Chapter 2

Square Foot and Cubic Foot Estimates

Square foot and cubic foot cost data is usually categorized by building type. (Means publishes this information in its annually updated *Assemblies Cost Data.*) Figures 1.5 and 1.6 show typical square foot and cubic foot cost tables based on thousands of buildings constructed within the ten years prior to 2001 and adjusted to January 1, 2001 prices.

Using Square Foot/ Cubic Foot Cost Data

Means square foot and cubic foot costs are shown in ranges of 1/4, median, and 3/4. For the 1/4 figures, three quarters of the projects studied had higher costs reported, and 1/4 had lower costs reported. For the median figures, one-half of the projects had higher costs reported, and one-half had lower. For the 3/4 figures, one-quarter had higher and three-quarters had lower costs reported. If nothing is known about a project except the building's purpose or type, use the median column as a starting point to approximate the building cost.

Figure 1.7, Unit Gross Area Requirements, can be used to approximate the square foot requirements of specified building types. Once an approximate project size has been determined, use the numbers in the tables to derive a representative cost per square foot for the appropriate type of building.

The Area Conversion Scale

The next step is deciding whether to price the building at the 1/4, median, or 3/4 range, or at some other point. For this decision, analyze:

- The owner's quality requirements.
- Unusual design or construction requirements.
- The extent of sitework, installed equipment, and furnishings.
- The extent of air conditioning, heating, and electrical requirements.
- Building configuration.
- Floor-to-floor height.
- Number of floors.

Also consider the building's size. When comparing buildings of similar design and specifications in the same locality, larger buildings tend to have lower square foot costs. This is mainly because of the decreasing contribution of the exterior walls and economy of scale. The Area Conversion Scale in Figure 1.4 provides factors for converting median

Footing Load Reduction Comparisons

Example One: Small Building

See the footing plan for the small building, Figure 5.2.

Footings: 1 Interior
4 Exterior
4 Corner

Assuming all footings are at full bay loading (75 kips load and 3 K.S.F. soil pressure), the footing cost is:

See Figure 3.15, line #7250:

9 ea. @ $327 = $2,943 or

$\frac{\$2,943}{2,500 \text{ S.F.}}$ = $1.18/S.F.

25' × 25' Bays

Now assume interior and exterior footings with load reduction:

Footing Loads: Interior = 75 kips
Exterior = 45 kips (75 kips × .6)
Corner = 34 kips (75 kips × .45)

Soil Pressure = 3 K.S.F.

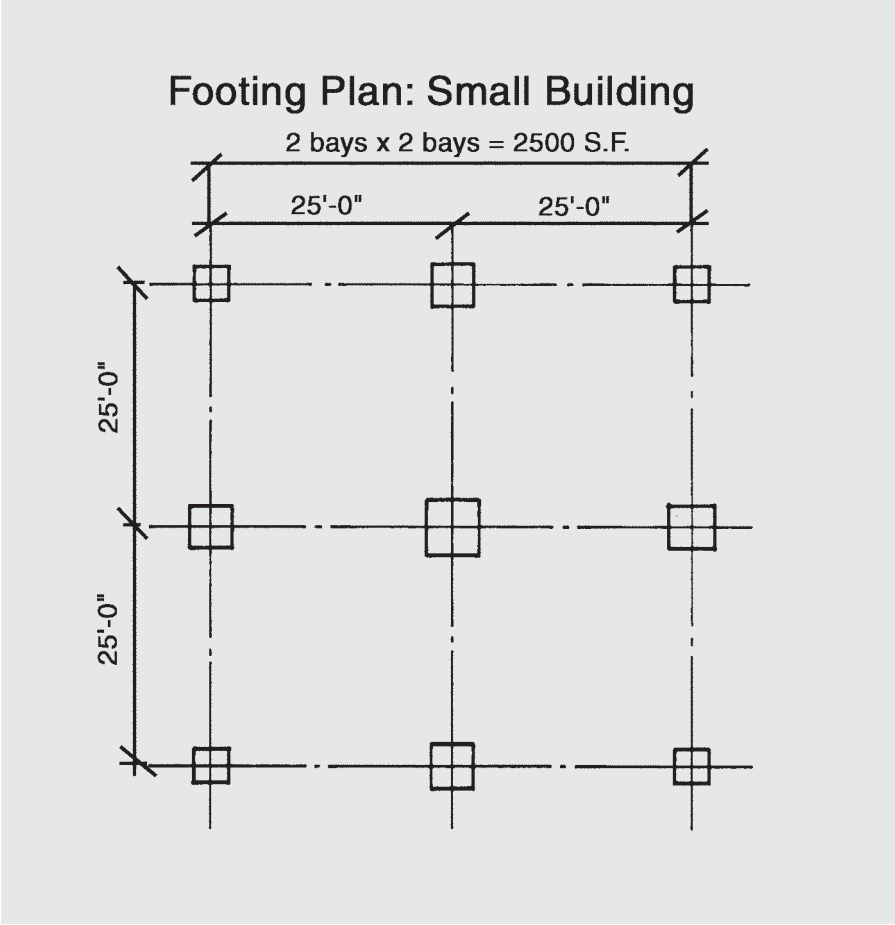

Figure 5.2

Assemblies Estimate: Three-Story Office Building

The total superimposed loads from the "Superimposed Load" section are:

Floor: 75 psf
Roof: 40 psf
25' × 25' Bay Spacing
3 stories with 2 elevated floors and a roof

Step One: Select the Floor System

See Figure 5.1:

Open Web Joists and Beams on Columns: $10.02/S.F.
Cast-in-Place Concrete Flat Plate: $10.24/S.F.

The designer and owner agree that the steel framing system is more desirable because of cost, quick erection time, availability, and because structural elements will not be exposed to view. *(Note: A concrete structure is fireproof. Steel and open web joist construction requires fireproofing. Therefore, the cost comparison at this point is not complete.)*

Step Two: Price the Floor System

Choose the appropriate table for an open web joist and beams on columns floor assembly.

(Figure 3.12, line #5100) 25' × 25' Bay; 75 psf Superimposed Load

Total Load	=	120 psf
System Cost	=	$10.02/S.F.

Step Three: Select a Roof System

Once the structural floor assembly has been designed and costs have been established, select a roof assembly. The roof framing assembly normally has the same bay spacing and may or may not be of the same construction.

Now select a roof system and price it.

See Figure 3.13, line #3300:

25' × 25' Bay; 40 psf Superimposed Load

Total Load	=	60 psf
System Cost	=	$4.52/S.F.

Step Four: Summarize Loads

The loads (depicted in Figure 3.14) were developed for this structure. They are as follows:

Minimum Column Load	=	39 kips
Maximum Column Load	=	191 kips
Load to the Foundation	=	191 kips

Step Five: Price the Columns

The column cost tables are arranged so that the user can enter and make cost determinations when any one of the following situations exists:

- The exact type, size, weight, and length of the columns being estimated have been predetermined.
- The type of column desired and the total load concentrated to the columns are known.
- The bay size has been determined, floor and roof systems (not including columns) have been selected, and the total load concentrated on the columns has been calculated.

ASSEMBLY NUMBER	DESCRIPTION	QTY	UNIT	TOTAL COST		COST PER S.F.
				UNIT	TOTAL	
DIVISION B	SHELL					
B10	SUPERSTRUCTURE					
B1010-208-1600	Columns, 38K (50K), 25 x 9'	225	V.L.F.	$ 19.90	$ 4,478	
B1010-208-4600	Columns, 191K (200K), 25 x 27.33'	683	V.L.F.	$ 43.45	$ 29,687	
B1010-212-3450	Column Fireproofing, 8" Average, Gyp. Board	859	L.F.	$ 16.45	$ 14,131	
B1010-250-5100	Floor Framing	20,000	S.F.	$ 10.02	$ 200,400	
B1020-112-3300	Roof Framing	10,000	S.F.	$ 4.52	$ 45,200	
	Subtotal, Division B10, Superstructure				$ 293,896	$ 9.80
B20	EXTERIOR CLOSURE					
B2010-109-3310	Insulated CMU at Penthouse, 6" CMU	493	S.F.	$ 6.78	$ 3,343	
B2010-103-5750	Wall Panels, Precast concrete, (170 S.F. Ea.)	9,338	S.F.	$ 14.99	$ 139,977	
B2020-118-2000	Windows, Alum. Flush Tube w/Thermal Break	5,750	S.F.	$ 21.25	$ 122,188	
B2020-120-1000	Glass, Insulating Type	5,750	S.F.	$ 14.20	$ 81,650	
B2030-105-6350	Doors, Aluminum & Glass, 6' x 7'	2	OPNG.	$ 3,025.00	$ 6,050	
C3020-410-1880	Window Sills, Precast Terrazzo	771	S.F.	$ 13.04	$ 10,054	
	Subtotal, Division B20, Exterior Closure				$ 363,262	$ 12.11
B30	ROOFING					
B3010-105-1900	Built-up, 3 ply w/gravel, Non-nailable Deck, Insulated	10,000	S.F.	$ 1.93	$ 19,300	
B3010-120-4020	Insulation, Composite w/1-1/2" Polyisocyanurate, 1" Perlite	10,000	S.F.	$ 1.36	$ 13,600	
B3010-430-0350	Aluminum Flashing	1,040	S.F.	$ 2.46	$ 2,558	
B3010-630-5200	Gravel Stop, Aluminum, 4"	92	L.F.	$ 6.92	$ 637	
	Subtotal, Division B30, Roofing				$ 36,095	$ 1.20

Figure 7.11

Air Conditioning

The purpose of air conditioning is to control the environment of an enclosed space for human comfort or for equipment operation. System objectives must be defined and evaluated by several factors, including:

- Temperature control
- Humidity control
- Cleanliness
- Odor, smoke, and fumes
- Ventilation

Figure 11.3 provides a general rule of thumb for the air conditioning requirements of various building types. The numbers include the BTUs per hour per square foot of floor area and square feet per ton of air conditioning.

Air Conditioning Assemblies

Heating and air conditioning assemblies are frequently linked together in one system. One exception is perimeter fin tube radiation heating with a separate forced-air cooling system.

Air conditioning system prices in *Means Assemblies Cost Data* are listed by the cost per square foot for several building types, as shown in

Outside Design Temperature Correction Factor (for Degrees Fahrenheit)

Outside Design Temperature	50	40	30	20	10	0	–10	–20	–30
Correction Factor	0.29	0.43	0.57	0.72	0.86	1.00	1.14	1.28	1.43

Figure 11.2

Air Conditioning Requirements

BTU's per hour per S.F. of floor area and S.F. per ton of air conditioning.

Type of Building	BTU per S.F.	S.F. per Ton	Type of Building	BTU per S.F.	S.F. per Ton	Type of Building	BTU per S.F.	S.F. per Ton
Apartments, Individual	26	450	Dormitory, Rooms	40	300	Libraries	50	240
Corridors	22	550	Corridors	30	400	Low Rise Office, Exterior	38	320
Auditoriums & Theaters	40	300/18*	Dress Shops	43	280	Interior	33	360
Banks	50	240	Drug Stores	80	150	Medical Centers	28	425
Barber Shops	48	250	Factories	40	300	Motels	28	425
Bars & Taverns	133	90	High Rise Office—Ext. Rms.	46	263	Office (small suite)	43	280
Beauty Parlors	66	180	Interior Rooms	37	325	Post Office, Individual Office	42	285
Bowling Alleys	68	175	Hospitals, Core	43	280	Central Area	46	260
Churches	36	330/20*	Perimeter	46	260	Residences	20	600
Cocktail Lounges	68	175	Hotel, Guest Rooms	44	275	Restaurants	60	200
Computer Rooms	141	85	Corridors	30	400	Schools & Colleges	46	260
Dental Offices	52	230	Public Spaces	55	220	Shoe Stores	55	220
Dept. Stores, Basement	34	350	Industrial Plants, Offices	38	320	Shop'g. Ctrs., Supermarkets	34	350
Main Floor	40	300	General Offices	34	350	Retail Stores	48	250
Upper Floor	30	400	Plant Areas	40	300	Specialty	60	200

*Persons per ton
12,000 BTU = 1 ton of air conditioning

Figure 11.3