

ROOFS

SECTION UIP 4

EXPLANATION

The general headings for roof structures in the Segregated Cost sections include the complete roof structure: rafters, purlins, sheathing or deck, bracing and ties. If a more detailed cost is needed, use the tables in this section.

TYPICAL ROOFS

WOOD RAFTERS

Cost per square foot includes necessary ties, ridges and bracing. Ceiling joists should be added. For pitched roofs, use the multipliers in the Roof Slope table. For prefabricated trussed rafters, see Page 3, in this section.

SPACING

DIMENSIONS (inches)	12" o.c.	16" o.c.	20" o.c.	24" o.c.	32" o.c.	48" o.c.
2 x 4	\$1.66	\$1.33	\$1.12	\$1.00	\$.80	\$.59
2 x 6	1.96	1.59	1.36	1.20	.97	.72
2 x 8	2.30	1.86	1.57	1.39	1.12	.84
2 x 10	2.89	2.35	1.99	1.76	1.43	1.08
2 x 12	3.40	2.77	2.35	2.06	1.66	1.23
3 x 4	2.67	2.16	1.85	1.62	1.32	1.00
3 x 6	3.67	2.97	2.52	2.21	1.78	1.32
3 x 8	4.63	3.75	3.19	2.79	2.27	1.68
3 x 12	6.53	5.28	4.47	3.92	3.17	2.35
4 x 6	4.39	3.54	3.01	2.63	2.14	1.57
4 x 8	5.32	4.31	3.63	3.18	2.56	1.89
4 x 12	7.46	6.03	5.10	4.46	3.60	2.67

ROOF SLOPE MULTIPLIERS

For roof components of sloping roofs, multiply by the figures given below to obtain the cost per square foot of horizontal projection.

RISE	MULTIPLIER	RISE	MULTIPLIER
1½ to 12	1.01	6 to 12	1.12
2 to 12	1.01	8 to 12	1.20
3 to 12	1.03	12 to 12	1.42
4 to 12	1.06	15 to 12	1.60
5 to 12	1.08	18 to 12	1.80

These multipliers may also be used to convert the horizontal projected area to the actual roof area for sloping roofs.

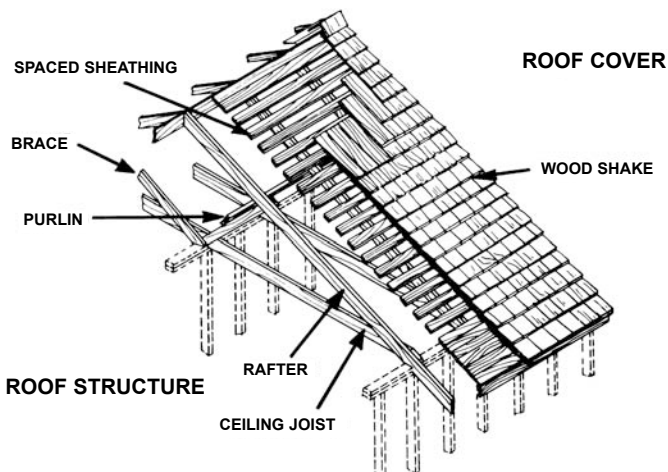
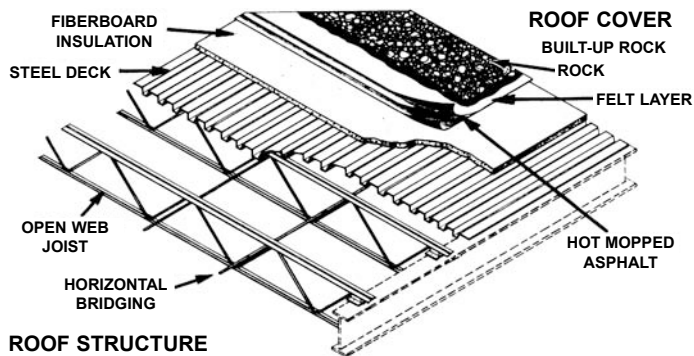
WOOD CEILING JOISTS

DIMENSIONS (inches)	SPACING			
	12" o.c.	16" o.c.	20" o.c.	24" o.c.
2 x 4	\$1.33	\$1.04	\$.85	\$.72
2 x 6	1.59	1.23	1.03	.86
2 x 8	1.86	1.46	1.28	1.11
2 x 10	2.35	1.84	1.51	1.28
2 x 12	2.77	2.15	1.78	1.51

EXPOSED WOOD BEAMS

Costs per linear foot including sanding and finish. For rough sawn ornamental beams, add 40%. Simulated plastic beams cost \$5.50 to \$6.50 per linear foot.

SIZE	COST	SIZE	COST	SIZE	COST
2 x 6	\$2.95	4 x 8	\$ 7.60	6 x 12	\$20.55
3 x 6	5.50	4 x 12	10.65	6 x 14	23.00
3 x 8	6.55	6 x 8	13.15	8 x 12	28.05
4 x 6	6.25	6 x 10	16.60	8 x 14	30.95



ROOFS

SECTION UIP 4

STEEL JOISTS

Costs of solid rolled or open-web joists, per square foot of roof area, including connections, ties, and braces. Depth is for open-web joists.

DEPTH	SPAN	LIGHT	MEDIUM	HEAVY
8"	10' to 14'	\$.85	\$1.27	----
10"	14' to 16'	.88	1.44	\$2.04
10"	18' to 20'	1.41	2.30	3.24
12"	16' to 20'	1.12	1.75	2.36
12"	20' to 22'	1.58	2.41	3.30
14"	18' to 22'	1.38	1.98	2.64
14"	22' to 26'	1.77	2.54	3.37
16"	20' to 24'	1.42	2.05	2.76
16"	24' to 28'	1.72	2.43	3.23
16"	28' to 32'	2.20	3.18	4.21
18"	22' to 26'	1.58	2.31	3.09
18"	26' to 30'	1.88	2.72	3.60
18"	30' to 34'	2.39	3.47	4.61
20"	24' to 28'	1.78	2.59	3.42
20"	28' to 32'	2.05	2.99	3.99
20"	32' to 36'	2.60	3.75	4.96
24"	28' to 34'	2.11	3.08	4.12
24"	34' to 40'	2.43	3.52	4.68
24"	40' to 46'	2.96	4.27	5.68
28"	40' to 48'	2.26	3.99	5.20
28"	48' to 54'	2.88	5.06	6.63
32"	50' to 56'	2.64	4.41	5.88
32"	56' to 62'	3.24	5.39	7.22
36"	58' to 64'	2.88	4.82	6.43
36"	64' to 70'	3.24	5.76	7.67
40"	66' to 72'	3.11	5.20	7.13
40"	72' to 78'	3.62	6.00	8.25
48"	82' to 88'	3.55	5.97	8.18
48"	88' to 94'	3.99	6.59	9.06

WOOD-TRUSSED JOISTS

Costs of light wood flange with solid plywood web or open tubular steel web joists, per linear foot, including ancillary connections.

TYPE	SPAN	LIGHT	MEDIUM	HEAVY
Plywood	15' to 30'	\$4.35	\$5.20	\$6.50
Tubular steel	40' to 70'	4.05	4.95	6.60

PURLINS

Costs per linear foot of purlin including connections or hangers. Light Z or C flanges for pre-engineered metal buildings may run 30% to 50% of the structural channel costs. Light wood nailing strips for wood pole frame buildings may run 65% to 85% of the purlin costs.

LIGHTWEIGHT STEEL CHANNELS		LIGHTWEIGHT I-BEAMS		WOOD WITHOUT STRUTS		WITH STRUTS
SIZE	COST	SIZE	COST	SIZE	COST	COST
4"	\$13.95	4"	\$16.45	1 x 6	\$1.05	----
6"	18.65	6"	21.80	2 x 4	1.35	\$3.40
8"	23.40	8"	27.20	2 x 6	1.60	3.80
10"	28.05	10"	32.50	2 x 8	1.95	4.35
12"	32.80	12"	38.10	2 x 10	2.30	5.05
15"	39.85	15"	46.00	2 x 12	2.95	5.70

STEEL SPACE FRAMES

The following square foot costs are averages of typical three-dimensional roof structures for buildings requiring long two-way spans. They do not apply to architectural embellishments or patented systems primarily designed for appearance and skylight areas. Costs include sheathing.

LIGHT	MEDIUM	HEAVY
\$12.00 – \$18.25	\$17.75 – \$22.75	\$22.00 – \$32.75

DOMES

Typical range of costs of dome structures where the dome forms both roof and walls. Cost per square foot of horizontal area which is covered, for dome structure only, excluding floor, finish, lighting, etc.

Skylight cover on metal frame, D = 5' to 40'	\$41.00 – \$86.00
Metal geodesic, D > 70'	18.25 – 33.25
Reinforced concrete, cast-in-place	24.25 – 36.00
Thin shell, concrete	16.00 – 26.00
Wood deck and frame	13.00 – 28.50

Domes may also be estimated by adding up the unit costs of the component parts and multiplying by an area calculated by resolving the dome into a rectangular structure as shown in the illustration.

30' x 30'	=	900 sq. ft.
4 x 30' x 15'	=	<u>+1,800 sq. ft.</u>
Apply unit cost to		2,700 sq. ft.

ROOFS

SECTION UIP 4

STEEL ROOF TRUSSES

Tapered steel girders will cost from 15% to 30% less for short spans to 25% to 35% less for long spans (over 80'). Costs include end connections.

COST – EACH TRUSS			
SPAN	LIGHT	MEDIUM	HEAVY
30'	\$2,100	\$ 2,550	\$ 3,100
40'	2,825	3,425	4,150
60'	4,350	5,200	6,250
80'	5,825	6,975	8,400
100'	7,300	8,800	10,500
120'	-----	10,550	12,650
140'	-----	12,400	14,750
160'	-----	-----	16,875

WOOD-TRUSSED RAFTERS

Costs are for prefabricated roof trusses common to light wood framing (12" to 48" on center) using 2" x 4" and 2" x 6" (up to 45' span) and 2" x 8", 2" x 10" and 2" x 12" (over 45' span) members, attached with steel plates or plywood gussets, including ancillary items and ties.

For pole-frame construction (8' to 14' spacing) with members 2" x 8" and larger with spans below 50', add 20%. Add 10% for site-built trusses. For double trusses, count both and deduct 5% from the total.

COST – EACH TRUSS			
SPAN	LIGHT	MEDIUM	HEAVY
20'	\$ 64.00	\$ 68.00	\$ 74.00
30'	100.00	110.00	121.00
40'	146.00	165.00	189.00
50'	197.00	230.00	269.00
60'	253.00	300.00	355.00

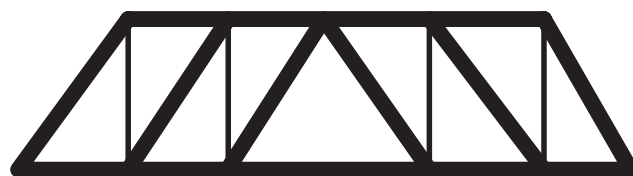
INDUSTRIAL WOOD TRUSSES

Costs are for timber or glulam industrial trusses, including end connections. For finished commercial trusses add 20% to 25%. Glued, laminated wood girders will cost approximately 25% to 50% less than bowstring trusses for short spans (up to 25'), 20% more for mid-range spans (up to 45'), to 50% to 75% more for long-span girders (up to 75'). Glued, laminated arches with ties, will cost approximately 15% to 20% less than bowstring trusses for short spans to 10% more for long spans (over 80'). Cost ranges are for trusses bearing roof loads only, not for those carrying hoists or cranes.



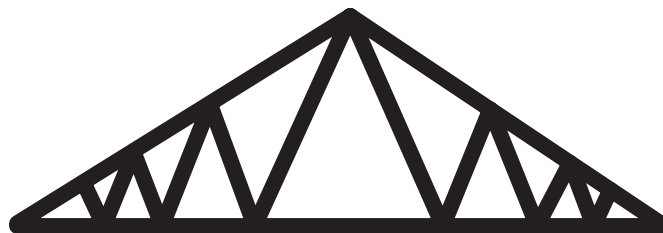
BOWSTRING TRUSS

BOWSTRING SPAN	COST – EACH TRUSS		
	LIGHT	MEDIUM	HEAVY
20'	\$ 800	\$ 925	\$ 1,025
40'	1,950	2,275	2,625
60'	3,250	3,825	4,575
80'	4,650	5,600	6,750
100'	6,150	7,475	9,050
120'	7,775	9,525	11,600
140'	9,500	11,625	14,275



FLAT HOWE

BELGIAN OR HOWE SPAN	COST – EACH TRUSS		
	LIGHT	MEDIUM	HEAVY
20'	\$ 500	\$ 625	\$ 850
40'	1,600	2,025	2,575
60'	3,125	3,950	4,975
80'	5,125	6,400	7,950
100'	7,525	9,325	11,450



BELGIAN TRIANGULAR

ROOFS

SECTION UIP 4

ROOF DECKS AND SHEATHING

Per square foot of decking or sheathing

TYPE	COST RANGE
Concrete, hollow precast plank	\$5.55 – \$ 8.75
Lift slab	6.60 – 10.40
Lightweight channels, 2" – 3"	4.55 – 6.95
Plank, 2" – 3" T&G	5.15 – 6.95
Reinforced slab, 4" – 6"	6.85 – 10.80
Topping, 1-3/4" – 2-1/2" foamed concrete	1.00 – 2.05
lightweight concrete, reinforced, 2" – 3"	2.25 – 2.95
Prestressed tees or double tees	6.10 – 10.00
Fiberboard, prefinished one side,	
2" T&G	2.25 – 3.15
3" T&G	2.90 – 3.65
Gypsum: 2" plank with metal edge	3.15 – 4.85
2" – 3" poured over gypsum board	2.45 – 3.40
2" – 3" poured over fiberglass	2.90 – 3.70
Steel: 18 gauge, corrugated or crimped	2.00 – 3.90
26 gauge	1.35 – 2.75
Cellular	5.15 – 9.35
Tectum, 2", prefinished one side	3.10 – 4.20
Wood sheathing: 5/16" plywood . . . . .	.77 – .95
3/8" plywood . . . . .	.84 – 1.06
1/2" plywood . . . . .	.94 – 1.22
5/8" plywood	1.10 – 1.48
3/4" plywood	1.30 – 1.65
1-1/8" plywood, T&G	1.96 – 2.71
1" spaced board . . . . .	.88 – 1.55
1" solid board	1.37 – 2.09
1" T&G	1.41 – 2.27
2" T&G	2.39 – 3.95
3" T&G	4.00 – 5.78
2" plank	2.32 – 4.60
3" plank	3.85 – 6.50
for oriented strand – waferboard, deduct . . . . .	.07 – .12
for fire-treated wood, add . . . . .	.29 – .58
Wood stresskin sandwich panels	4.60 – 10.00

ROOF COVER

Cost per square foot of roof area, including typical flashing, valleys and underlayment as required by the roofing type. Extremely steep or cut-up roofs may be 20% above the high end of the range. For vertical or mansard applications, add 20%. Curved metal panels, add \$.60 to \$2.00.

Aluminum, sheet, corrugated, crimped or tile panels	
preformed, light (.0175" to .024" thick)	\$1.50 – \$2.90
heavy (.032" to .050" thick)	
including prefab lock and seam	2.75 – 4.25
formed seam, flat or standing	2.80 – 7.00
batten seam	3.30 – 7.85
shingles	2.15 – 4.65
Built-up, 2-ply . . . . .	.84 – 1.34
3-ply	1.00 – 1.66
4-ply	1.15 – 1.92
5-ply	1.39 – 2.39
add for gravel or small rock . . . . .	.19 – .31
add for large rock . . . . .	.22 – .38
Cement fiber, (asbestos) shingles	2.15 – 4.70
corrugated or sheet (transite)	1.86 – 7.84
Composition, roll . . . . .	.54 – 1.18
Composition shingle, light, to 235# . . . . .	.95 – 1.62
heavy, over 235#	1.20 – 2.41

ROOF COVER

(Continued)

TYPE	COST RANGE
Copper, flat or standing seam	\$6.80 – \$12.55
batten seam	7.30 – 13.40
shingles	6.90 – 9.50
Elastomeric, single ply	1.70 – 5.05
reinforced sheet or spray fluid coat	3.15 – 6.10
Fiberglass, corrugated or sheet	1.10 – 2.15
structural or (FRP) panels over 8 oz.	2.15 – 5.50
Modified bitumen, single-ply	1.75 – 5.20
reinforced sheet	2.90 – 5.95
Slate (red slate, add 100%)	4.20 – 9.00
Steel, corrugated, crimped or tile panels, galvanized	
preformed, light (30 – 26 gauge)	1.10 – 2.80
heavy (24 – 18 gauge)	
including prefab lock and seam	2.50 – 4.15
formed seam, flat or standing	2.65 – 6.40
batten seam	3.15 – 7.30
shingles	2.00 – 4.35
add for porcelain enamel finish	1.70 – 3.35
add for sandwich panels	2.25 – 7.55
add for interior metal liner	1.10 – 2.00
add for stainless steel	1.95 – 3.85
Terne, flat or standing seam	6.25 – 11.65
batten seam	6.85 – 12.55
Tile, clay	3.40 – 10.15
concrete	2.85 – 5.30
plastic	2.50 – 4.60
Wood, shakes	2.05 – 3.85
shingles	1.90 – 3.60
fiber shingles	1.25 – 2.60
add for fire-resistant finish . . . . .	.29 – .64
Roof walkways	3.15 – 4.20

INSULATION

(Per square foot of insulated area)

Aluminum foil, single plyR- 5 – R- 9	\$.24 – \$.29
add, per additional ply . . . . .	.10 – .15
Expanded mica, 3-1/2"R- 7 – R- 9	.84 – 1.18
Fiberboard, 1/2" woodR- 1 – R- 2	.64 – .75
1"R- 2 – R- 3	.76 – 1.03
2"R- 5 – R- 6	1.19 – 1.55
Fiberglass or rock wool:	
For blown-in, use appropriate batt R-value plus 20%.	
1" boardR- 3 – R- 4	.93 – 1.40
2" boardR- 7 – R- 8	1.34 – 1.97
batts or roll, 2-1/2"R- 7 – R- 9	.43 – .59
3-1/2"R-11 – R-13	.48 – .63
6"R-19 – R-22	.68 – .92
9"R-28 – R-30	.94 – 1.24
12"R-36 – R-38	1.22 – 1.64
add for vinyl-faced or wire support . . . . .	.12 – .26
add for colored band support . . . . .	.20 – .39
Foamglass, 1" boardR- 2 – R- 3	2.17 – 2.60
2" boardR- 4 – R- 6	2.73 – 3.44
3" boardR- 7 – R- 8	3.57 – 4.20
Polyurethane, 1" boardR- 7 – R- 8	1.13 – 1.39
2" boardR-14 – R-17	1.47 – 1.88
3" boardR-22 – R-25	2.11 – 2.53
Polystyrene, 1" boardR- 5 – R- 6	.83 – 1.13
2" boardR-10 – R-12	1.24 – 1.61

ROOFS

SECTION UIP 4

SKYLIGHTS

Costs are given per square foot of framed area.

TYPE	PLAIN GLASS OR PLASTIC		WIRE GLASS
	Flat	\$26.00 – \$35.00	\$28.25 – \$39.00
Pitched, without vent	28.50 – 41.00	30.50 – 49.00	
Pitched, with vent	29.00 – 50.75	32.00 – 57.00	
	Small		Large
Plastic domes, fixed	\$36.50 – \$ 62.25	\$27.00 – \$46.25	
Roof windows or			
vented domes	65.25 – 102.75	46.00 – 75.00	
add for blinds	5.40 – 8.35	3.10 – 5.40	
screens	9.00 – 11.20	7.20 – 9.00	
	electric controls, cost \$315 to \$385 per opening.		
Tubular, cost each,	10' ... \$400	14" ... \$525	21" ... 1,025

ROOF HATCHES AND FIRE VENTS

Cost per square foot of framed area.

	COST RANGE
Small (under 10 sq. ft.)	\$82.50 – \$108.25
Medium	68.00 – 93.25
Large (over 25 sq. ft.)	50.00 – 78.75

VENTILATORS

Cost for each range includes galvanized steel (lowest), aluminum, and stainless steel or copper (highest). For light residential installations, deduct 50%.

DIAMETER	STATIONARY COST RANGE		ROTARY COST RANGE
	6"	\$ 85.00 – \$ 200.00	\$105.00 – \$ 275.00
12"	160.00 – 360.00	225.00 – 500.00	
18"	265.00 – 485.00	340.00 – 715.00	
24"	340.00 – 620.00	465.00 – 920.00	
30"	435.00 – 740.00	595.00 – 1,115.00	
36"	540.00 – 870.00	720.00 – 1,310.00	
48"	735.00 – 1,085.00	985.00 – 1,685.00	

CONTINUOUS RIDGE VENTS

Cost range per linear foot including screen and damper.

THROAT SIZE (inches)	COST RANGE	THROAT SIZE (inches)	COST RANGE
4"	\$35.75 – \$48.00	12"	\$55.50 – \$70.25
9"	46.75 – 60.50	14"	61.50 – 77.00

EXHAUST VENTS

Costs each are for propeller type in galvanized housings, including installation. For residential attic fans, deduct 50%.

SIZE (inches)	CAPACITY (CFM)	MOTOR SIZE	FLAT ROOF	PITCHED ROOF
12"	800	1/20 HP	\$ 485.00	\$ 595.00
15"	1,200	1/15 HP	575.00	700.00
18"	2,400	1/10 HP	685.00	825.00
24"	4,200	1/4 HP	940.00	1,120.00
30"	6,000	1/2 HP	1,325.00	1,550.00
36"	11,000	3/4 HP	1,850.00	2,100.00
42"	15,000	1 HP	2,525.00	2,900.00
48"	20,000	2 HP	3,500.00	3,975.00

GUTTERS AND DOWNSPOUTS

Costs are given per linear foot of gutter or downspout. For scupper and conductor head, add \$105.00 to \$185.00 each.

TYPE	COST RANGE
Aluminum	\$4.30 – \$ 9.25
Copper or stainless steel	9.85 – 15.05
Fiberglass or vinyl	4.05 – 6.25
Galvanized steel	4.00 – 7.90
Wood	8.05 – 11.60
Add for mesh guard	1.00 – 1.35

FALSE-MANSARD FASCIA

False-mansard framework is not normally a part of the roof structure. It can be priced on a cost per square foot of vertical projection, exclusive of sheathing and cover which can be added from Page 4.

TYPE	COST RANGE
Metal frame	\$5.20 – \$9.85
Wood frame	3.70 – 6.90

For finished soffit, add \$3.20 to \$5.05 for plaster or stucco, \$2.00 to \$4.55 for wood or \$2.90 (residential) to \$5.25 for metal or vinyl, per square foot of soffit area.

FASCIA BOARD

Cost per linear foot for wood, metal or vinyl fascia boards. For residential construction, use low end of range. For 1" wood material reduce costs by 50%.

	COST RANGE	COST RANGE
6" and less ...	\$1.95 – \$2.65	8" and over ... \$2.15 – \$3.85

STEEPLES

Costs are given per linear foot of height except where noted.

CUPOLAS

TYPE	SMALL (up to 10')	MEDIUM	LARGE (over 20')
	COST RANGE	COST RANGE	COST RANGE
Copper or terne	\$430 – \$1,015	\$670 – \$1,615	\$1,015 – \$2,520
Aluminum or steel	155 – 640	230 – 890	355 – 1,220
Fiberglass	125 – 470	200 – 735	330 – 1,160
Wood	160 – 320	260 – 505	385 – 785

SPIRES

Copper or terne	\$370 – \$570	\$575 – \$905	\$905 – \$1,475
Aluminum or steel	125 – 300	155 – 460	185 – 700
Fiberglass	110 – 205	140 – 355	185 – 595
Wood	95 – 145	120 – 205	190 – 310

DOMES

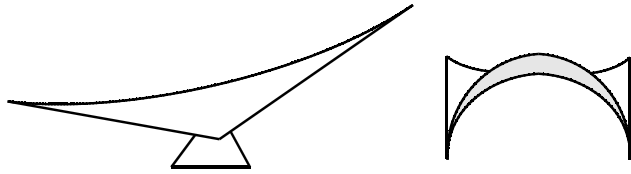
Cost per linear foot of dome diameter, up to 8'

	COST RANGE
Copper or terne	\$ 265 – \$ 485
Aluminum or steel	110 – 190
Fiberglass	70 – 110
Wood or stucco	70 – 140
Add for cupola clocks, per face	1,435 – 2,315
Crosses, per linear foot of height	140 – 610
Spikes, per linear foot of height	105 – 315
Balls, cost each	120 – 575
Weather veins, cost each	145 – 840

ROOFS

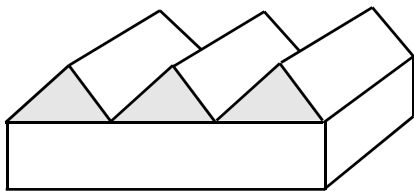
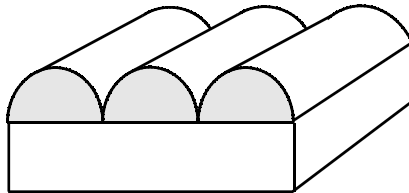
SECTION UIP 4

ROOF SHAPES



HYPERBOLIC PARABOLOIDS

BARREL SHELL



FOLDED PLATE

ROOF SHAPES

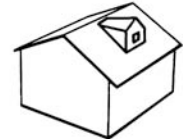
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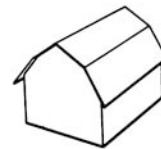
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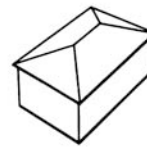
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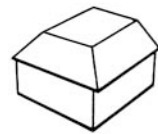
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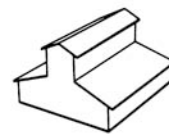
GAMBREL



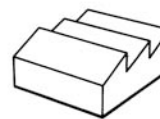
HIP



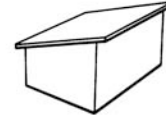
MANSARD



MONITOR



SAWTOOTH



SHED

THIN-SHELL REINFORCED CONCRETE

Cost ranges per square foot of horizontal area. For domes, see page 2.

	COST RANGE
Barrel shell	\$12.00 – \$21.50
Folded plate	11.25 – 20.00
Hyperbolic-paraboloid, small bays	10.75 – 20.50
large span	12.00 – 21.75

FABRIC ROOF STRUCTURES

Costs per square foot of floor area for permanent single-layer fabric structures completely installed. For interior thermal liners, add \$2.50 to \$5.05 per square foot.

	COST RANGE
Air supported	\$26.50 – \$36.50
Tension supported	29.50 – 44.75

DORMERS

Costs of exterior construction of dormer windows and necessary dormer structure vary greatly with the size of the dormer. It may be approximated by applying 1/3 to 2/3 of the dwelling square foot cost to the horizontal area of the dormer at the dormer eave line.

MONITOR AND SAWTOOTH ROOFS

Costs of monitor and sawtooth roofs may be built up as with any other roof structure, adding for trusses if they exist, and then pricing the vertical window sections as follows:

	FIXED WINDOWS	VENTED WINDOWS
Fiberglass	\$11.65 – \$14.55	\$15.75 – \$19.50
Glass	13.10 – 16.25	17.45 – 21.55
Wire glass	16.00 – 19.80	20.65 – 25.95