35	1.95	2.03

Table 3. Floor constructions ranked from lowest to highest cost index for specified minimum Sound Transmission Class (STC) and Impact Insulation Class (IIC) ratings.

Floor no.	Description	Relative costs index ^a	STC rating	IIC rating
STC or IIC Less Than 40				
1	Wood frame floor and ceiling system: 2x8 joists @ 16" o.c.; 7/8" x 3 1/4" T & G wood floor sanded and finished; 3/8" gypsum wallboard ceiling nailed with joints reinforced and finished, painted.....	100	34	32
2	Wood frame floor and ceiling system: 2x10 joists @ 16" o.c.; 1 11/32" x 23 1/4" compressed paper pulp building board (approximate density 26.1 lbs./cu. ft.) nailed @ 8" o.c.; 1/8" hardboard laminated, a single layer of 15 lb. felt building paper laminated, 1/8" x 9" x 9" vinyl asbestos tile laid in mastic; 1/2" gypsum wallboard ceiling nailed @ 12" o.c., joints reinforced and finished, painted.	124	35	39
3	Steel frame floor and ceiling system: 8" steel joists @ 16" o.c.; 1 11/32" x 23 1/4" paper pulp building board (26.1 lbs./cu. ft.) subfloor, 1/8" hardboard laminated, a single layer 15 lb. building felt glued, 1/8" x 9" x 9" vinyl asbestos tile laid in mastic; 1/2" gypsum wallboard ceiling, joints reinforced and finished, painted.	126	37	40
4	Prestressed concrete channel floor slab: 3" prestressed concrete channels with joints grouted full; 3/4" concrete topping; ceiling painted.	126	42	32

^aRelative cost indexes were calculated by using the cost figures for Des Moines, with a base of \$1.24/sq. ft. = 100 for the least expensive floor considered. Similar relationships between the costs of floor constructions existed in the other cities studied. (See table 4 for 1966 estimated dollar costs per sq. ft. in 12 cities.)

Table 3. Continued

Floor no.	Description	Relative costs index ^a	STC rating	IIC rating
5	Wood frame floor and ceiling system: 2x10 joists @ 16" o.c.; 3/8" plywood subfloor, 1/2" plywood underlayment nailed with staggered joints, 1/8" x 9" x 9" vinyl asbestos tile laid in mastic; 1/2" gypsum wallboard ceiling nailed, joints reinforced and finished, painted.	128	37	33
6	Wood frame floor and ceiling system: 2x8 joists @ 16" o.c.; 1/2" C-D plywood subfloor, 25/32" x 2 1/4" hardwood floor sanded and finished; 1/2" gypsum wallboard ceiling nailed to joists, 1/2" acoustical tile laminated to gypsum wallboard.	131	39	37
7	Wood frame floor and ceiling system: 2x10 joists @ 16" o.c.; 1/2" plywood subfloor nailed @ 6" o.c. along the edges and @ 10" o.c. in the field, building paper underlayment, 25/32" x 2 1/4" oak flooring sanded and finished; on the ceiling, resilient channels @ 24" o.c. screwed attached @ 12" o.c., 5/8" gypsum wallboard attached to resilient channels, joints reinforced and finished, painted.	134	47	39
8	Wood frame floor and ceiling system with insulation: 2x10 joists @ 16" o.c. with 3" thick mineral fiber batt insulation stapled between joists; 1/2" plywood subfloor nailed @ 6" o. c. @ edges and 10" o.c. in the field, building paper underlayment, 25/32" x 2 1/4" oak flooring sanded and finished; 5/8" gypsum wallboard ceiling nailed @ 6" o.c., joints reinforced and finished, painted.	135	40	32
9	Wood frame floor and ceiling system: 2x10 joists @ 16" o.c.; 1/2" plywood sub-			

Table 3. Continued

Floor no.	Description	Relative costs index ^a	STC rating	IIC rating
	floor nailed; 3/8" fiber glass board laminated to subfloor; 1/2" T & G plywood underlayment stapled @ 12" o.c. 1/2" oak flooring laid in mastic, sanded and finished; 1/2" gypsum wallboard ceiling nailed @ 6" o.c.; joints reinforced and finished, painted.	137	41	38
10	Prestressed concrete floor slabs: 20" x 6" deep prestressed pumice concrete slabs; 3/8" leveling grout, 3/4" sand-cement topping; 3/8" gypsum sand plaster ceiling, painted.	141	46	30
11	Isolated 4" concrete slab: 4" concrete slab reinforced with 6x6-10/10 welded wire fabric, 1/8" vinyl floor tile laid in mastic; ceiling painted.	148	44	29
12	Steel frame floor system with carpet and pad: 8" steel joists @ 24" o.c.; 1 27/32" paper pulp building board, foam rubber pad with woven back, nylon carpet with 1/4" looped pile; 1/2" gypsum wallboard ceiling, joints reinforced and finished, painted.	148	37	63
13	Wood frame floor system with carpet: 2x8 joists @ 16" o.c.; 1 1/2" T & G wood fiber board nailed, pad and carpet; 1/2" gypsum wallboard ceiling nailed 6" o.c. with joints reinforced and finished, painted.	153	29	56
14	Wood frame floor system with carpet: 2x10 joists @ 24" o.c.; 1 27/32" x 23 1/4" paper pulp building board (26.1 lbs./cu. ft.), foam rubber carpet pad with woven jute fiber cloth bark, nylon carpet-1/8" woven backing and 1/4" looped pile; 1/2" gypsum wallboard ceiling, joints reinforced and finished, painted.	155	38	57
15	Reinforced concrete slab: 6" reinforced concrete slab; 5/8" mastic asphalt floor; 3/4" gypsum sand plaster ceiling, painted.	171	47	31
16	Steel frame concrete floor: 14" steel bar joists @ 16" o.c.; 2 1/2" concrete slab, 1/8" asphalt tile laid in mastic; on ceiling, 3/4" cold-rolled channels 13 1/2" o.c. wire-tied to joists, diamond mesh metal lath (3.4 lbs./sq. yd.) wire-tied, 9/16" perlite gypsum plaster with 1/16" white-coat finish, painted.	210	49	35
17	Wood frame insulated floor system with carpet and pad: 2x10 joists @ 16" o.c.; 3" mineral fiber batt insulation stapled between joists, 1/2" plywood subfloor, building paper underlayment; 25/32" x 2 1/4" hardwood flooring sanded and finished, 40 oz./sq. yd. hair felt pad, 44 oz./sq. yd. carpet; 5/8" gypsum wallboard ceiling, joints reinforced and finished, painted.	216	39	58
18	Steel frame concrete floor system: 7" steel bar joists @ 27" o.c.; 3/8" rib lath, 2" concrete slab; on ceiling, resilient clips and 3/4" cold-rolled channels 16" o.c., 3/8" plain gypsum lath attached with wire clips, 7/16" gypsum sand plaster and 1/16" white-coat finish, painted.	259	51	35
Minimum STC & IIC = 40				
19	Wood frame floor and ceiling system: 2x8 joists @ 16" o.c.; 7/8" x 3 1/4" wood flooring, nailed, sanded and finished; on the ceiling, glass wool quilt attached with 1" x 1 1/2" wood strips, wood lath and 1/2" gypsum sand plaster, painted.	110	43	43
20	Reinforced concrete structural slab with wood block flooring: 4" concrete slab reinforced with 6x6-10/10 welded wire			

Table 3. Continued

Floor no.	Description	Relative costs index ^a	STC rating	IIC rating
	fabric; 1/2" x 9" x 9" prefinished oak block flooring laid in mastic; ceiling painted.	125	44	41
21	Reinforced concrete structural slab with wood block floor on underlayment: 4" concrete slab reinforced with 6x6-10/10 welded wire fabric; 1/4" semi-rigid polyurethane foam (2.2 lbs./cu. ft. density) laid in mastic, 1/2" x 9" x 9" prefinished oak block flooring laid in mastic; ceiling painted.	131	44	52
22	Wood frame floor and resilient ceiling system: 2x8 joists @ 16" o.c., 3/4" plywood subfloor, layer of building paper, 7/8" x 3 1/4" T & G fir flooring sanded and finished; on the ceiling, resilient channels @ 24" o.c. nailed @ 12" o.c., 5/8" gypsum wallboard screwed to channels, joints reinforced and finished, painted.	140	45	44
23	Wood frame floor and separate wood frame ceiling: 2x8 joists @ 16" o.c.; 3" fiber glass blanket insulation stapled between joists, 1/2" plywood subfloor nailed @ 8" o.c., 25/32" oak flooring sanded and finished; on the ceiling, 2x4 ceiling joists staggered between floor joists, 1/2" gypsum wallboard nailed, joints reinforced and finished, painted.	143	44	43
24	Concrete joists framing system: 3 3/4" x 5 1/4" deep concrete joists @ 21" o.c. with 2" slab (total thickness 7 1/4"); 3/4" sand cement topping; 5/8" wood lath nailed to wood nailing strips in bottom of concrete joists, 5/8" reeds and plaster ceiling, painted.	147	46	42
25	Concrete floor slab with carpet and pad: 4" concrete slab reinforced with 6x6-10/10 welded wire fabric; 1/4" foam rubber pad and wood carpeting (1/4" wool loop pile with 1/8" woven jute backing), ceiling painted.	163	44	80
26	Precast concrete channels with wood block flooring: 7" deep x 14" wide precast trapezoidal concrete channels; spaces between channels filled and 1 1/2" concrete topping slab, 1" thick wood block floor covering; 3.4 lbs./sq. yd. expanded metal lath and 3/4" gypsum sand plaster ceiling, painted.	203	47	42
27	Prestressed concrete floor slab: 14" x 12 1/2" x 5" deep trapezoidal prestressed concrete slabs @ 14 1/2" o.c. with spaces between grouted full; 2x2 sleepers @ 18" o.c., 7/8" x 3 1/4" T & G flooring sanded, linoleum floor covering; 3/4" gypsum sand plaster ceiling, painted.	230	44	48
Minimum STC & IIC = 45				
28	Reinforced concrete structural slab suspended ceiling system: 4 3/8" reinforced concrete slab; 3/4" concrete topping; metal lath suspended 4" with wire hangers, 7/8" gypsum sand plaster, painted.	128	48	47
29	Reinforced concrete structural slab: 4 3/8" reinforced concrete slab; 3/4" concrete topping, 1/8" linoleum floor covering; 3/8" gypsum sand plaster ceiling, painted.	141	51	48
30	Wood frame floor and ceiling system with insulation and resilient channels: 2x10 joists @ 16" o.c. with 3" thick mineral fiber batt insulation stapled between joists; 1/2" plywood subfloor nailed @ 6" o.c. @ edges and 10" o.c. in the field, build-			

Table 3. Continued

Floor no.	Description	Relative costs index ^a	STC rating	IIC rating
	ing paper underlayment, 25/32" x 2 1/4" oak flooring sanded and finished; on the ceiling, resilient channels @ 24" o.c., 5/8" gypsum wallboard screw attached @ 12" o.c., joints reinforced and finished, painted.	144	49	46
31	Reinforced concrete slab: 5" reinforced concrete slab; bitumen-felt underlayment, 1/8" linoleum; 1/2" fiber board ceiling, painted.	148	51	47
32	Wood frame floor and resilient ceiling system: 2x6 joists @ 16" o.c.; 5/8" plywood subfloor; 1/2" wood fiber board (approx. density 20. lbs./cu. ft.) stapled to sub-floor, 1/2" plywood underlayment glued to fiber board, 3/32" vinyl floor covering laid in mastic; on the ceiling, 1 x 2 furring strips attached to joists with resilient clips @ 24" o.c., 5/8" gypsum wallboard screwed @ 12" o.c., joints reinforced and finished, painted.	156	50	47
33	Concrete slab with wood finish floor: 5" concrete slab; 1/4" cork underlayment (11-12 lbs./cu. ft.), 5/8" plywood subfloor, 5/16" prefinished oak block flooring; ceiling painted.	159	49	47
34	Wood frame floor with concrete topping and resilient ceiling system: 2x8 joists @ 16" o.c.; 3" fiber glass blanket insulation stapled between joists, 5/8" T & G plywood subfloor, 1 5/8" lightweight concrete (100 lbs./cu. ft.) slab over 4 mil polyethylene film, 0.075" vinyl sheet glued to concrete; resilient channels @ 24" o.c. screwed to underside of joists, 5/8" gypsum wallboard screw attached to channels @ 12" o.c., entire periphery caulked and sealed, joints reinforced and finished, painted.	160	46	85
35	Wood frame floor with concrete topping and carpet and pad: 2x8 joists @ 16" o.c.; 5/8" T & G C-D plywood subfloor, layer 4 mil polyethylene film, 1 5/8" perlite concrete, 40 oz./sq. yd. hair felt pad, 44 oz./sq. yd. carpet; 5/8" gypsum wallboard ceiling, joints reinforced and finished, entire periphery caulked and sealed, painted.	167	47	66
36	Wood frame insulated floor with carpet and pad and resilient ceiling system: 2x8 joists @ 16" o.c.; 3" mineral fiber batt insulation stapled between joists, 5/8" T & G plywood subfloor, 40 oz./sq. yd. hair felt pad, 44 oz./sq. yd. carpet; 5/8" gypsum wallboard ceiling, screwed to resilient channels spaced 24" o.c., joints reinforced and finished, entire periphery caulked and sealed, painted.	169	47	69
37	Steel frame concrete floor with carpet and pad: 7" steel bar joists @ 27" o.c.; 3/8" rib lath, 2" concrete slab, foam rubber pad with woven jute fiber cloth, nylon carpet with woven backing and 1/4" looped pile; on the ceiling, 3/4" cold-rolled channels wire-tied, 3/8" plain gypsum lath attached with clips, 7/16" gypsum sand plaster and 1/16" white-coat finish, painted.	178	46	74
38	Wood frame floor with insulation and resilient ceiling system: 2x8 joists @ 16" o.c.; 3" fiber glass blanket insulation stapled between joists, 1/2" plywood sub-floor, 1/2" cane fiber board stapled to sub-floor, 2x3 sleepers glued @ 16" o.c.,			

Table 3. Continued

Floor no.	Description	Relative costs index ^a	STC rating	IIC rating
	5/8" T & G, C-D plywood underlayment nailed, .075" vinyl flooring laid in mastic; resilient channels @ 24" o.c. screwed to underside of joists, 5/8" gypsum wallboard screw attached to channels @ 12" o.c., entire periphery caulked and sealed, joints reinforced and finished and painted.	183	52	49
39	Concrete joist floor system with filler blocks and floating topping: 2 1/2" x 5 1/2" deep, concrete joists at 14 1/2" o.c. with 1 1/2" slab over 4" x 12" hollow filler blocks; 1" glass wool quilt covered with building paper laid in mastic, 1 1/2" concrete topping reinforced, plastic tile laid in mastic; 1/2" gypsum sand plaster ceiling, painted.	197	52	47
40	Wood frame floor with carpet and pad and resilient ceiling system: 2x10 joists @ 16" o.c.; 1/2" plywood subfloor, building paper underlayment, 25/32" x 2 1/4" hardwood flooring sanded and finished, 40 oz./sq. yd. pad, 44 oz./sq. yd. carpet; resilient channels attached to joists, 5/8" gypsum wallboard ceiling, joints reinforced and finished, painted.	215	47	66
41	Reinforced hollow tile floor: 15 3/4" wide x 5" deep hollow tile beams reinforced; prefinished wood parquet flooring laid in mastic; 1x3 ceiling furring @ 19" o.c., 3/8" gypsum lath, 3/8" reeds and gypsum sand plaster, painted.	219	50	46
42	Composite steel joist and concrete slab floor system: 4" steel beams @ 30" o.c., 4 1/2" concrete floor slab poured around and over steel joists; 1" lightweight concrete topping, 7/8" wood fir flooring sanded, 1/8" linoleum cemented; 1/2" gypsum sand plaster ceiling, painted.	227	46	47
43	Prestressed concrete floor slab with isolated wood finish floor: 14" x 12 1/2" x 5" deep trapezoidal prestressed concrete slabs @ 14 1/2" o.c. with spaces between grouted full; 1" glass wool quilt, 2x2 sleepers @ 20" o.c., 7/8" x 3 1/4" T & G wood flooring sanded, linoleum floor covering; 5/8" gypsum sand plaster ceiling, painted.	231	50	49
44	Steel frame insulated floor system carpet and pad: 18" steel bar joists @ 32" o.c.; 1 1/8" T & G (2-4-1) plywood subfloor, 40 oz./sq. yd. all-hair pad, 44 oz./sq. yd. all-wood pile carpet; on ceiling, resilient channels @ 24" o.c., screw attached 5/8" gypsum wallboard, joints reinforced and finished, entire periphery caulked and sealed, painted.	237	47	69
45	Steel frame concrete floor system with carpet and pad: 18" steel bar joists @ 16" o.c.; 5/8" plywood, 1 5/8" lightweight concrete topping, 40 oz./sq. ft. all-hair pad, 44 oz./sq. yd. all-wool pile carpet; 5/8" gypsum wallboard ceiling, joints reinforced and finished, entire periphery caulked and sealed, painted.	264	47	62
46	Steel frame concrete floor with carpet and pad: 14" steel bar joists @ 16" o.c.; 28 gage corrugated steel deck, 2 1/2" perlite concrete slab, felt pad, carpet; on ceiling, 3/4" cold-rolled channels 13 1/2" o.c. wire-tied to joists, diamond mesh metal lath (3.4 lbs./sq. yd.) wire-tied, 9/16" perlite gypsum plaster with 1/16" white-coat finish, painted.	265	47	59

Table 3. Continued

Floor no.	Description	Relative costs index ^a	STC rating	IIC rating
Minimum STC & IIC = 50				
47	Wood frame floor with insulation and resilient ceiling system: 2x8 joists @ 16" o.c.; 3" fiber glass blanket insulation stapled between joists, 1/2" plywood subfloor, 1/2" fiber board stapled to subfloor, 2x3 wood sleepers glued @ 16" o.c.; 25/32" x 2 1/4" hardwood flooring, sanded and finished; resilient channels @ 24" o.c. screwed to underside of joists, 5/8" gypsum wallboard screw attached to channels @ 12" o.c., entire periphery caulked and sealed, joints reinforced and finished, painted.	160	52	51
48	Concrete slab, wood sleepers, wood finish floor: 5 1/2" reinforced concrete slab; 2x2 wood sleepers laid in asbestos lined metal clips anchored to slab, 3/4" T & G wood flooring, 1/2" gypsum sand plastered ceiling, painted.	173	54	51
49	Prestressed concrete floor slabs: 14" x 12 1/2" x 5" deep trapezoidal prestressed concrete slabs @ 14 1/2" o.c.; grouted and topped with 1" sand-cement topping, 3/16" cork tile laid in mastic; on the ceiling, 1x2 furring strips @ 16" o.c. attached with metal clips, 3/8" gypsum wallboard, joints reinforced and finished, painted.	218	50	51
50	Precast concrete channels with topping and floating wood finish floor: 5" deep precast concrete channels @ 14 1/2" o.c.; spaces between channels filled and 3/4" concrete topping slab, 1" glass wool quilt, 1x2 wood sleepers @ 20" o.c., 7/8" x 3 1/4" T & G wood flooring sanded and finished; 1x2 ceiling furring @ 14 1/2" o.c., 3/8" gypsum wallboard, 1/8" gypsum sand plaster, painted.	219	50	53

Table 3. Continued

Floor no.	Description	Relative costs index ^a	STC rating	IIC rating
51	Wood frame insulated floor with carpet and pad and resilient ceiling system: 2x10 joists @ 16" o.c.; 3" mineral fiber batt insulation stapled between joists, 1/2" plywood subfloor, building paper underlayment, 25/32" x 2 1/4" hardwood flooring sanded and finished, 40 oz./sq. yd. hair felt pad, 44 oz./sq. yd. carpet; 5/8" gypsum wallboard ceiling screwed to resilient channels spaced 24" o.c., joints reinforced and finished, painted.	224	50	70
52	Concrete joist floor system with filler blocks, floating topping and suspended ceiling: 2 1/2" x 5 1/2" deep concrete joists @ 14 1/2" o.c. with 1 1/2" slab over 4" x 12" hollow filler blocks; 1" glass wool quilt covered with building paper laid in mastic, 1 1/2" concrete topping reinforced, plastic tile laid in mastic; 1/4" x 1 1/4" steel bars suspended 6" below the underside of slab, 3.4 lbs./sq. yd. expanded rib lath, 1/2" gypsum sand plaster, painted.	226	55	53
53	Wood frame floor and separate wood frame ceiling: 2x8 joists @ 16" o.c.; 1 1/8" (2-4-1) plywood subfloor, 40 oz./sq. yd. hair felt pad, 44 oz./sq. yd. carpet; 2x4 ceiling joists staggered between floor joists, 3" fiber glass blanket insulation stapled between joists, 3/8" gypsum wallboard, joints reinforced and finished, entire periphery caulked and sealed; painted.	269	52	80
Minimum STC & IIC = 55				
54	Reinforced concrete slab with wood finish floor: 6" reinforced concrete slab; 1" glass wool quilt, 2x2 wood sleepers @ 16" o.c., 3/4" x 3 1/2" T & G wood flooring nailed, sanded and finished; 1/2" gypsum sand plaster ceiling, painted.	190	55	57

Table 4. Estimated in-place costs per square foot of different floor constructions in 12 selected U. S. cities.

Floor no.	Sound trans. mission class (STC)	Impact insula- tion class (IIC)	City											
			Atlanta	Chicago	Dallas	Denver	Des Moines	Detroit	Los Angeles	Miami	Minne- apolis	New York	Seattle	St. Louis
			(Dollars)											
1	34	32	1.18	1.41	1.14	1.20	1.24	1.32	1.30	1.14	1.24	1.55	1.29	1.34
2	35	39	1.46	1.76	1.42	1.50	1.54	1.65	1.62	1.42	1.54	1.92	1.60	1.66
3	37	40	1.48	1.78	1.44	1.52	1.56	1.67	1.64	1.44	1.52	1.94	1.62	1.68
4	42	32	1.48	1.78	1.44	1.51	1.56	1.67	1.63	1.44	1.56	1.95	1.62	1.68
5	37	33	1.51	1.82	1.46	1.54	1.59	1.70	1.66	1.46	1.59	2.00	1.65	1.71
6	39	37	1.54	1.85	1.49	1.57	1.62	1.74	1.70	1.49	1.62	2.02	1.68	1.75
7	47	39	1.58	1.90	1.53	1.61	1.66	1.78	1.74	1.53	1.66	2.07	1.72	1.80
8	40	32	1.60	1.92	1.55	1.63	1.68	1.80	1.76	1.55	1.68	2.10	1.75	1.83
9	41	38	1.62	1.94	1.56	1.65	1.70	1.82	1.78	1.56	1.70	2.12	1.76	1.83
10	46	30	1.66	2.00	1.61	1.70	1.75	1.87	1.84	1.61	1.75	2.18	1.82	1.90
11	44	29	1.74	2.08	1.68	1.77	1.83	1.96	1.92	1.68	1.83	2.28	1.90	1.98
12	37	63	1.75	2.10	1.70	1.78	1.84	1.97	1.93	1.70	1.84	2.30	1.91	1.99
13	29	56	1.80	2.15	1.74	1.83	1.89	2.02	1.98	1.74	1.89	2.36	1.97	2.04
14	38	57	1.82	2.19	1.77	1.86	1.92	2.05	2.02	1.77	1.92	2.40	2.00	2.07
15	47	31	2.01	2.42	1.95	2.06	2.12	2.26	2.22	1.95	2.12	2.65	2.20	2.28
16	49	35	2.47	2.96	2.40	2.52	2.60	2.78	2.73	2.40	2.60	3.25	2.70	2.80
17	39	58	2.55	3.06	2.47	2.60	2.68	2.87	2.81	2.47	2.68	3.35	2.79	2.89
18	51	35	3.05	3.66	2.95	3.10	3.21	3.44	3.37	2.95	3.21	4.00	3.34	3.47
19	43	43	1.30	1.56	1.26	1.33	1.37	1.47	1.44	1.26	1.37	1.71	1.42	1.48
20	44	41	1.47	1.77	1.43	1.50	1.55	1.66	1.63	1.43	1.55	1.94	1.61	1.67
21	44	52	1.54	1.85	1.49	1.57	1.62	1.73	1.70	1.49	1.62	2.03	1.68	1.75
22	45	44	1.65	1.97	1.59	1.68	1.73	1.85	1.81	1.59	1.73	2.15	1.79	1.86
23	44	43	1.68	2.02	1.63	1.71	1.77	1.89	1.86	1.63	1.77	2.20	1.84	1.90
24	46	42	1.73	2.08	1.67	1.76	1.82	1.94	1.90	1.67	1.82	2.28	1.89	1.98
25	44	80	1.92	2.30	1.86	1.96	2.02	2.16	2.12	1.86	2.02	2.53	2.10	2.18
26	47	42	2.40	2.86	2.32	2.44	2.52	2.68	2.64	2.32	2.52	3.13	2.62	2.72
27	44	48	2.71	3.23	2.63	2.76	2.85	3.05	2.99	2.63	2.85	3.55	2.96	3.07
28	48	47	1.51	1.81	1.47	1.54	1.59	1.70	1.67	1.47	1.59	1.98	1.65	1.71
29	51	48	1.66	2.00	1.61	1.70	1.75	1.87	1.84	1.61	1.75	2.18	1.82	1.90
30	49	46	1.69	2.03	1.64	1.72	1.78	1.90	1.87	1.64	1.78	2.22	1.85	1.92
31	51	47	1.75	2.10	1.69	1.78	1.84	1.96	1.92	1.69	1.84	2.30	1.91	2.00
32	50	47	1.84	2.21	1.78	1.88	1.94	2.07	2.04	1.78	1.94	2.42	2.02	2.10
33	49	47	1.87	2.24	1.81	1.91	1.97	2.10	2.07	1.81	1.97	2.46	2.05	2.12
34	46	85	1.89	2.26	1.83	1.93	1.99	2.13	2.08	1.83	1.99	2.49	2.07	2.16
35	47	66	1.97	2.36	1.90	2.01	2.07	2.21	2.17	1.90	2.07	2.59	2.15	2.24
36	47	69	1.99	2.38	1.92	2.03	2.09	2.24	2.19	1.92	2.09	2.61	2.17	2.26
37	46	74	2.10	2.52	2.03	2.14	2.21	2.36	2.32	2.03	2.21	2.76	2.30	2.39
38	52	49	2.16	2.58	2.08	2.20	2.27	2.42	2.38	2.08	2.27	2.83	2.36	2.45
39	52	47	2.32	2.78	2.24	2.36	2.44	2.60	2.56	2.24	2.44	3.05	2.54	2.64
40	47	66	2.53	3.03	2.45	2.58	2.66	2.85	2.79	2.45	2.66	3.33	2.77	2.87
41	50	46	2.58	3.10	2.50	2.63	2.72	2.92	2.85	2.50	2.72	3.41	2.82	2.93
42	46	47	2.68	3.20	2.60	2.73	2.82	3.02	2.96	2.60	2.82	3.52	2.93	3.04
43	50	49	2.73	3.25	2.65	2.78	2.87	3.07	3.01	2.65	2.87	3.57	2.98	3.09
44	47	69	2.79	3.35	2.70	2.85	2.94	3.15	3.09	2.70	2.94	3.68	3.06	3.17
45	47	62	3.11	3.73	3.01	3.17	3.27	3.50	3.43	3.01	3.27	4.09	3.40	3.53
46	47	59	3.12	3.74	3.02	3.18	3.28	3.51	3.44	3.02	3.28	4.10	3.41	3.54
47	52	51	1.89	2.26	1.83	1.93	1.99	2.13	2.08	1.83	1.99	2.50	2.07	2.16
48	54	51	2.03	2.44	1.97	2.08	2.14	2.28	2.24	1.97	2.14	2.67	2.22	2.30
49	50	51	2.56	3.08	2.48	2.61	2.70	2.90	2.84	2.48	2.70	3.40	2.81	2.92
50	50	53	2.57	3.09	2.49	2.62	2.71	2.91	2.84	2.49	2.71	3.40	2.81	2.92
51	50	70	2.64	3.17	2.56	2.70	2.78	2.97	2.92	2.56	2.78	3.48	2.89	3.00
52	55	53	2.66	3.18	2.58	2.71	2.80	3.00	2.94	2.58	2.80	3.50	2.91	3.02
53	52	80	3.13	3.80	3.08	3.24	3.34	3.58	3.50	3.08	3.34	4.18	3.48	3.60
54	55	57	2.24	2.70	2.16	2.28	2.36	2.52	2.48	2.16	2.36	2.97	2.46	2.56