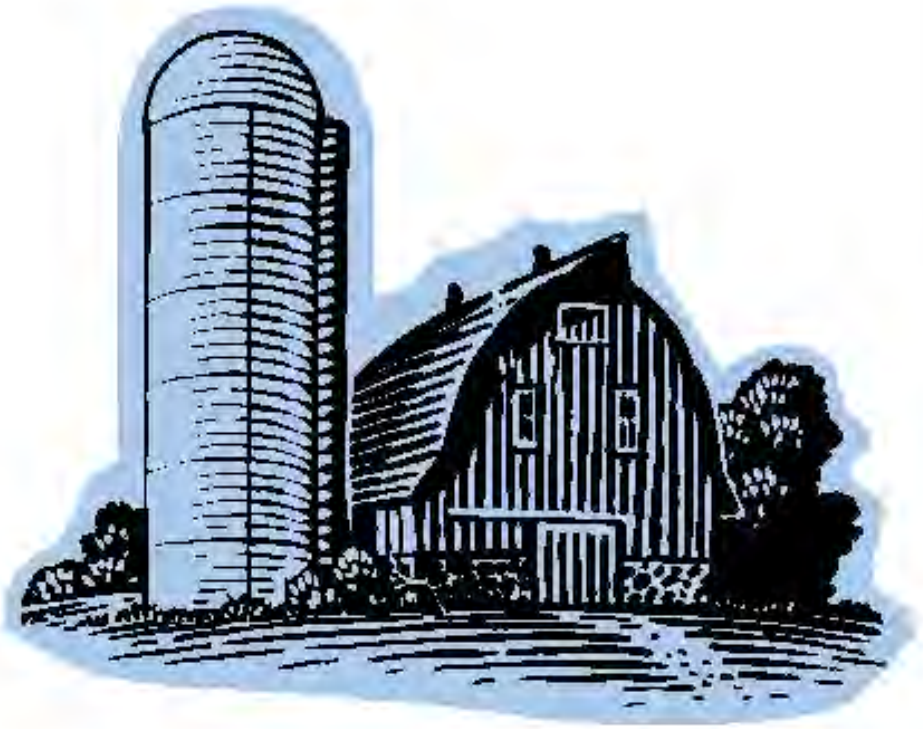
Cost Factors for Farm Buildings

2009 Edition



OREGON DEPARTMENT OF REVENUE

Cost Factors For

Farm Buildings

Series 150

Foreword

This book provides Oregon assessors with cost data for farm buildings and some accessory improvements. The information is arranged in a way to facilitate an efficient calculation of a cost estimate.

The Oregon Department of Revenue publishes this manual to help achieve the standards of assessment uniformity required by Oregon's ad valorem tax laws (ORS 306.120 (1)).

If you have questions about the information in this manual or need additional assistance, contact the Property Tax Division's Assessment & Taxation Standards Section in Salem at (503) 945-8278.

For additional copies of this publication, write: Oregon Department of Revenue, Special Services, 955 Center St. NE, Salem, OR, 97301, or call (503) 945-8636. You may also access the manual on-line at www.oregon.gov /DOR/.

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The Cost Estimating Process
General Instructions

The Cost Approach

The cost approach is one of several methods appraisers use to arrive at an indication of value. This method assumes an informed purchaser will pay no more for a structure than the cost of replacing it.

One advantage of the cost approach is that it can be applied to most types of improved properties. Another advantage is that the cost data can be adjusted easily to reflect current market trends. These advantages make the cost approach a useful tool for mass appraisal. This manual will help you apply the cost approach quickly and uniformly.

Base Cost Method

This method develops an estimate of replacement cost. Replacement cost is the cost to build a similar structure using current construction methods and materials. The replacement structure must offer similar construction quality, usable space, and other significant features. The advantage of this method is its speed and simplicity.

Cost data for supplementary farm structures such as grain bins, feed bunks and fences can be found in the Accessory Improvements Section.

Composition of Costs

Information from owners, contractors, suppliers and field inspections was used to develop the cost factors in this book. In addition to direct costs such as labor, materials, and contractor's profit and overhead, the cost factors also include indirect costs. Indirect costs must be included in all estimates because they are part of the cost of a finished project. Indirect costs include such items as:

Plans and specifications	Temporary facilities
Building permits	Insurance coverage
Advertising	Construction financing
Performance bonds	Engineering fees

Include the indirect costs typical for your market area when comparing cost factors in this manual to local building costs.

Base Location

Because of the varied building types and where they are located, it was necessary to collect cost data from rural areas around Oregon. Therefore, the base location for this manual is generically listed as: OREGON.

Base Date

The date for which the cost factors in this manual were derived is called "the base date." The base date for this manual is January 1 of the year the manual was published.

Issue Date

The issue date may vary for different pages or segments of this manual due to updates and revisions issued after the original date of publication. To ensure you have the latest updates and revisions, we've placed an issue date at the bottom outside corner of each page of this book. Issue dates do not affect the base date.

The Cost Estimating Process
General Instructions (cont.)

Local Cost Modifier

Both location and time have a major impact on the cost of construction. Because the cost factors in this manual were obtained throughout Oregon and were developed as of a specific date, each assessor must develop a Local Cost Modifier (LCM) to adjust the cost factors to a specific locality and appraisal date. An LCM developed for a particular market area is a vital part of any cost estimate.

To develop an LCM, follow these procedures:

1. Obtain actual building costs on new farm structures in your local market area.

2. Develop a cost estimate for each new farm structure using the cost factors in this book.

3. Divide the actual building cost total by the cost estimate total from this book. The result is the LCM.

EXAMPLE

Building Number	Actual Cost of Farm Structures	Factor Book Cost Estimate
1	$ 25,430	$19,073
2	28,360	26,375
3	44,290	49,605
4	35,780	34,349
5	39,420	38,632
6	32,100	27,285
7	22,540	21,188
8	42,720	38,448
9	36,220	37,307
10	38,450	37,297
Totals	$ 345,310	$ 329,556

$ 345,310 Actual Costs / $ 329,556 Factor Book Cost Estimate = 1.05 LCM

Follow this process of developing an LCM for each farm building type contained in this manual. For example, an LCM developed for General Purpose Buildings may not apply to Potato Storage facilities.

Another way to develop an LCM is to compare your local construction material and labor costs to the cost data used to develop this book. To use this method, contact your Regional Field Office for instructions and data collection procedures.

For more information on developing an LCM, refer to *Appraisal Methods for Real Property*.

Building Inspection

Your inspection of the appraisal subject must be objective and comprehensive to ensure proper cost estimates. The quality of the building or its components must be determined through a careful review of layout, design, materials and workmanship. During the inspection you should note:

1. Building components such as foundation, exterior wall, roof, floors, and interior partitions.

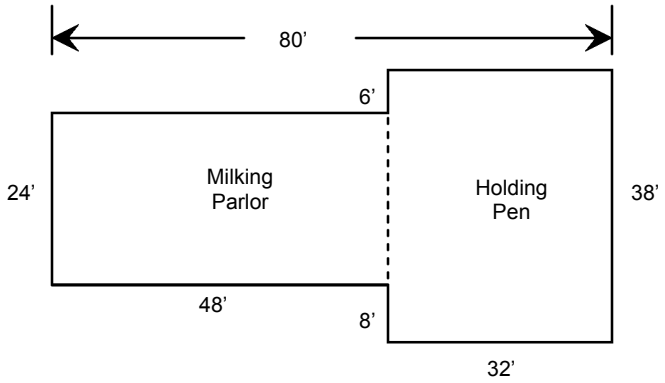
2. Equipment and fixtures such as stalls, feeders, plumbing and electrical items.

3. Other attached improvements such as stairs, roof covers and loading docks.

The Cost Estimating Process
General Instructions (cont.)

You'll also need to measure the building and determine its size because the cost factors in this book are based on building size. Measurements should be taken from the outside of the building walls and rounded to the nearest whole foot. Before leaving the property, you should check your measurements of the building to be sure they balance. The total of the building's front measurements should equal the total of the building's back measurements. The same holds true for the side measurements.

EXAMPLE



Uniformity and Equity

Achieving uniformity and equity in replacement cost estimates is a very important part of mass appraisal. Appraisers should be consistent in selecting appropriate building class and adjustment factors. Variation would result in an unacceptable range of values for buildings which should be valued similarly.

Assessment supervisors should establish reference buildings called "benchmarks" to maintain appraisal uniformity. The benchmarks will provide the appraisal staff with standards and guidelines for estimating the cost of similar structures. You can find procedures for setting benchmarks in *Appraisal Methods for Real Property*.

Base Costs
Instructions

Base Cost Method

This section contains a unit cost system for estimating the replacement costs of typical rural structures. The system is designed to give you reliable cost estimates with a minimum of building notations and calculations.

The cost schedules in this section are arranged under three identifying categories: “group,” “type” and “class.” To locate the proper cost schedule for your subject building, you need to determine which “group,” “type” and “class” best describes the building you are appraising. An analysis of the subject building’s components and features will help you make these determinations.

Group Category

The group is an overall category for buildings, based on general use characteristics. Group categories in this section include Multi-Purpose Structures, Livestock Shelters, Feed and Produce Storage and Specialty Structures.

Type Category

This is a subsection of the group category and is based on design characteristics. For example, type categories provided in the Feed and Produce Storage group are Hay Cover, Silos, Potato Storage, Seed Warehouse, and Commercial Grain Storage.

To aid you in selecting the building “type,” brief descriptive narratives titled “Type Features” are included.

Class Category

Class categories provide for quality variations within each building type. Each class category is related directly to the quality of construction as described by the Base Specification and displayed in the Class Illustrations.

Class Illustrations will assist you in visualizing the quality features of each class. The photographs illustrate a variety of structural designs and architectural styles. However, the buildings are alike in overall quality and functional utility. Therefore, the replacement costs are similar. Emphasis is placed on construction features and utility according to current farming standards.

Base Specifications describe the building components of a replacement structure typical to each class. Comparison between the Base Specifications and your locally developed classification benchmarks should be your primary consideration when selecting the class that is most like a subject building.

Base Factors

A Base Factor is the unit cost (per square foot, lump sum, per bushel) for each class of structure. For most property types the Base Factors are presented in two formats, table format and square foot plus lump sum format. Base Factors contain only the costs of those components listed in the Base Specifications. The cost of any item, component, or machinery and equipment not described in the Base Specifications are not included in the Base Factors.

To select the Base Factor for your subject building, follow this procedure:

1. Determine the categories which best fit your subject building.
   a. Group (general use characteristics)
   b. Type (design characteristics)
   c. Class (quality levels)

Table format:

2. Locate the line of the table for the building’s class.

3. Read across this line to the column headed by the subject building’s size. The dollar figure in this column is the Base Factor. If the size of your building falls between the sizes listed in the table, an interpolated estimate of the Base Factor is sufficient.

Base Costs
Instructions (cont.)

Square foot plus lump sum format:

2. Locate the size range of the subject.

3. Read across this line to the column headed by the subject building's class.

4. Multiply the square foot number by the subject's square footage. Add to that figure the accompanying lump sum. This is the base cost for your subject.

5. If you wish to know the cost per square foot Base Factor, simply divide the above base cost by the subject's square footage. With this method there is no need to interpolate, as the base factor is determined for the subject's specific size.

Adjustment Factors

A schedule of adjustment factors is provided with each building type. These factors enable you to modify the base factor for differences between your subject building and the components listed in the Base Specifications.

Plus or minus signs before each adjustment factor indicate whether the adjustment should be added to or subtracted from the Base Factor.

When making adjustments, keep in mind that the adjustment factor may represent either:

1. The full installed cost of the item. For example, you're estimating the cost of a General Purpose Building which has an electrical service panel and several outlets. The Base Specifications for this building type list "none" under electrical items. Hence, the adjustment you'd make for the electrical service panel and outlets would be for the total installed cost of the electrical system.

2. The difference between the item described in the Base Specifications and a substitute item. For example, if you are appraising a Class 5 General Purpose Building that has a galvanized metal roof cover, an adjustment is necessary because the Base Specifications for this building type list a metal roof cover with baked enamel finish. Therefore, the indicated adjustment is the cost difference between a metal roof with a galvanized finish and a metal roof with a baked enamel finish.

If you need to adjust for an item not listed under the adjustment factors, refer to the Component Cost Section for additional cost data. For instance, if your subject General Purpose Building contains a laundry tub, you can obtain cost data for a laundry tub from the Plumbing portion of the Component Cost Section. Also, keep in mind that the adjustment factor you need may be located in the cost information for another building type elsewhere in this book. Check the index for other references.

If the required adjustment factor isn't listed in the manual, you may develop the cost factors from your local area.

Base Costs
Instructions (cont.)

Replacement Cost Examples

The following examples illustrate the steps to compute replacement cost estimates from this section.

1. The example structure is a Class 5 General Purpose Building containing 2,500 square feet. The building is pole frame construction with exterior wall height of 12 feet and metal cover with baked enamel finish. The roof is a gable design with galvanized metal cover. The building has a concrete floor and a 60 ampere electrical service panel and ten 110 volt outlets. The LCM for this example is 115 percent.

EXAMPLE

Base Factor, Class 5 General Purpose Building;				
Using table format method:				
2,500 square foot Base Factor	+	$ 13.12		
Adjustment factors:				
Cost per square foot adjustments:				
Wall height 12'; add for 2' higher exterior wall	+	.36		
Galvanized metal roof cover	-	.22		
Square foot costs and adjustments subtotal; 2,500 sq. ft. @		13.26	=	$ 33,150
Lump sum adjustments:				
60 ampere service panel	+	900		
110 volt outlets; 10 @ $ 70 each	+	700		
Lump Sum Adjustments Subtotal		1,600	+	1,600
Replacement Cost From Manual				$ 34,750
Multiplied by General Purpose Building LCM			x	115%
TOTAL REPLACEMENT COST NEW			=	**$ 39,963**

2. The structure in this example is a Class 5 Arena. The building measures 96' x 130', contains 17 box stalls and meets the Class 5 Arena Base Specifications except for the following differences: no hot water service or wash room; a 4' high instead of an 8' high arena safety cover; and it lacks two 10' x 12' doors. The LCM for this example is 105 percent.

EXAMPLE

Base Factor, Class 5 Arena;				
Using square foot + lump sum method:				
96' x 130' = 12,480 sq. ft. @ $ 7.30 + $ 42,802			=	$ 133,906
(To determine cost per sq. ft.: $ 133,906 / 12,480 sq. ft. = $ 10.73)				
Lump Sum Adjustments:				
Box stalls; 17 @ $ 1,800	+	$ 30,600		
Less hot water service	-	500		
Less wash room	-	5,010		
Less safety cover 4' high; 380 lin. ft. x 4' = 1,520 sq. ft. @ $ .70	-	1,064		
Less two 10' x 12' doors; 10' x 12' x 2 = 240 sq. ft. @ $ 2.90	-	696		
Lump Sum Adjustments Subtotal		23,330	+	23,330
Replacement Cost From Manual			=	$ 157,236
Multiplied by Arena LCM			x	105%
TOTAL REPLACEMENT COST NEW			=	**$ 165,098**

Depreciation is not addressed in the above examples. For more discussion on measurement, benchmarking, and application of depreciation, refer to *Appraisal Methods for Real Property*.

Group: Multi-Purpose Structures
Type: Multi-Purpose Shed

Type Features: Buildings of this type include the accessory type of structure found on many farms. They are comparatively small in size and are typically utilized as wood sheds, hand tool storage, chicken houses, etc. Class 4 buildings of this type are usually owner-built and often combine poor quality workmanship and materials. However, Class 6 buildings reflect standard or better construction and often have an exterior designed to harmonize with the other buildings on the farm.

This type of building is generally found on farms that have been in existence for many years. However, they will normally have little functional use in the present-day operation.

Class Illustrations

Class 4

Class 5

Class 6

Multi-Purpose Shed
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Wood mud sill.	Wood girder on masonry piers.	Continuous concrete.
Frame	Box construction or wide spaced 2" x 4" studs.	Conventional construction: 4" x 4" post and beam with nailers, or 2" x 4" studs set 24" o.c.	Conventional construction: 2" x 4" studs set 16" o.c.
Exterior Wall	Base wall height 8'. Vertical board, shiplap or equivalent single layer cover. Openings: one swinging access door, one barn sash window.	Base wall height 8'. Conventional construction: board and batt, plywood or galvanized metal cover. Openings: one swinging or slider door, two to three barn sash windows.	Base wall height 8'. Conventional construction: good quality single layer vertical, horizontal or panel siding; or baked enamel metal cover. Openings: one slider door, one access door, three to four windows.
Roof	Shed or low gable roof. 2" x 4" wide-spaced rafters. Solid sheathing with composition roll cover.	Gable roof. Conventional construction: 2" x 4" rafters 24" o.c. Solid sheathing with composition shingle or galvanized metal cover.	Gable roof. Conventional construction: 2" x 6" rafters 24" o.c. Spaced or solid sheathing; good quality shingles or baked enamel metal cover.
Floor	Gravel.	Minimal wood joists with plywood or equivalent flooring.	Concrete slab, 4" thick.
Partitions	None.	None.	None.
Interior Components	None.	None.	None.
Electrical	None.	None.	None.
Plumbing	None.	None.	None.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Multi-Purpose Shed
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	50	100	150	200	250	300	350	400	450	500
Class 4	$ 24.73	17.91	15.64	14.50	13.82	13.06	12.44	11.98	11.62	11.33
Class 5	28.68	21.01	18.45	17.17	16.40	15.55	14.84	14.32	13.91	13.58
Class 6	55.69	39.62	34.26	31.58	29.97	28.10	26.56	25.40	24.50	23.78

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 260 Sq. Ft.	$ 11.09 +	682	13.34 +	767	23.55 +	1,607
261 – 500 Sq. Ft.	8.74 +	1,297	10.63 +	1,475	17.30 +	3,239

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		Class 4	Class 5	Class 6
Protective Finish:				
Baked Enamel	+	$ .56	.56	
Galvanized	–			.56

Floor

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Material Type:				
Concrete, 4" thick	+	$ 2.89	2.89	
Gravel	–			2.89
Dirt	–	1.62	1.62	4.50

Electrical

Apply cost to each unit		All Classes
Service Panel:		
60 amp	+	$ 900
100	+	1,000
200	+	1,300
Wiring per outlet:		
110 volt	+	70
220	+	250

Multi-Purpose Shed
Cost Factor Tables

Adjustment Factors (cont.)

Base Component Cost *(based on a 320 sq. ft. building)*

Building Component:	Class 4	Class 5	Class 6
Foundation	$ 1.00	$ 1.42	$ 7.66
Frame	2.81	2.88	2.94
Exterior Wall	4.70	5.10	7.31
Roof	2.52	4.47	4.65
Floor	1.76	1.37	4.86
TOTAL	12.79	15.24	27.42

Group: Multi-Purpose Structures
Type: General Purpose Building

Type Features: This type of building is easily adaptable to many different uses. They are primarily used for garages, machinery repair and storage, but are also occasionally used for grain storage, hay storage or livestock shelter. The design of these buildings is usually simple with emphasis on maximum utility with minimum cost. The majority of the buildings of this type will be Class 4 or Class 5 with pole frame construction being predominant in the newer structures of these two classes.

These buildings are common to most farming operations and will generally be useful to the farm enterprise.

Class Illustrations

Class 4

Class 5

Class 6

General Purpose Building
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Wood girder on masonry piers or gravel backfilled holes for pole frame construction.	Minimal concrete or gravel and cement binder backfilled holes for pole frame construction.	Continuous concrete.
Frame	Conventional construction: 4" x 4" post and beam or wide spaced 2" x 4" studs. Pole frame construction: pressure treated 4" x 6" poles set 10' to 12' o.c.	Conventional construction: 2" x 4" studs set 24" o.c. Pole frame construction: pressure treated 6" x 6" poles set 10' to 12' o.c.	Conventional construction: 2" x 6" studs set 24" o.c.
Exterior Wall	Base wall height 10'. Conventional construction: shiplap, vertical board or equivalent single layer cover. Pole frame construction: 2" x 6" utility grade girts; light weight galvanized metal cover. Openings: one 8' x 10' swinging or slider door, one window, one access door.	Base wall height 10'. Conventional construction: horizontal or vertical single layer siding. Pole frame construction: pressure treated skirt board; 2" x 6" construction grade girts; baked enamel metal cover. Openings: one 10' x 12' slider door, two windows, one access door.	Base wall height 10'. Conventional construction: good quality single layer vertical, horizontal or panel siding; or baked enamel metal cover. Openings: one 10' x 12' sliding or roll-up door, two windows, one access door.
Roof	Gable roof. Conventional construction: site built wide-spaced rafters. Solid sheathing with composition roll cover. Pole frame construction: doubled, site built trussed rafters, 2" x 6" purlins or nailers, light weight galvanized metal cover.	Gable roof. Conventional construction: engineered trussed rafters 24" o.c. Solid sheathing with average quality shingle cover. Pole frame construction: doubled engineered trussed rafters; 2" x 6" purlins or nailers, baked enamel metal cover.	Gable roof. Conventional construction: engineered trussed rafters 24" o.c. Spaced or solid sheathing; good quality shingles or baked enamel metal cover.
Floor	Gravel.	Concrete slab, 4" thick.	Reinforced concrete slab, 4" thick.
Partitions	None.	None.	None.
Interior Components	None.	None.	None.
Electrical	None.	None.	None.
Plumbing	None.	None.	None.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

General Purpose Building
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000
Class 4	$ 11.42	10.05	9.33	8.97	8.75	8.53	8.37	8.25	8.16	8.06
Class 5	17.05	15.05	13.97	13.44	13.12	12.79	12.56	12.38	12.24	12.10
Class 6	22.11	19.15	17.55	16.76	16.28	15.79	15.43	15.17	14.96	14.75

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 1,000 Sq. Ft.	$ 8.68 +	1,368	13.05 +	1,998	16.20 +	2,957
1,001 – 2,500 Sq. Ft.	7.89 +	2,160	11.85 +	3,190	14.38 +	4,760
2,501 – 4,500 Sq. Ft.	7.42 +	3,331	11.14 +	4,952	13.31 +	7,424
4,501 – 10,000 Sq. Ft.	7.20 +	4,286	10.82 +	6,391	12.83 +	9,598

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		**1,000**	**3,000**	**5,000**
Height Variation, each 2' from base				
Class 4, base wall height 10'	±	$ .44	.23	.18
Class 5, base wall height 10'	±	.57	.29	.23
Class 6, base wall height 10'	±	.47	.24	.18
Apply cost to sq. ft. of ground floor area		**Class 4**	**Class 5**	**Class 6**
Protective Finish:				
Baked Enamel	+	$ .17		
Galvanized	–		.17	.17

Roof

Apply cost to sq. ft. of ground floor area		**Class 4**	**Class 5**	**Class 6**
Shed Roof	–	$ .42	.00	
Protective Finish:				
Baked Enamel	+	.22		
Galvanized	–		.22	.22
Plywood Sheathing, 3/8"	+		.81	
Apply cost to sq. ft. of ground floor area		**All Classes**		
Insulation:				
Fiberglass roll, 1 1/2" thick	+		$ .60	
Sprayed foam, 1" thick	+		3.00	

General Purpose Building
Cost Factor Tables

Adjustment Factors (cont.)

Floor

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Material Type:				
Concrete, 4" thick	+	$ 2.89		
Gravel	−		2.89	3.06
Dirt	−	1.62	4.50	4.67

Partitions

Apply to linear foot of partition wall		Class 4	Class 5	Class 6
Interior partition wall	+	$ 9.81	14.33	20.49

Electrical

Apply cost to each unit		All Classes
Service Panel:		
60 amp	+	$ 900
100 amp	+	1,000
200 amp	+	1,300
Wiring per outlet:		
110 volt	+	70
220 volt	+	250

Base Component Cost *(based on a 2,880 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation	$ .54	$ .75	$ 2.74
Frame	.19	.48	2.48
Exterior Wall	3.70	4.12	1.78
Roof	2.44	2.78	3.97
Floor	1.71	4.73	4.92
TOTAL	8.58	12.86	15.89

Group: Multi-Purpose Structures
Type: Utility Building

Type Features: The utility building would best be described as a farm "warehouse." The basic use of these buildings is for large open area storage. The design of this type of building is usually simple; however the materials and professional workmanship are generally of standard or better quality. Few if any, utility buildings would be of low cost construction.

This building type will normally be found on larger farming operations utilizing modern farming practices.

Class Illustrations

Class 4 **Class 5** **Class 6**

Utility Building
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation		Gravel with cement binder backfilled holes for pole frame construction.	Continuous concrete.
Frame		Pole frame construction: 6” x 8” pressure treated poles set 10' to 12' o.c.	Conventional construction: 2" x 6" studs set 24" o.c.
Exterior Wall		Base wall height 14'. Pole frame construction: pressure treated skirt board; 2" x 6" construction grade girts; baked enamel metal cover. Openings: two 14' x 14' slider doors, one access door. May have fiberglass lite panels.	Base wall height 14'. Conventional construction: good quality single layer vertical, horizontal, panel or baked enamel metal siding. Openings: two 14' x 14' slider door. Fiberglass lite panels.
Roof		Gable roof. Pole frame construction: doubled engineered trussed rafters; 2" x 6" purlins or horizontal nailers, baked enamel metal cover.	Gable roof. Conventional construction: engineered trussed rafters 24" o.c. Spaced or solid sheathing; good quality shingles or baked enamel metal cover.
Floor		Concrete slab, 4" thick.	Reinforced concrete slab, 6" thick.
Partitions		None.	None.
Interior Components		None.	None.
Electrical		None.	None.
Plumbing		None.	None.
Heating-Cooling		None.	None.
Exterior Components		None.	None.

Utility Building
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000
Class 5	$ 13.87	13.13	12.66	12.33	12.09	11.92	11.79	11.68	11.60	11.51
Class 6	$ 18.49	17.48	16.83	16.39	16.05	15.82	15.64	15.50	15.39	15.26

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

Size Range	Class 5 Cost Per Sq. Ft.		Class 5 Lump Sum	Class 6 Cost Per Sq. Ft.		Class 6 Lump Sum
0 – 1,000 Sq. Ft.	$ 13.43	+	2,273	17.91	+	3,090
1,001 – 2,500 Sq. Ft.	12.05	+	3,641	16.00	+	4,979
2,501 – 4,500 Sq. Ft.	11.24	+	5,662	14.89	+	7,768
4,501 – 10,000 Sq. Ft.	10.87	+	7,311	14.38	+	10,045
10,001 – 25,000 Sq. Ft.	10.56	+	10,474	13.95	+	14,411

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		**2,000**	**6,000**	**10,000**
Height Variation, each 2' from base				
Class 5, base wall height 14'	±	$ .42	.27	.21
Class 6, base wall height 14'	±	.29	.18	.13
Apply cost to sq. ft. of ground floor area		**Class 4**	**Class 5**	**Class 6**
Protective Finish:				
Galvanized	–		.20	.20

Roof

Apply cost to sq. ft. of ground floor area		**Class 4**	**Class 5**	**Class 6**
Protective Finish:				
Galvanized	–		$ .22	.22
Plywood Sheathing, 3/8"	+		.81	.81
Apply cost to sq. ft. of ground floor area		**All Classes**		
Insulation:				
Fiberglass roll, 1 1/2" thick	+		.60	
Sprayed foam, 1" thick	+		3.00	

Utility Building
Cost Factor Tables

Adjustment Factors (cont.)

Floor

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Material Type:				
Asphalt, 3" thick	−		$ 1.60	3.27
Gravel	−		2.89	4.56
Dirt	−		4.50	6.17

Electrical

Apply cost to each unit		All Classes
Service Panel:		
60 amp	+	$ 900
100	+	1,000
200	+	1,300
Wiring per outlet:		
110 volt	+	70
220	+	250

Base Component Cost *(based on a 4,032 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation		$ .70	$ 2.42
Frame		.54	2.43
Exterior Wall		4.06	1.74
Roof		2.70	3.84
Floor		4.64	6.39
TOTAL		12.64	16.82

Group: Multi-Purpose Structures
Type: Machine Shed

Type Features: Machine sheds are primarily designed for storage of machinery and equipment. However, they may occasionally be used for feed and hay storage or livestock shelter. The design of the machine shed is simple and provides a roof and three sides for protection from the weather, an open front for easy entrance and exit, and adequate height and depth to accommodate the machinery and equipment.

This type of building is commonly found on most farm enterprises. Little or no functional obsolescence will be observed when the building is of a proper size for the equipment typically used on the property.

Class Illustrations

Class 4 | **Class 5** | **Class 6**









Machine Shed
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Wood mud sill or gravel backfilled holes for pole frame construction.	Minimal concrete or gravel with cement binder backfilled holes for pole frame construction.	Continuous concrete.
Frame	Conventional construction: 4" x 4" post and beam or wide spaced 2" x 4" studs. Pole frame construction: pressure treated 4" x 6" poles set 10' to 12' o.c.	Conventional construction: 2" x 4" studs set 24" o.c. Pole frame construction: pressure treated 6" x 6" poles set 10' to 12' o.c.	Conventional construction: 2" x 6" studs set 24" o.c.
Exterior Wall	Base wall height 10'. Wall cover on 3 sides only. Conventional construction: shiplap, vertical board or equivalent single layer cover. Pole frame construction: 2" x 6" utility grade girts; light weight galvanized metal cover. Openings: one side wall open, no windows or doors.	Base wall height 14'. Wall cover on 3 sides only. Conventional construction: average quality single vertical, horizontal or panel siding. Pole frame construction: pressure treated skirt board; 2" x 6" construction grade girts; baked enamel metal cover. Openings: one side wall open, no windows or doors.	Base wall height 14'. Wall cover on 3 sides only. Conventional construction: good quality single layer vertical, horizontal or panel siding; or baked enamel metal cover. Openings: one side wall open, two 3’ x 4’ windows, no doors.
Roof	Shed roof. Conventional construction: 2” x 4” rafters 24” o.c., solid sheathing with composition roll cover. Pole frame construction: 2” x 6’ rafters set on poles, 2" x 6" purlins or nailers, light weight galvanized metal cover.	Gable roof. Conventional construction: engineered trussed rafters 24" o.c. Solid sheathing with average quality shingle cover. Pole frame construction: doubled engineered trussed rafters; 2" x 6" purlins or nailers, baked enamel metal cover.	Gable roof. Conventional construction: engineered trussed rafters 24" o.c. Spaced or solid sheathing; good quality shingles or baked enamel metal cover.
Floor	Dirt.	Gravel.	Gravel.
Partitions	None.	None.	None.
Interior Components	None.	None.	None.
Electrical	None.	None.	None.
Plumbing	None.	None.	None.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Machine Shed
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000
Class 4	$ 8.63	7.41	6.77	6.45	6.25	6.06	5.92	5.81	5.73	5.65
Class 5	12.99	11.30	10.39	9.94	9.68	9.40	9.20	9.05	8.94	8.82
Class 6	17.19	14.72	13.38	12.72	12.32	11.91	11.62	11.40	11.22	11.04

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

Size Range	Class 4 Cost Per Sq Ft	Class 4 Lump Sum	Class 5 Cost Per Sq Ft	Class 5 Lump Sum	Class 6 Cost Per Sq Ft	Class 6 Lump Sum
0 – 1,000 Sq. Ft.	$ 6.19 +	1,221	9.61 +	1,690	12.24 +	2,473
1,001 – 2,500 Sq. Ft.	5.49 +	1,919	8.60 +	2,687	10.73 +	3,969
2,501 – 4,500 Sq. Ft.	5.07 +	2,951	8.01 +	4,160	9.85 +	6,178
4,501 – 10,000 Sq. Ft.	4.89 +	3,794	7.74 +	5,362	9.45 +	7,982

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		1,000	3,000	5,000
Height Variation, each 2' from base				
Class 4, base wall height 10'	±	$ .38	.21	.16
Class 5, base wall height 14'	±	.56	.29	.23
Class 6, base wall height 14'	±	.39	.19	.14
Apply cost to sq. ft. of ground floor area		**Class 4**	**Class 5**	**Class 6**
Protective Finish:				
Baked Enamel	+	$ .17		
Galvanized	–		.17	.17
Apply cost to linear foot of wall or door		**Class 4**	**Class 5**	**Class 6**
Closed Front:				
Curtain Wall	+	24.29	30.23	59.70
Slider Door	+	40.87	51.08	51.08

Roof

Apply cost to sq. ft. of ground floor area		Class 4	Class 5	Class 6
Roof Type:				
Shed Roof	–		.00	
Gable Roof	+	$ .42		
Protective Finish:				
Baked Enamel	+	.22		
Galvanized	–		.22	.22

Machine Shed
Cost Factor Tables

Adjustment Factors (cont.)

Floor

Apply costs to sq. ft. of floor area		Class 4	Class 5	Class 6
Material Type:				
Concrete, 4" thick	+	$ 4.50	2.89	2.89
Asphalt, 3" thick	+	2.90	1.29	1.29
Gravel	+	1.62		
Dirt	−		1.62	1.62

Partitions

Apply to linear foot of partition wall		Class 4	Class 5	Class 6
Interior partition wall	+	$ 9.81	14.33	20.49

Electrical

Apply cost to each unit		All Classes
Service Panel:		
60 amp	+	$ 900
100	+	1,000
200	+	1,300
Wiring per outlet:		
110 volt	+	70
220	+	250

Base Component Cost *(based on a 2,880 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation	$ .64	$ .75	$ 2.18
Frame	.58	.58	2.59
Exterior Wall	3.07	3.65	1.56
Roof	1.80	2.77	3.98
Floor	.00	1.70	1.69
TOTAL	6.09	9.45	12.00

Group: Multi-Purpose Structures
Type: Metal Component Building

Type Features: The metal component building is adaptable to a variety of uses. This type of building is generally characterized by a large clear span area.

These buildings are usually constructed with good quality materials and skilled workmanship. The quality classes listed for this type of building reflect differences in structural design more than quality of workmanship or materials.

Class Illustrations

Class 4

Class 5

Class 6

Metal Component Building
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Continuous concrete footing with column supports integral with slab floor.	Continuous concrete footing with column supports integral with slab floor.	Reinforced continuous concrete footing with column supports integral with slab floor.
Frame	Open web steel columns set 20' o.c. structurally engineered for minimal design loads.	Steel "I" beam columns set 20' o.c. structurally engineered for average design loads.	Tapered plate steel "I" beam columns set 20' o.c. structurally engineered for above average design loads.
Exterior Wall	Base wall height 12 ft. Steel girts. Galvanized metal cover. Openings: one 10' x 12' slider door, one access door, two 3' x 4' windows.	Base wall height 14 ft. Steel girts. Metal cover with baked enamel finish. Openings: two 14' x 14' doors, one access door, two 3' x 4' windows.	Base wall height 14 ft. Steel girts. Metal cover with baked enamel finish. Openings: two 14' x 14' doors, one access door, two 3' x 4' windows.
Roof	Gable roof. Open web steel trusses 20' o.c. Steel purlins. Galvanized metal cover.	Gable roof. Steel "I" beam trusses 20' o.c. Steel purlins. metal cover with baked enamel finish.	Gable roof. Tapered plate steel "I" beam trusses 20' o.c. Steel purlins. Metal cover with baked enamel finish.
Floor	Concrete slab, 4" thick.	Concrete slab, 6" thick.	Reinforced concrete slab, 6" thick.
Partitions	None.	None.	None.
Interior Components	None.	None.	None.
Electrical	None.	None.	None.
Plumbing	None.	None.	None.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Metal Component Building
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	12,000
Class 4	$ 23.95	22.32	21.29	20.58	20.04	19.66	19.37	19.14	18.96	18.58
Class 5	27.04	25.16	23.95	23.13	22.50	22.06	21.72	21.46	21.25	20.81
Class 6	28.27	26.21	24.89	23.98	23.30	22.81	22.45	22.16	21.93	21.44

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 1,000 Sq. Ft.	$ 23.04 +	4,913	26.00 +	5,688	27.13 +	6,224
1,001 – 2,500 Sq. Ft.	19.97 +	7,959	22.42 +	9,230	23.22 +	10,107
2,501 – 4,500 Sq. Ft.	18.17 +	12,458	20.33 +	14,462	20.93 +	15,842
4,501 – 10,000 Sq. Ft.	17.35 +	16,131	19.38 +	18,732	19.88 +	20,524
10,001 – 25,000 Sq. Ft.	16.65 +	23,173	18.56 +	26,920	18.99 +	29,500

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		2,000	6,000	10,000
Height Variation, each 2' from base				
Class 4, base wall height 12'	±	$ .84	.45	.36
Class 5, base wall height 14'	±	.87	.47	.37
Class 6, base wall height 14'	±	.87	.47	.37
Protective Finish:				
Baked Enamel, Class 4	+	.28	.14	.11
Galvanized, Class 5	–	.32	.16	.11
Galvanized, Class 6	–	.32	.16	.11

Roof

Apply cost to sq. ft. of ground floor area		Class 4	Class 5	Class 6
Protective Finish:				
Baked Enamel	+	.22		
Galvanized	–		.22	.22
Apply cost to sq. ft. of ground floor area		All Classes		
Insulation:				
Fiberglass roll, 1 1/2" thick	+		.60	
Sprayed foam, 1" thick	+		3.00	

Metal Component Building
Cost Factor Tables

Adjustment Factors (cont.)

Roof (cont.)

		All Classes	
Ventilators:			
Revolving turbine vents, 14" diam	+	$ 140	Per unit
Continuous ridge vent, 12" wide	+	8.00	Per linear foot

Floor

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Material Type:				
Concrete, reinforced 6" thick	+	$ 1.67	.17	
Gravel	−	2.89	4.39	4.56

Partitions

		All Classes	
Stud frame 2" x 4":			
Plywood, one side	+	$ 2.21	Per sq. ft. of surface area
Plywood, two sides	+	3.16	Per sq. ft. of surface area
Finished office area: sheetrock walls, acoustical ceiling, asphalt tile floor	+	33.00	Per sq. ft. of office area

Electrical

Apply cost to each unit		All Classes
Service Panel:		
60 amp	+	$ 900
100	+	1,000
200	+	1,300
400	+	
Wiring per outlet:		
110 volt	+	70
220	+	250

Plumbing

Apply cost to each unit		All Classes
Cold Water Service, 2 hose bibs	+	$ 530
Fixtures:		
Lavatory	+	400
Toilet	+	445
Hot water heater, 50 gallons	+	500

Metal Component Building
Cost Factor Tables

Adjustment Factors (cont.)

Heating

	All Classes		
Electric wall heater, 2,000 watt	+	$ 230	Each unit
Forced Air Central Furnace	+	3.10	Per sq. ft. of heated area

Base Component Cost *(based on a 6,000 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation	$ 2.40	$ 2.45	$ 3.05
Frame	.56	.70	.70
Exterior Wall	6.98	7.50	7.49
Roof	5.45	5.67	5.67
Floor	4.65	6.18	6.39
TOTAL	20.04	22.50	23.30

Group: Livestock Shelters
Type: Feeder Barn

Type Features: Buildings of this type perform the dual function of hay storage and livestock feeding. They are characterized by one or two open sides with feed racks; hay storage area through the middle portion of the building; and an extended roof over the feeding area.

The design is plain with the emphasis on utility. The construction of the newer feeder barn will generally be of pole frame construction.

Class Illustrations

Class 4

Class 5

Class 6

Feeder Barn
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Wood girder on masonry piers or gravel backfilled holes for pole frame.	Minimal concrete or gravel with cement binder backfilled holes for pole frame.	Continuous concrete.
Frame	Conventional construction: post and beam. Pole frame construction: 4" x 6" poles set 10' to 12' o.c.	Conventional construction: 2" x 4" studs set 24" o.c. Pole frame construction: 6" x 6" pressure treated poles set 10' to 12' o.c.	Conventional construction: 2" x 6" studs set 24" o.c.
Exterior Wall	Base wall height 10 ft. Conventional construction: vertical board, shiplap or equivalent type cover. Pole frame construction: 2" x 6" utility grade girts; skirt board; galvanized metal cover. Openings: one side wall open; one 10' x 10' swinging door on end wall.	Base wall height 12 ft. Conventional construction: horizontal or vertical single layer siding. Pole frame construction: 2" x 6" utility grade girts; 18" high pressure treated skirt boards; galvanized metal cover. Openings: one side wall open; one 12' x 12' slider door on each end wall.	Base wall height 12 ft. Conventional construction: good quality single layer vertical, horizontal or panel siding, or metal cover with baked enamel finish. Openings: one side wall open; one 12' x 12' slider door on each end wall.
Roof	Gable roof. Conventional construction: 2" x 4" rafters 24" o.c. Spaced sheathing. Light weight galvanized metal cover. Pole frame construction: site built rafters set on poles, 2" x 6" purlins or nailers, light weight galvanized metal cover.	Gable or monitor roof.; Conventional construction: 2" x 4" rafters 24" o.c. Solid sheathing; composition shingle or galvanized metal cover. Pole frame construction: double engineered trussed rafters, 2" x 6" purlins or nailers, galvanized metal cover.	Gable or monitor roof. Conventional construction: engineered trussed rafters 24" o.c.; sheathing with composition shingle or baked enamel metal cover.
Floor	Dirt.	Dirt.	Dirt.
Partitions	None.	None.	None.
Interior Components	Inexpensive wood feed racks along open side.	Wood feed racks. 4’ high by 3’ wide, length of open side..	Heavy wood or metal feed racks. 4’ high by 3’ wide, length of open side.
Electrical	None.	None.	None.
Plumbing	None.	None.	None.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Feeder Barn
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
Class 4	$ 7.55	6.58	6.20	5.96	5.80	5.69	5.60	5.54	5.49	5.45
Class 5	10.26	8.48	7.77	7.33	7.03	6.81	6.65	6.53	6.43	6.36
Class 6	13.89	11.35	10.35	9.71	9.29	8.97	8.74	8.56	8.43	8.32

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 1,000 Sq. Ft.	$ 6.22 +	1,331	7.91 +	2,355	10.57 +	3,321
1,001 – 2,500 Sq. Ft.	5.61 +	1,937	6.71 +	3,545	8.83 +	5,038
2,501 – 4,500 Sq. Ft.	5.25 +	2,831	6.01 +	5,303	7.82 +	7,574
4,501 – 10,000 Sq. Ft.	5.09 +	3,561	5.69 +	6,737	7.36 +	9,645
10,001 – 25,000 Sq. Ft.	4.95 +	4,960	5.41 +	9,488	6.96 +	13,614

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		1,000	5,000	9,000
Height Variation, each 2' from base				
Class 4, base wall height 10'	±	$ .30	.14	.11
Class 5, base wall height 12'	±	.34	.17	.12
Class 6, base wall height 12'	±	.30	.15	.11
Side Walls, both side walls open				
Class 4	±	.43	.25	.18
Class 5	±	.50	.31	.22
Class 6	±	1.15	.65	.46
Apply cost to sq. ft. of ground floor area		**Class 4**	**Class 5**	**Class 6**
Protective Finish:				
Baked Enamel	+	.12	.15	
Galvanized	–			.15

Roof

Apply cost to sq. ft. of ground floor area		Class 4	Class 5	Class 6
Protective Finish:				
Baked Enamel	+	$ .22	.22	
Galvanized	–			.22

Feeder Barn
Cost Factor Tables

Adjustment Factors (cont.)

Floor

Apply cost to sq. ft. of floor area		All Classes
Material Type:		
Asphalt, 3" thick	+	$ 2.90
Concrete, 4" thick	+	4.50

Interior Components

Apply to linear foot of component		Class 4	Class 5	Class 6
Feed Racks, compare to base	±	$ 10.50	13.09	15.75

Electrical

Apply cost to each unit		All Classes
Service Panel:		
60 amp	+	$ 900
Wiring per outlet:		
110 volt	+	70

Plumbing

Apply cost to each unit		All Classes
Cold Water Service, 2 hose bibs	+	$ 530

Base Component Cost *(based on a 2,880 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation	$ .58	$ .88	$ 2.23
Frame	.22	.60	2.61
Exterior Wall	3.32	4.04	1.99
Roof	2.04	2.23	3.48
Floor	.00	.00	.00
Interior Components	.07	.10	.14
TOTAL	6.23	7.85	10.45

Group: Livestock Shelters
Type: Loft Barn

Type Features: The loft barns described in this manual incorporate two different styles; the low cost general purpose barn and the "classic" loft barn. Historically, the lofts in these barns were used to store hay and the ground floor area was used to shelter livestock. The structural design, workmanship, and materials of the barns ranges from the most basic on the low side of the scale to "prestige" quality on the high side.

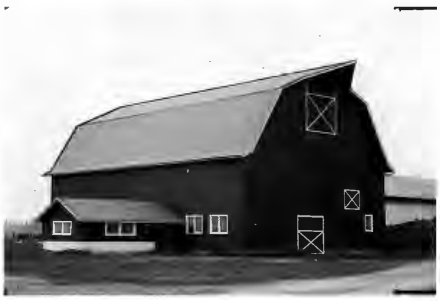
Due to the modern farming practice of separating hay storage from livestock sheltering, many of these barns now suffer from functional obsolescence. Many classic loft barns are currently being converted to living quarters or recreational use. This manual does not include costs for these types of conversions.

Class Illustrations

Class 4 **Class 5** **Class 6**








Loft Barn
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Wood girders on masonry piers.	Continuous concrete.	Continuous concrete.
Frame	Conventional construction: 4" x 4" post and beam frame.	Conventional construction: mill type post and beam frame or 2" x 6" studs 24" o.c.	Conventional construction: 2" x 8" studs set 24" o.c. Post and beam loft supports.
Exterior Wall	Base wall height 10 ft. Single shiplap, vertical board or equivalent type cover. Openings: two 10' x 10' swinging or slider doors, two walk-through access doors, 4 to 6 windows.	Base wall height 12 ft. Painted single layer siding or vertical board and batt. Openings: two 10' x 12' slider doors, two walk-through access doors, 8 to 10 factory built windows.	Base wall height 12 ft. Solid sheathing: painted good quality vertical or horizontal siding. Openings: four 10' x 12' slider doors, four walk-through access doors, 10 to 14 factory built windows.
Roof	Gable roof. 2" x 4" rafters 24" o.c. Spaced or solid sheathing; lower quality wood shingles or composition roll cover.	Gambrel or gable roof. Spaced or solid sheathing; wood or composition shingles; 2" x 6" rafters 24" o.c. or 2" x 8" rafters 48" o.c.	Gambrel or arch roof. 2" x 8" rafters 24" o.c. Spaced or solid sheathing, good quality wood or composition shingles.
Floor	Ground floor: plank on wood sleepers. Loft floor: 1" board on 2" x 8" joists, one-half of ground floor area.	Ground floor: concrete slab. Loft floor: 2" plank or plywood on 2" x 10" joists.	Ground floor: reinforced concrete. Loft floor: 2" T & G decking on 2" x 12" joists.
Partitions	None.	None.	None.
Interior Components	None.	None.	None.
Electrical	None.	One light outlet each 300 square foot of ground floor area; one convenience outlet each 500 square foot.	One light outlet each 200 square foot of ground floor area; one convenience outlet each 400 square foot.
Plumbing	None.	None.	None.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Loft Barn
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	500	1,000	1,500	2,000	3,000	4,000	5,000	6,000	7,000	8,000
Class 4	$ 21.66	19.29	18.01	17.37	16.59	16.10	15.76	15.50	15.32	15.18
Class 5	28.96	25.08	23.17	22.22	21.09	20.39	19.92	19.57	19.32	19.13
Class 6	35.21	30.67	28.39	27.26	25.91	25.07	24.50	24.08	23.77	23.54

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 1,000 Sq. Ft.	$ 16.93 +	2,366	21.20 +	3,881	26.13 +	4,542
1,001 – 2,500 Sq. Ft.	15.46 +	3,815	19.37 +	5,697	23.87 +	6,777
2,501 – 4,500 Sq. Ft.	14.61 +	5,956	18.30 +	8,379	22.55 +	10,080
4,501 – 10,000 Sq. Ft.	14.22 +	7,704	17.81 +	10,568	21.95 +	12,776

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		2,000	4,000	8,000
Height Variation, each 2' from base				
Class 4, base wall height 10'	±	$ .61	.53	.44
Class 5, base wall height 12'	±	.79	.70	.61
Class 6, base wall height 12'	±	.88	.79	.70

Roof

Apply cost to sq. ft. of ground floor area		Class 4	Class 5	Class 6
Protective Finish				
Galvanized	–	$ .25	.50	

Floor

Apply cost to sq. ft. of ground floor area		Class 4	Class 5	Class 6
Ground Floor Type:				
Concrete, 4" thick	+	$ .75		
Dirt	–	3.75	4.50	4.67
Loft:				
None. *(use ground floor area)*	–	4.03	5.44	6.38
1" loft boards. *(use loft area)*	–		0.56	0.66

Loft Barn
Cost Factor Tables

Adjustment Factors (cont.)

Interior Components

Apply cost to each unit		All Classes	
Manger, Light wood	+	$ 27.46	Per linear foot
With wood stanchions	+	51.97	
With steel stanchions	+	70.74	
Box Stalls 10 X 12, 2" T & G, 6' high	+	1,650	Per stall

Electrical

Apply cost to sq ft of ground floor area		Class 4	Class 5	Class 6
No Electric Service	−		$ .42	.77
Apply cost for each unit			All Classes	
Wiring per outlet:				
110 volt	+		70	

Plumbing

Compare to base specs		All Classes
No plumbing	−	$ 530

Exterior Components

Apply cost per sq. ft. of covered area		All Classes
Lean-to:		
Light weight, 4" x 6" posts,		
galvanized roof cover, dirt floor	+	$ 4.00
Lean-to:		
Heavy weight, 6" x 8" posts,		
comp shingle roof, dirt floor	+	4.54

Base Component Cost *(based on a 4,320 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component			
Foundation	$ .66	$ 1.95	$ 2.77
Frame	1.82	2.87	3.61
Exterior Wall	3.83	4.29	5.00
Roof	5.38	5.82	6.36
Floor	4.30	4.72	6.20
Electrical	.00	.42	.77
Plumbing	.00	.17	.17
TOTAL	15.99	20.24	24.88

Group: Livestock Shelters
Type: Free Stall Barn

Type Features: Free stall barns are usually found in conjunction with a dairy operation. They are designed to provide the cows with free access to individual stalls as well as feed areas. Adequate ventilation is an important design consideration. Concrete curbs and alleyways are often incorporated to facilitate manure removal.

The free stall barn is a common unit in the arrangement of the modern dairy operation, and is a highly functional building within that use.

Class Illustrations

Class 4

Class 5

Class 6

Free Stall Barn
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Gravel backfilled holes for pole frame construction.	Gravel with cement binder backfilled holes for pole frame construction.	Continuous concrete.
Frame	Pole frame construction: 4" x 6" poles set 12' o.c.	Pole frame construction: 6" x 6" pressure treated poles set 12' o.c.	Tapered plate steel "I" beam columns set 20' o.c. integral with roof trusses.
Exterior Wall	Base wall height 8 ft. 2" x 6" utility grade girts. Galvanized metal cover. Top 2' of side wall open. Openings: four 8' x 10' openings.	Base wall height 8 ft. 2" x 6" construction grade girts. Galvanized metal cover. Top 2' of side walls open. Openings: one 8' x 10' opening each 25 L.F. of end wall.	Base wall height 10 ft. Steel girts, metal cover with baked enamel finish; top 2' of side walls open. Openings: one 8' x 10' opening each 25 L.F. of end wall.
Roof	Gable roof. Site built rafters set on pole frame; 2" x 6" purlins or nailers; galvanized metal cover.	Gable roof. Double engineered trussed rafters; 2" x 6" purlins or nailers; galvanized metal cover.	Gable roof. Tapered plate steel "I" beam trusses 20' o.c.; steel purlins; metal cover with baked enamel finish
Floor	1/3 of floor area concrete alleyways 4" thick; 2/3 of floor area dirt.	1/3 of floor area concrete alleyways 6" thick; 2/3 of floor area dirt.	1/2 of floor area concrete alleyways 6" thick; 1/2 of floor area dirt.
Partitions	2" thick planks, 4' high dividers between rows of stalls and on interior of exterior walls.	2" thick pressure treated planks, 4' high dividers between rows of stalls and on interior of exterior walls	2" thick pressure treated T & G planks, 4' high dividers between rows of stalls and on interior of exterior walls
Interior Components	4' x 7' wood free stalls. One stall for each 50-60 sq. ft. of floor area.	4' x 7' metal free stalls set in concrete curbs. One stall for each 50-60 sq. ft. of floor area.	4' x 7' metal free stalls set in concrete curbs. One stall for each 50-60 sq. ft. of floor area.
Electrical	None.	None.	None.
Plumbing	None.	None.	None.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Free Stall Barn
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	2,000	4,000	6,000	8,000	10,000	12,000	14,000	16,000	18,000	20,000
Class 4	$ 17.63	13.31	11.80	11.04	10.58	10.25	10.02	9.84	9.70	9.59
Class 5	19.68	15.04	13.38	12.54	12.03	11.66	11.39	11.19	11.04	10.91
Class 6	29.08	23.44	21.31	20.21	19.55	19.03	18.66	18.38	18.16	17.99

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 1,000 Sq. Ft.	$ 9.84 +	16,181	11.79 +	16,756	20.87 +	18,588
1,001 – 2,500 Sq. Ft.	9.25 +	16,765	10.83 +	17,707	18.73 +	20,705
2,501 – 4,500 Sq. Ft.	8.90 +	17,629	10.26 +	19,112	17.48 +	23,831
4,501 – 10,000 Sq. Ft.	8.74 +	18,333	10.01 +	20,259	16.91 +	26,384
10,001 – 25,000 Sq. Ft.	8.61 +	19,685	9.79 +	22,457	16.43 +	31,277

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		2,000	6,000	12,000
Height Variation, each 2' from base				
Class 4, base wall height 8'	±	$ .28	.20	.15
Class 5, base wall height 8'	±	.33	.23	.18
Class 6, base wall height 10'	±	.75	.52	.37
Protective Finish				
Baked Enamel, Class 4	+	.10	.05	.03
Baked Enamel, Class 5	+	.12	.06	.05
Galvanized, Class 6	–	.14	.07	.06

Roof

Apply cost to sq. ft. of ground floor area		Class 4	Class 5	Class 6
Protective Finish:				
Baked Enamel	+	$ .22	.22	
Galvanized	–			.22

Floor

Apply cost to sq. ft. of coverage area		Class 4	Class 5	Class 6
Material Type:				
Concrete, 4" thick	±	$ 4.50	6.00	6.00

Free Stall Barn
Cost Factor Tables

Adjustment Factors (cont.)

Interior Components

Apply cost to each unit		**All Classes**	
Free stalls			
Metal	±	$ 60.00	Per Stall
Wood	±	60.00	
Fence Line Feeders, wood	+	21.60	Per linear foot
Stanchions, steel, group lockout type	+	34.00	

Electrical

Apply cost to each unit		**All Classes**	
Service Panel:			
60 amp	+	$ 900	
100	+	1,000	
Wiring per outlet:			
110 volt	+	70	

Plumbing

Apply cost to each unit		**All Classes**	
Cold Water Service, 2 hose bibs	+	$ 530	

Base Component Cost *(based on a 10,368 sq. ft. building)*

	Class 4	**Class 5**	**Class 6**
Building Component:			
Foundation	$ .52	$ .74	$ 1.60
Frame	.20	.49	.43
Exterior Wall	2.14	2.16	5.33
Roof	2.49	2.60	5.39
Floor	3.58	4.21	4.70
Partitions	.10	.28	.50
Interior Components	1.48	1.48	1.50
TOTAL	10.51	11.96	19.45

Group: Livestock Shelters
Type: Broiler House

Type Features: The broiler house, as well as the similar brooder house, is designed as a "floor operation." In this type of operation, the birds are kept on the ground "floor" of the building rather than in cages. Floor operations usually have some form of heating, ventilation and air conditioning available for the birds. There are fewer birds per square foot of floor area than with a laying house, the ventilation requirements are not as great.

The modern building is equipped with automated feeding and watering systems, light control, heating, cooling and ventilation equipment, including controllers and backup power supply.

Class Illustrations

Class 4

Class 5

Class 6

Broiler House
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Minimal concrete.	Continuous concrete.	
Frame	Conventional construction: 2" x 4" studs set 24" o.c. Two rows of roof support posts 8' o.c.	Conventional construction: 2" x 6" studs set 24" o.c. Two rows of roof support posts 8' o.c. or clearspan	
Exterior Wall	Base wall height 8 ft. Galvanized metal cover; top 2' of one sidewall open for ventilation. Openings: one 10' x 12' sliding door at each end.	Base wall height 8 ft. Galvanized metal cover; hinged vents. Openings: one 10' x 12' sliding door at each end.	
Roof	Gable roof. Site built rafters set 24" o.c. with bracing; galvanized metal cover.	Gable roof. Engineered truss or rafters set 24'"o.c. 3/8" plywood sheathing; galvanized metal cover.	
Floor	Dirt.	Dirt.	
Partitions	None.	Interior plywood sheathing.	
Interior Components	None.	None.	
Electrical	Entry service; one lighting outlet per 400 sq. ft.; 2 convenience outlets.	Entry service; 200 amp. panel; one glass globe light per 200 sq. ft.; 4 convenience outlets.	
Plumbing	Cold water service; 2 to 3 hose bibs.	Cold water service; 4 to 5 hose bibs.	
Heating-Cooling	None.	None.	
Exterior Components	None.	None.	

Broiler House
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	2,000	4,000	6,000	8,000	10,000	12,000	14,000	16,000	18,000	20,000
Class 4	$ 11.10	10.08	9.63	9.39	9.24	9.11	9.02	8.95	8.89	8.85
Class 5	13.76	12.40	11.80	11.48	11.29	11.11	10.99	10.89	10.82	10.76

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

			Class 4			Class 5		
Size Range			Cost Per Sq. Ft.		Lump Sum	Cost Per Sq. Ft.		Lump Sum
0	– 1,000	Sq. Ft.	$ 10.39	+	2,366	12.86	+	3,070
1,001	– 2,500	Sq. Ft.	9.46	+	3,285	11.60	+	4,322
2,501	– 4,500	Sq. Ft.	8.92	+	4,643	10.86	+	6,170
4,501	– 10,000	Sq. Ft.	8.67	+	5,751	10.52	+	7,679
10,001	– 25,000	Sq. Ft.	8.46	+	7,876	10.23	+	10,572

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of floor area		**All Classes**		
Insulation:				
Fiberglass roll, 1 1/2" thick	+		$ .22	
Polystyrene Panels, 1" thick	+		.43	
Apply cost to sq. ft. of floor area		**Class 4**	**Class 5**	**Class 6**
Interior Sheathing, 3/8" plywood				
Class 4	+	.34		
Class 5, none	–		.34	

Roof

Apply cost to sq. ft. of floor area		**All Classes**		
Insulation:				
Fiberglass roll, 1 1/2" thick	+		$ .60	
Polystyrene Panels, 1" thick	+		1.20	
Apply cost to sq. ft. of floor area		**Class 4**	**Class 5**	**Class 6**
Roof Sheathing, 3/8" plywood				
Class 4	+	.81		
Class 5, none	–		.81	

Broiler House
Cost Factor Tables

Adjustment Factors (cont.)

Floor

Apply cost to sq. ft. of floor area		All Classes
Material Type:		
Concrete, 2 1/2" thick	+	$ 3.19

Plumbing

Apply cost to each item		Class 4	Class 5	Class 6
Cold Water Service:				
None	−	$ 620	800	

Heating & Ventilation

Apply cost per square foot of floor area		All Classes	
Heating, Cooling and Ventilation All systems necessary to maintain proper building temperature.	+	$ 1.35	Per square foot

Equipment

Apply cost per square foot of floor area		All Classes	
Feed and Water Systems *(Does not include bulk feed tanks.)*	+	$ 2.00	Per square foot

Base Component Cost *(based on a 10,080 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation	$ 1.44	$ 1.77	
Frame	2.19	2.77	
Exterior Wall	1.43	1.50	
Roof	3.83	4.41	
Floor	.00	.00	
Partitions	.00	.21	
Electrical	.27	.52	
Plumbing	.08	.10	
TOTAL	9.24	11.28	

Group: Livestock Shelters
Type: Laying House

Type Features: The laying house is specifically designed for an egg production operation with the birds kept in cages. If there are ventilation and temperature control systems, the buildings are usually designed to prevent outside light and heat from entering the building. Timed artificial lighting is then used for a simulated day. Air control and conditioning equipment along with the bird confinement system is considered part of the building.

Construction materials and workmanship are typically of standard quality for special use rural structures. The typical low exterior wall height and interior post framing limit the adaptability of the Class 4 and Class 5 laying house to other uses.

Class Illustrations

Class 4

Class 5

Class 6

Laying House
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Continuous concrete, integral with slab floor.	Continuous concrete, integral with slab floor.	Continuous reinforced concrete with 2' stem wall.
Frame	Conventional construction: 2" x 4" studs set 24" o.c.; roof support posts set 8' o.c.	Conventional construction: 2" x 4" studs set 24" o.c.; roof support posts set 8' o.c.	Conventional construction: 2" x 10" studs set 24" o.c. or 2" x 6" studs set 18" o.c., roof support posts set 12' o.c.
Exterior Wall	Base wall height 8 ft. Galvanized metal cover; top 1' of main side walls open; additional 4' wall extending down from eaves 1' outside of main wall. Hinged vent doors between walls with manual control. Openings: four access doors.	Base wall height 8 ft. 3/8" plywood sheathing; 3/4" polystyrene panel insulation; galvanized metal cover; top 1' of main sidewall open; additional 4' wall extending down from eaves 1' outside of main wall; hinged vent doors between walls with manual control. Openings: four sets of double access doors.	Base wall height 16 ft. 3/8" plywood sheathing with vapor barrier, 1 1/2" polystyrene panel insulation; baked enamel metal cover; hinged vent doors in walls with auto and manual controls. Openings: three overhead doors and three access doors.
Roof	Gable roof. 2" x 4" rafters 8' o.c. Galvanized metal cover.	Gable roof. 2" x 4" rafters 8' o.c. 3/8" plywood sheathing, 3/4" polystyrene panel insulation, galvanized metal cover.	Gable roof. 2" x 8" rafters 8' o.c. 2" x 4" purlins; 1 1/2" polystyrene panel insulation; 3/8" plywood sheathing; galvanized metal cover.
Floor	Concrete slab, 2 1/2" thick.	Concrete slab, 3" thick.	Concrete slab litter area, 4" thick. Plywood covered second floor service area and 2' wide walkways between open cage areas.
Partitions	None.	None.	None.
Interior Components	None.	None.	None.
Electrical	Entry service. 150 amp. panel; nonmetallic sheathed wiring; lighting outlets 12' o.c.; 4 convenience outlets.	Entry service. 200 amp. panel, metal conduit wiring, lighting outlets 12' o.c., 6 to 8 convenience outlets	Entry service. 600 amp. panel, 3 phase, 240 volt; lighting system. metal conduit wiring. dust proof lights 12' o.c.. manual and time clock controlled system; auxiliary electrical source.
Plumbing	Cold water service, 2 to 3 hose bibs.	Cold water service, 4 to 5 hose bibs.	Cold water service and service sink, 5 or 6 hose bibs and watering service to birds.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Laying House
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	6,000	8,000	10,000	12,000	14,000	16,000	18,000	20,000	24,000	28,000
Class 4	$ 12.57	12.08	11.79	11.52	11.33	11.19	11.08	10.99	10.86	10.76
Class 5	15.29	14.51	14.05	13.66	13.38	13.17	13.01	12.88	12.69	12.55
Class 6	24.00	22.40	21.45	20.70	20.17	19.77	19.46	19.21	18.84	18.57

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 1,000 Sq. Ft.	$ 13.95 +	5,218	15.99 +	11,139	22.89 +	27,858
1,001 – 2,500 Sq. Ft.	12.14 +	7,011	13.93 +	13,176	20.05 +	30,677
2,501 – 4,500 Sq. Ft.	11.09 +	9,661	12.73 +	16,187	18.38 +	34,841
4,501 – 10,000 Sq. Ft.	10.60 +	11,824	12.18 +	18,644	17.62 +	38,240
10,001 – 30,000 Sq. Ft.	10.19 +	15,970	11.71 +	23,355	16.97 +	44,756

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Exterior Sheathing				
3/8" plywood	±	$ .14	.13	.22
Insulation:				
Fiberglass Roll, 3 1/2" thick	±	.49	.10	.05
Polysturene Panels, 1" thick	±	.42	.03	.16

Roof

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Roof Sheathing				
3/8" plywood	±	$ .81	.81	.81
Insulation:				
Fiberglass Roll, 3 1/2" thick	±	1.40	.30	.10
Polysturene Panels, 1" thick	±	1.20	.10	.30

Floor

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Material Type:				
Dirt	–	$ 3.19	3.66	4.50

Laying House
Cost Factor Tables

Adjustment Factors (cont.)

Plumbing

Apply cost to component		Class 4	Class 5	Class 6
Cold Water Service				
None	−	$ 620	800	1,770
Apply cost to each item		All Classes		
Fixtures:				
Hot Water Heater, 50 gallons	+		500	

Heating & Ventilation

Apply cost to sq. ft. of ground area		All Classes
Total Enviornmental Control Systems		
Roof System: Includes roof top evaporative coolers, temperature controls, ventilation ductwork, automatic lighting and 3/4" line to brooder stoves.	+	$ 2.60
Wall System: Includes exterior wall air filter pad with water activated cooling, air temperature, humidity and circulation sensors and control panel; fans with wall shutters; ventilation ductwork; programmable lighting system.	+	2.60
Apply cost to each system or item		All Classes
Evaporative Coolers (only), roof mounted:		
3/4 HP, 5,000 CFM	+	$ 1,600
1 HP, 8,500 CFM	+	2,400
1 1/2 HP, 10,000 CFM	+	2,900
2 HP, 12,000 CFM	+	3,400

Interior Components

		All Classes
Bird Confinement Systems:		
Includes tiered cages, automatic chain feeding, watering, egg collection, and waste control system.	+	$ .00
Note: Bird Confinement Systems are exempt under ORS 307.397 (5).		

Laying House
Cost Factor Tables

Adjustment Factors (cont.)

Base Component Cost

Building Component:	Class 4 11,520 sq. ft.	Class 5 17,280 sq. ft.	Class 6 22,464 sq. ft.
Foundation	$ 1.44	$ 1.50	$ 1.95
Frame	1.93	1.94	2.38
Exterior Wall	1.43	2.04	3.12
Roof	4.02	4.39	5.13
Floor	2.44	2.80	5.40
Electrical	.25	.31	.81
Plumbing	.07	.08	.17
TOTAL	11.58	13.06	18.96

Group: Livestock Shelters
Type: Arenas

Type Features: The arena type building generally incorporates a greater attention to material and workmanship detail than most pole frame buildings. This occurs because owners are concerned with both the building's use and its image since the payment for stabling and training of horses is common.

The building design consists of two major areas. An open-span riding arena and at least one lean-to area for stables with a tack room and wash room. Occasionally the lean-to area will serve for the storage of equipment.

Equestrian buildings are considered a farm building but seldom do they tie into a traditional farm enterprise. Alternative uses of arenas are not restricted like other special purpose buildings due to the high clear span design.

Class Illustrations

Class 4

Class 5

Class 6

Arenas
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Dirt or gravel backfilled holes for pole frame.	Gravel with cement binder backfilled holes for pole frame.	
Frame	Pole frame construction: 6" x 6" pressure-treated poles set 10' to 12' o.c.	Pole frame construction: 6" x 6" to 6" x 10" pressure-treated poles set 10' to 14' o.c.	
Exterior Wall	Arena base wall height 14'. Shed base wall height 10'. 2" x 6" utility or construction grade girts; skirt boards; baked enamel metal exterior cover. Openings: two 10'x 10' and two 12' x 12' sliding doors.	Arena base wall height 16'. Shed base wall height 12'. 2" x 6" No. 2 or better grade girts 2' o.c.; 2" x 10" skirt boards baked enamel metal exterior cover. Openings: two 10' x 12' and two 12' x 14' sliding doors.	
Roof	Gable roof. Dbl. site built trussed rafters over arena, 12' o.c. 2" x 6" horizontal nailers; baked enamel metal cover with vapor barrier.	Gable or monitor roof. Dbl. engineered trussed rafters over arena, 10' to 14' o.c. 2" x 6" purlins or nailers; adequate ridge or turbine ventilators with gable vents; baked enamel metal cover with vapor barrier.	
Floor	Dirt and sawdust in arena area. Dirt in stall area with plank flooring in tack/feed room. Concrete in wash room with drain.	Dirt and sawdust in arena area. Dirt in stall area with plank flooring in tack/feed room. Concrete in wash room with drain.	
Partitions	Stud wall: 2" x 4" studs 24" o.c. with 1/2" plywood cover for tack/feed room. Wash room with painted 1/2" plywood cover. 1/2" plywood safety cover 4' high on interior of arena with 8' height on stall/arena common wall.	Stud wall: 2" x 4" studs 24" o.c. with 1/2" plywood cover for tack/feed room. Wash room with 1/2" plywood with laminated plastic cover. 5/8" plywood safety cover 8' high on interior of arena	
Interior Components	Two wood or metal gates.	Two wood or metal gates.	
Electrical	Minimal fluorescent arena lights; one light per 400 sq. ft. in stable area; few 110 volt convenience outlets with one 100 amp. panel box.	Good quality mercury or fluorescent lights over arena; one dust-tight or shatter-proof glass globe per 200 sq. ft. of stable area; adequate 110 volt convenience outlets; light- weight metal conduit wiring; 200 amp. panel box.	
Plumbing	Cold water service, four hose bibs.	Cold water service, six hose bibs; hot water service for wash room.	
Heating-Cooling	None.	None.	
Exterior Components	None.	None.	

Arenas
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	6,000	8,000	10,000	12,000	14,000	16,000	18,000	20,000	22,000	24,000
Class 4	$ 9.61	8.91	8.49	8.16	7.92	7.75	7.61	7.50	7.41	7.33
Class 5	14.10	12.52	11.58	10.87	10.36	9.98	9.68	9.44	9.25	9.09

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5	
Size Range	Cost Per Sq. Ft.	Lump Sum	Cost Per Sq. Ft.	Lump Sum
0 – 1,000 Sq. Ft.	$ 9.18	+ 12,140	11.90	+ 29,657
1,001 – 2,500 Sq. Ft.	7.90	+ 13,414	9.69	+ 31,850
2,501 – 4,500 Sq. Ft.	7.15	+ 15,294	8.40	+ 35,089
4,501 – 10,000 Sq. Ft.	6.80	+ 16,830	7.81	+ 37,733
10,001 – 25,000 Sq. Ft.	6.51	+ 19,774	7.30	+ 42,802

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		6,000	12,000	24,000
Height Variation, each 2' from base				
Class 4, base wall height 14'	±	$ .30	.23	.18
Class 5, base wall height 16'	±	.43	.33	.25
Apply cost to sq. ft. of ground floor area		**Class 4**	**Class 5**	**Class 6**
Protective Finish:				
Galvanized	–	.09	.10	
Exterior Cover:				
Painted plywood siding 5/8"; no sheathing or metal	+	.24	.25	

Roof

Apply cost to sq. ft. of ground floor area		**Class 4**	**Class 5**	**Class 6**
Protective Finish:				
Galvanized	–	.22	.22	
Plywood Sheathing, 3/8"	+		.81	
Apply cost to sq. ft. of ground floor area			**All Classes**	
Insulation:				
Fiberglass roll, 1 1/2" thick	+		.60	
Vapor barrier, none	–		.10	

Arenas
Cost Factor Tables

Adjustment Factors (cont.)

Floor

Apply cost to sq. ft. of ground floor area		All Classes
Ground Floor Type:		
Concrete, rough screed, 4" thick	+	$ 4.50
Asphalt, 3" thick	−	2.90
Loft:		
Plank flooring *(use loft area)*	−	3.65

Partitions

Compare to base specifications		Class 4	Class 5	Class 6
Arena Safety Cover				
1/2" Plywood, 4' high, none	−	$ .45		
5/8" Plywood, 8' high, none	−		.70	
Apply cost to each room		**Class 4**	**Class 5**	**Class 6**
Rooms:				
Tack Room, none	−	1,530	2,050	
Wash Room, none	−	3,560	5,010	

Interior Components

Apply cost to each gate		All Classes
Gate, 12' metal or wood	±	$ 225

Plumbing

Apply cost to each unit		All Classes
Cold Water Service, none	−	$ 350
Hose bib	±	90
Automatic waterer	+	300
Fixtures:		
Lavatory	+	400
Toilet	+	445
Hot water heater, 50 gallons	±	500

Arenas
Cost Factor Tables

Adjustment Factors (cont.)

Box Stalls

Apply cost to each stall		All Classes
10' x 10' to 12' x 12' in size; walls up to 8' high of construction grade planks; wood or plastic feed box; lightweight plywood wood framed swing door; wire mesh partial fronts; lightweight hardware; dirt floor.	+	$ 1,500
12' x 12' in size; walls 8' high of plank or tongue and groove boards; wood or plastic feed box; heavy rail door with wood frame; good quality hardware; steel bars or wire mesh partial fronts; dirt floor.	+	1,800
12' x 12' to 14' x 14' in size; walls of tongue and groove boards; wood or plastic feed box; dutch door or heavy rail wood door with metal frame; good quality hardware; heavy steel bars with special trim fronts; dirt floor.	+	2,200

Base Component Cost *(based on a 14,976 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation	$ .49	$ .66	
Frame	.28	.93	
Exterior Wall	3.34	3.58	
Roof	2.87	2.97	
Floor	.08	.09	
Partitions	.25	.40	
Interior Components	.04	.04	
Electrical	.42	1.39	
Plumbing	.06	.10	
TOTAL	7.83	10.16	

Group: Livestock Shelters
Type: Hobby Stables

Type Features: Hobby stables generally are used for housing one to four horses on a smaller, gentleman farmer type of operation. Many times the structure will be of the same or similar construction as the residence.

The design of these buildings runs from very plain and simple to ornate styles with excellent materials and workmanship.

Class Illustrations

Class 4

Class 5

Class 6

Hobby Stables
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Minimal concrete.	Continuous concrete.	Continuous concrete.
Frame	Conventional construction: 2" x 4" studs, wide spaced.	Conventional construction: 2" x 4" studs set 24" o.c.	Conventional construction: 2" x 4" studs set 24" o.c.
Exterior Wall	Base wall height 8 ft. Single shiplap, vertical board or equivalent type cover. Openings: one sliding or swinging 4' x 7' door per stall, one 2' x 2' window.	Base wall height 8 ft. Single siding or 5/8" plywood cover. Openings: one 4' x 7' sliding or swinging door per stall, one 3' x 6' access door, one 3' x 3' window.	Base wall height 8 ft. Sheathing, siding or plywood exterior. Interior: 1/2" plywood. Openings: one 4' x 8' job built dutch or heavy sliding door per stall, three 3' x 3' windows.
Roof	Shed or low gable roof with minimal overhang; 2" x 4" rafters 24" o.c., solid sheathing, roll composition cover.	Gable roof with 4' overhang; 2" x 4" rafters 24" o.c., solid sheathing, composition shingle or galvanized metal cover.	Gable roof with 4' overhang; 2" x 6" rafters 24" o.c., solid sheathing, good quality composition or wood shingle cover.
Floor	Dirt.	One-fifth of area concrete slab for tack-feed room; dirt in stall area.	One-fifth of area concrete slab for tack and feed room; dirt in stall area.
Partitions	None.	Stud wall: 2" x 4" studs 24" o.c. with 1/2" plywood cover one side for tack-feed room.	Stud wall: 2" x 4" studs 24" o.c. with 1/2" plywood cover two sides for tack room and feed storage area .
Interior Components	Box stalls: 2" thick wood plank 5' high; wood feed boxes.	Box stalls: 2" thick wood plank 5' high, balance light wire; feed boxes .	Box stalls: 2" x 6" tongue and groove plank 5' high, balance heavy wire; feed boxes.
Electrical	None.	One light outlet each 100 square foot of floor area.	One light outlet each 100 square foot of floor area, two convenience outlets .
Plumbing	None.	None.	Cold water service, 2 hose bibs
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Hobby Stables
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	300	350	400	450	500	550	600	650	700	750
Class 4	$ 25.40	24.04	23.03	22.24	21.61	21.09	20.66	20.30	19.98	19.71
Class 5	35.44	33.00	31.17	29.75	28.61	27.68	26.90	26.25	25.69	25.20
Class 6	43.59	40.32	37.87	35.96	34.43	33.18	32.14	31.26	30.50	29.85

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 260 Sq. Ft.	$ 18.64 +	2,132	22.32 +	4,088	25.83 +	5,528
261 – 1,000 Sq. Ft.	15.92 +	2,842	18.37 +	5,119	20.69 +	6,871
1,001 – 2,500 Sq. Ft.	14.99 +	3,743	17.02 +	6,429	18.92 +	8,577
2,501 – 4,500 Sq. Ft.	14.47 +	5,039	16.26 +	8,314	17.94 +	11,030

Adjustment Factors

Roof

Apply cost to covered area		Class 4	Class 5	Class 6
Material Type				
Wood Shingle	+		$ 3.05	
Apply cost to overhang area		**Class 4**	**Class 5**	**Class 6**
Overhang, 4'				
None	–		4.00	4.54

Floor

Apply cost to sq. ft. of coverage area		Class 4	Class 5	Class 6
Material Type:				
Concrete, 4" thick	+	$ 4.50		
Dirt	–		4.50	4.50

Interior Components

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Tack Room				
None	–		$ 1.68	2.24

Hobby Stables
Cost Factor Tables

Adjustment Factors (cont.)

Electrical

Apply cost to each unit		Class 4	Class 5	Class 6
Service Panel:				
60 amp	+	$ 900		
Apply cost to each unit above base		All Classes		
Wiring per outlet:				
110 volt	±		70	

Plumbing

Compare service to base		Class 4	Class 5	Class 6
Cold Water Service, 2 hose bibs	+	$ 530	530	

Base Component Cost *(based on a 512 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation	$ 4.55	$ 5.95	$ 5.95
Frame	3.33	3.54	3.74
Exterior Wall	5.45	5.85	8.33
Roof	5.41	6.39	6.84
Floor	.00	.67	.67
Partitions	.00	.36	.52
Interior Components	2.73	3.28	3.98
Electrical	.00	2.33	2.62
Plumbing	.00	.00	1.46
TOTAL	21.47	28.37	34.11

Group: Feed And Produce Storage
Type: Hay Cover

Type Features: This type of structure is primarily a roof with open pole or steel frame supporting members. The primary use of the structure is for storage of large volumes of baled hay, but occasionally may be used for supplemental storage of equipment.

The main consideration in the design of the Hay Cover building is an adequate height to provide for the loading and unloading of the hay and large volume storage.

Class Illustrations

Class 4

Class 5

Class 6

Hay Cover
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Gravel backfilled holes for pole frame.	Gravel with cement binder backfilled holes for pole frame.	Poured concrete footing and piers.
Frame	Pole frame construction: 4" x 6" poles set 12' o.c.	Pole frame construction: 6" x 6" pressure treated poles set 12' o.c.	Open web steel columns set 20' o.c.
Exterior Wall	Base height 14 ft. No wall cover.	Base height 18 ft. No wall cover.	Base height 18 ft. No wall cover.
Roof	Shed roof. Dbl. 2" x 10" rafters set on poles, 2" x 6" purlins or nailers, galvanized metal cover.	Gable roof. Dbl. 2" x 12" trussed rafters, 2" x 6" purlins or nailers, galvanized metal cover.	Gable roof. Open web steel trusses for clearspan, steel purlins, baked enamel metal cover.
Floor	Dirt.	Dirt.	Dirt.
Partitions	None.	None.	None.
Interior Components	None.	None.	None.
Electrical	None.	None.	None.
Plumbing	None.	None.	None.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Hay Cover
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	2,000	4,000	6,000	8,000	10,000	12,000	14,000	16,000	18,000	20,000
Class 4	$ 4.86	4.32	4.06	3.93	3.84	3.77	3.71	3.67	3.64	3.61
Class 5	5.60	5.14	4.92	4.81	4.74	4.67	4.63	4.59	4.57	4.54
Class 6	10.94	10.15	9.79	9.59	9.48	9.36	9.28	9.22	9.18	9.14

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

Size Range	Class 4 Cost Per Sq Ft	Class 4 Lump Sum	Class 5 Cost Per Sq Ft	Class 5 Lump Sum	Class 6 Cost Per Sq Ft	Class 6 Lump Sum
0 – 1,000 Sq. Ft.	$ 4.63 +	1,061	5.40 +	907	10.64 +	1,494
1,001 – 2,500 Sq. Ft.	4.03 +	1,659	4.89 +	1,406	9.76 +	2,366
2,501 – 4,500 Sq. Ft.	3.68 +	2,541	4.60 +	2,144	9.24 +	3,655
4,501 – 10,000 Sq. Ft.	3.52 +	3,264	4.46 +	2,747	9.01 +	4,707
10,001 – 25,000 Sq. Ft.	3.38 +	4,651	4.35 +	3,907	8.80 +	6,724

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		2,000	10,000	20,000
Height Variation, each 2' from base				
Class 4, base wall height 14'	±	$ .11	.08	.08
Class 5, base wall height 18'	±	.11	.04	.06
Class 6, base wall height 18'	±	.15	.06	.07
Gable End Walls				
Class 4	+	$ .11	.07	.07
Class 5	+	.11	.07	.07
Class 6	+	.33	.16	.14
Apply cost to linear foot of wall cover		**All Classes**		
Curtain Wall *(height per class)*				
Galvanized wall cover	+		$ 8.24	

Roof

Apply cost to sq. ft. of ground floor area		Class 4	Class 5	Class 6
Shed Roof	–		.99	
Gable Roof	+	$ .56		
Protective Finish				
Baked Enamel	+	.22	.22	
Galvanized	–			.22

Hay Cover
Cost Factor Tables

Adjustment Factors (cont.)

Floor

Apply cost to sq. ft. of floor area		**All Classes**
Material Type:		
Concrete, 4" thick	+	$ 4.50
Asphalt, 3" thick	+	2.90

Base Component Cost *(based on a 11,088 sq. ft. building)*

	Class 4	**Class 5**	**Class 6**
Building Component			
Foundation	$ .55	$ .58	$ .81
Frame	.55	.32	.59
Exterior Wall	1.18	1.18	2.69
Roof	1.52	2.62	5.32
Floor	.00	.00	.00
TOTAL	3.80	4.70	9.41

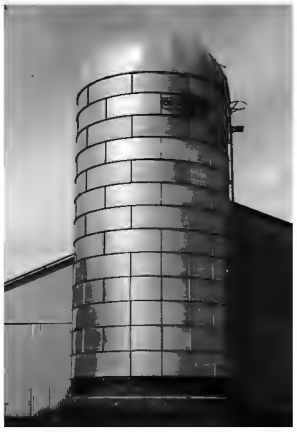
Group: Feed And Produce Storage
Type: Silos

Type Features: These structures are used for the storage of silage, haylage, etc. There is very little difference in quality between silos within the same construction types. Therefore, the three classes for this type of structure reflect differences in cost due to structural design rather than quality of workmanship or materials.

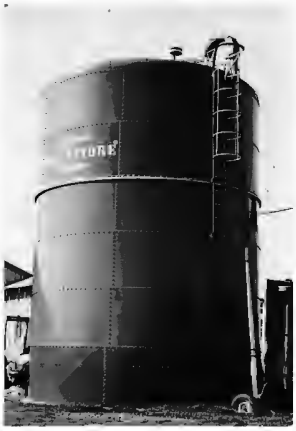
Class Illustrations

Class 4

Class 5



Class 6



Silos
Base Specifications

Item	Class 4	Class 5	Class 6
Base	Concrete reinforced footing 36" wide x 24" thick, concrete center fill.	Concrete reinforced footing 36" wide x 24" thick, concrete center fill.	Concrete reinforced footing 30" wide x 24" thick, concrete wall 6" thick x 16" high, concrete center fill.
Cylinder Wall	Concrete staves: 3" thick interlocking precast staves, steel retaining rings, concrete plaster interior with plastic spray seal coat, galvanized steel ladder, unloading chute, access doors, 9" diameter filler pipe.	Galvanized steel panels: interior protective finish, galvanized steel ladder, unloading chute, access doors, 9" diameter filler pipe.	Steel panels: glass lined protective finish, galvanized steel ladder with safety cage, access doors, 9" diameter filler pipe.
Roof	Metal dome: access panel, ladder, work platform, filler pipe elbow and chute dormer.	Metal dome: access panel, ladder, work platform, filler pipe elbow and chute dormer.	Metal dome: access panel, ladder, work platform and filler pipe elbow.
Floor	Concrete 6" reinforced slab.	Concrete 6" reinforced slab.	Concrete 6" reinforced slab.
Electrical	None.	None.	Service subpanel, metal conduit wiring, safety switches and starters.
Equipment	None.	None.	Unloader: auger system, bottom unloading conveyor.

Silos
Cost Factor Tables

Base Factors: Table Format

Class 4

Diameter	Height of Silo								
	25'	30'	35'	40'	45'	50'	55'	60'	65'
12'		$ 14,290	16,650	19,010	21,360				
14'		15,850	18,470	21,090	23,700				
16'		16,290	18,980	21,680	24,360				
18'			20,500	23,420	26,310	29,210			
20'			22,380	25,560	28,710	31,870			

Class 5

Diameter	Height of Silo								
	25'	30'	35'	40'	45'	50'	55'	60'	65'
11'	23,200	24,170	25,140	26,110	27,080				
13'	25,120	26,480	27,840	29,190	30,550	33,540			
15'	27,370	29,170	30,980	32,780	34,590	37,580			
17'		32,260	34,570	36,890	39,210	41,530			
19'			38,620	41,510	44,410	47,310		53,100	
21'			43,110	46,650	50,190	53,720		60,800	
25'						68,480		78,510	

Class 6

Diameter	Height of Silo								
	25'	30'	35'	40'	45'	50'	55'	60'	65'
21'		90,680	96,280	101,870	107,470	113,070	118,670	124,270	129,870
25'		104,690	112,630	120,560	128,490	136,430	144,360	152,300	160,230
30'		125,640	137,060	148,490	159,910	171,340	182,760	194,190	205,620
36'				188,710	205,160	221,610	238,060	254,520	270,970

Adjustment Factors

Cylinder Wall

Apply cost to each silo		Class 4	Class 5	Class 6
No glass lining - per silo	–			30%
No filler pipe - per linear foot	–	$ 18.65	18.90	18.30

Roof

Apply cost to each silo		Class 4	Class 5	Class 6
No filler pipe elbow	–	$ 320	350	
No chute dormer	–	470	500	

Silos
Cost Factor Tables

Adjustment Factors (cont.)

Electrical

Apply cost to each unit		Class 4	Class 5	Class 6
Service panel;				
High voltage, metal conduit wiring	+	$ 1,220	1,300	

Equipment

Apply cost to each unit		Class 4	Class 5	Class 6
Unloader				
12' diameter silo	+	$ 6,070		
16'	+	6,350	6,350	
20'	+	6,910	6,910	
25'	+		7,550	
Load distributor	+	1,050	1,050	

Group: Feed And Produce Storage
Type: Potato Storage

Type Features: Potato storage structures are designed to store raw potatoes for varying lengths of time.

The Class 4 is also known as a potato cellar and is constructed partly below grade level. Minimal quality materials and unskilled labor are utilized. The potato storage period is relatively short. Adaptation to other uses is not common.

The Class 5 is also referred to as a potato warehouse and is constructed at grade level using standard quality materials and workmanship. The potato storage period can be quite long depending on the amount of temperature and humidity control equipment included. Because of the high walls and lack of extensive interior construction these buildings are often put to other uses.

Class Illustrations

Class 4 | **Class 5** | **Class 6**

Potato Storage
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Continuous concrete.	Continuous concrete reinforced.	
Frame	Bearing wall: interior roof support poles set 20' o.c.	Conventional construction: 2" x 6" studs set 24" o.c.	
Exterior Wall	Earthen sidewalls approximately 8' deep. End walls of 8" concrete block 24' to top of center section. Openings: one 12' x 14' insulated double sliding door, one louvered vent at each end wall.	Base wall height 14 ft.; 5/8" plywood sheathing, 2" polystyrene panel insulation, galvanized metal cover. Openings: two 12' x 14' insulated overhead doors, two walk-in doors	
Roof	Gable roof. Pole rafters 2' o.c., vapor barrier, heavy gauge wire netting, bailed straw insulation, wired on nailing strips, galvanized metal cover, louvered cupolas.	Gable roof. 3" x 12" rafters set 24" o.c., 5/8" plywood sheathing, 2" polystyrene panel insulation, galvanized metal cover.	
Floor	Dirt.	Dirt in storage area; 2 1/2" concrete slab in air channels.	
Partitions	None.	Three full length bin separator walls; reinforced concrete footing, 2" x 10" studs set 2' o.c. with 8" x 8" posts set 10' o.c., spaced sheathing for air flow.	
Interior Components	None.	None.	
Electrical	Entry service, one lighting outlet each 1,500 sq. ft. of floor area, 220 volt power outlet.	Entry service, one lighting outlet each 1,000 sq. ft. of floor area, 220 volt power outlet.	
Plumbing	None.	Entry service, two hose bibs.	
Heating-Cooling	None.	None.	
Exterior Components	None.	None.	

Potato Storage
Cost Factor Tables

Special Instructions: The Class 5 building area is based on dimensions taken at grade level, including any air channels and fan rooms that may exist.

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	5,000	10,000	15,000	20,000	25,000	30,000	35,000	40,000	45,000	50,000
Class 4	$ 9.20	8.00	7.53	7.29	7.15	7.06	6.99	6.94	6.90	6.87
Class 5	25.30	21.75	20.25	19.50	19.05	18.75	18.54	18.38	18.25	18.15

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4			Class 5		
Size Range	Cost Per Sq. Ft.		Lump Sum	Cost Per Sq Ft		Lump Sum
0 – 1,000 Sq. Ft.	$ 8.58	+	8,496	25.85	+	20,449
1,001 – 2,500 Sq. Ft.	7.62	+	9,445	21.72	+	24,548
2,501 – 4,500 Sq. Ft.	7.06	+	10,847	19.30	+	30,603
4,501 – 10,000 Sq. Ft.	6.80	+	11,992	18.20	+	35,546
10,001 – 50,000 Sq. Ft.	6.58	+	14,186	17.25	+	45,022

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of floor area		5,000	15,000	30,000
Height Variation, each 2' from base:				
Class 5, base wall height 14'	±	.63	.35	.35
Sheathing, Class 5:				
None	–	.91	.56	.35
Insulation, Class 5:				
Fiberglass Batt, 6"	–	.68	.42	.31
Sprayed on polyurethane, 2"	+	2.00	1.22	.90
Protective Finish, Class 5:				
Baked Enamel	+	.12	.07	.05
Endwall Construction, Class 4:				
Stud Frame; 6" fiberglass batt insulation; plywood cover	–	.91	.63	.49

Potato Storage
Cost Factor Tables

Adjustment Factors (cont.)

Roof

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Sheathing:				
None	−		$ 1.22	
Protective Finish:				
Baked Enamel	+	.22	.22	
Insulation:				
Fiberglass Batt, 6"	−		.85	
Sprayed polyurethane, 2"	+		2.50	
Apply cost to each unit			**All Classes**	
Ventilators:				
Revolving Turbine, 18" diameter	+		210	

Floor

Apply cost to sq. ft. of coverage area		**All Classes**
Material Type:		
Asphalt, 3"	+	$ 2.90
Concrete, 4"	+	4.50

Electrical

Apply cost to floor area		Class 4	Class 5	Class 6
Base electrical:				
None	−	0.14	0.22	

Temperature and Humidity Control

Apply cost to sq. ft. of floor area		5,000	10,000	15,000	20,000	25,000	30,000
Air and Humidity Control Only: Includes fan room, louver system, humidifiers, perforated air pipe, and control panel. Class 5	+	$ 4.76	3.36	2.94	2.66	2.52	2.45
Air Conditioning: Includes complete refrigeration unit and control as well as the air and humidity system above. Class 5	+	10.65	8.47	7.21	6.72	6.30	5.95

Potato Storage
Cost Factor Tables

Adjustment Factors (cont.)

Base Component Cost *(based on a 25,200 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation	$ 1.16	$ 1.91	
Frame	.32	3.45	
Exterior Wall	2.07	5.11	
Roof	3.45	6.21	
Floor	.00	.70	
Partitions	.00	1.40	
Electrical	.14	.22	
Plumbing	.00	.04	
TOTAL	7.14	19.04	

Group: Feed And Produce Storage
Type: Seed Warehouse

Type Features: The seed warehouse building is designed for the cleaning and storage of various kinds of grass seed.

Typically, seed is received and stored in bulk prior to being processed through the seed cleaning equipment. Cleaned seed is sacked and often stored in the warehouse for a limited period of time.

Seed warehouses are often characterized by two eave heights. The higher portion usually houses the elevator and the bins over the cleaning equipment. The lower portion is usually the bulk storage area.

Class Illustrations

Class 4

Class 5

Class 6

Seed Warehouse
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation		Continuous concrete, integral with slab floor.	
Frame		Conventional construction: 2" x 8" studs set 2' o.c.	
Exterior Wall		Base wall height 24 ft. in equipment area. 2" x 6" girts, baked enamel metal cover. Openings: one 14' x 14' and one 16' x 14' sliding doors, one access door.	
Roof		Gable roof. 2" x 12" trussed rafter 24" o.c., plywood sheathing or 2" x 8" purlins, baked enamel metal cover.	
Floor		Reinforced concrete slab, 6" thick, hard smooth surface. Elevated heavy wood equipment deck.	
Partitions		None.	
Interior Components		Plywood sheathing on interior of exterior walls. Combination office and electrical room. Elevated equipment deck with stairs and guard rails.	
Electrical		Entry service, metal conduit wiring, dust tight lighting and fixtures. Equipment circuits included in equipment costs.	
Plumbing		Entry service, two hose bibs.	
Heating-Cooling		None.	
Exterior Components		None.	

Seed Warehouse
Cost Factor Tables

Special Instructions: Base Factors are for the dump pit and seed cleaning areas only. Storage factors are addressed in the adjustment factors section under seed storage.

Seed handling and processing equipment costs are listed in the adjustment factors table under interior components. Equipment costs must be added to the base for a total replacement cost estimate.

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	2,000	2,500	3,000	3,500	4,000	4,500	5,000	5,500	6,000	6,500
Class 5	$ 41.97	36.78	33.13	30.53	28.57	27.05	25.78	24.74	23.88	23.15

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

Size Range	Class 5 Cost Per Sq. Ft.		Class 5 Lump Sum
0 – 1,000 Sq. Ft.	$ 17.94	+	50,001
1,001 – 2,500 Sq. Ft.	16.02	+	51,910
2,501 – 4,500 Sq. Ft.	14.89	+	54,731
4,501 – 10,000 Sq. Ft.	14.37	+	57,034
10,001 – 25,000 Sq. Ft.	13.93	+	61,449

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		2,000	4,000	6,000
Height Variation, each 2' from base Class 5, base wall height 24'	±	$ 1.06	.82	.62
Apply cost to sq. ft. of ground floor area		**Class 5**		
Protective Finish: Galvanized	–		$ .17	

Roof

Apply cost to sq. ft. of ground floor area		**Class 5**
Protective Finish:		
Galvanized	–	$ .22
Plywood Sheathing, none	–	.81
Roof Overhang		
Includes concrete underneath	+	9.80
Insulation:		
Fiberglass roll, 1 1/2" thick	+	.60
Sheet drip suppressor, none	–	.10

Seed Warehouse
Cost Factor Tables

Adjustment Factors (cont.)

Floor

Apply cost to sq. ft. of ground floor area		Class 5	
Ground Floor Type:			
Gravel	–	$ 4.75	
Dirt	–	6.36	
Equipment deck (different than base)	±	18.75	

Interior Components

Apply cost to each room		Class 5	
Office / Electrical Room			
12' x 20' x 8' - none	–	$ 8,000	
Interior sheathing - none	–	.80	Per surface sq. ft.

Plumbing

Apply cost to each unit		Class 5	
Cold Water Service, none	–	$ 350	
Hose bib	±	90	

Seed Storage

Apply cost to each unit		Class 5	
Bulk Commodity Bins			
Bins attached to machine room	+	$ 14.30	Per square foot
Bin divider walls	+	129.49	Per linear foot of wall
Bagged & Palletized Storage		*See appropriate Multi-Purpose Building cost section*	

Seed Warehouse
Cost Factor Tables

Adjustment Factors (cont.)

Interior Components - Seed Handling Equipment

(Includes basic item, fittings, mounting brackets, supports, power connections, subpanel, disconnect, and installation costs)

Apply cost to each item	Class 5	
Dump Pit With Grate		
Vibrating, steel construction		
10' x 6' x 30"	+	$ 12,070
12' x 8' x 33"	+	13,970
Non-vibrating	–	20%
Floor auger		
6" shaft, 9" flight with VFD	+	8,570
Elevators		
Steel construction, 35' base height		
3 3/4" x 3" cups, 3/4 HP	+	7,400
4" x 6" cups, 1 HP	+	8,220
5" x 9" cups, 1 1/2 HP	+	13,220
Height variation, each foot from 35' base		
3 3/4" x 3" cups, 3/4 HP	±	65
4" x 6" cups, 1 HP	±	95
5" x 9" cups, 1 1/2 HP	±	180

Apply cost to each item	Class 5		
Distributors			
Steel construction, manual control			
Spouting Size	6"	8"	10"
4 way	$ 1,620	1,680	1,910
6 way	1,850	1,940	2,320
8 way	2,070	2,120	2,560
10 way	2,270	2,440	2,930
12 way		2,870	3,490

Apply cost to each item	Class 5	
Belt Conveyors		
Steel frame, skirting, hopper, and motor with drive		
Base length 30'		
12" wide belt	+	$ 6,170
16" wide belt	+	6,540
24" wide belt	+	7,210
Length variation, each foot from 30' base		
12" wide belt	±	65
16" wide belt	±	70
24" wide belt	±	90
Vibrating Conveyors		
Steel construction, base length 10'		
12" wide trough	+	4,250
24" wide trough	+	5,530
Length variation, each foot from 10' base		
12" wide trough	±	260
24" wide trough	±	370
Bagging Device		
Semi-automatic gross bagging scale, 25 to 145 lb. range	+	2,550
Automatic	+	10,020

Seed Warehouse
Cost Factor Tables

Adjustment Factors (cont.)

Interior Components - Seed Cleaning and Processing

(Includes basic item, fittings, mounting brackets, supports, power connections, subpanel, disconnect, and installation costs)

Apply cost to each item	Class 5	
Debearder		
Direct drive	+	$ 8,070
Variable drive	+	9,370
Scalper		
Wooden frame, without fan		
34" x 60" screen size, 1 screen	+	13,330
34" x 60" screen size, 3 screen	+	17,880
54" x 60" screen size, 3 screen	+	29,230
Separators		
Disc-cylinder separator		
Combination, 25" discs over indented cylinder		
Single cylinder		
Without aspirator	+	15,510
Double cylinder		
Without aspirator	+	27,170
With aspirator	+	34,970
Double spiral separator	+	4,570
Velvet roller separator	+	13,570
Aspirator		
Open, uses 1,000 CFM from dust control	+	14,570
Closed, Includes fan and settling chamber	+	29,130
Indent		
23" x 90" each unit	+	9,270
3m x 12m each unit	+	38,130

Apply cost to each item	Class 5	
Airscreen Seed Cleaner		
Wooden frame		
Four screen models		
42" x 60" screen size	+	$ 31,780
54" x 60" screen size	+	33,130
Six screen models		
42" x 60" screen size	+	43,630
54" x 60" screen size	+	48,130
Metal frame		
Four screen models		
54" x 86" screen size	+	45,030
54" x 86" screen size With bottom air	+	53,500
Five screen models		
54" x 86" screen size	+	48,930
54" x 86" screen size With bottom air	+	57,400
Six screen models		
54" x 86" screen size	+	63,030
54" x 86" screen size With bottom air	+	75,090
Seven screen models		
54" x 86" screen size	+	69,030
54" x 86" screen size With bottom air	+	82,090
Eight screen models		
54" x 86" screen size	+	79,630
54" x 86" screen size With bottom air	+	92,690

Seed Warehouse
Cost Factor Tables

Adjustment Factors (cont.)

Interior Components - Miscellaneous Equipment

(Includes basic item, fittings, mounting brackets, supports, power connections, subpanel, disconnect, and installation costs.)

Apply cost to each item	Class 5
Dust Control System	
Includes typical air cleaner, collector, piping, and installation connections with blower fan and motor	
Single cleaning line	+ $ 57,360
Double cleaning line	+ 72,360
Blender	
Twin screw, one ton capacity	+ 17,670

Apply cost to each item	Class 5
Color Sorter System	
4 lane	+ $ 68,130
7 lane	+ 124,700
Sewing Line	
Includes conveyor, scales, and sewing machines	+ 21,170
Electrical Center	
Includes motor control center, variable frequency drives, 400 amp breaker panel, programable logic controller and four 400 watt metal halide lights	+ 15,000

Base Component Cost *(based on a 3,360 sq. ft. building)*

	Class 4	Class 5	Class 6
Building Component:			
Foundation		$ 3.65	
Frame		4.88	
Exterior Wall		4.93	
Roof		5.16	
Floor		4.92	
Interior Components		6.74	
Electrical		0.74	
Plumbing		0.16	
TOTAL		31.18	

Group: Feed And Produce Storage
Type: Commercial Grain Storage

Type Features: Grain storage structures receive and store harvested grain prior to shipping.

Generally, smaller, light-duty corrugated steel bins are used for on farm storage (see Accessory Improvement Section). Larger corrugated bins, bolted steel tanks, wood cribs and concrete silos are found in commercial storage facilities.

Concrete or wood crib elevators are designed to provide high volume capacity with the capability to segregate stored grain. Wood crib structures are rarely built today. The utility of crib storage has been replaced by concrete. A concrete elevator is typically constructed as a complex of silos with either an interior or exterior distribution system. Concrete silos may be designed with fan and interstice bins to allow for additional segregation.

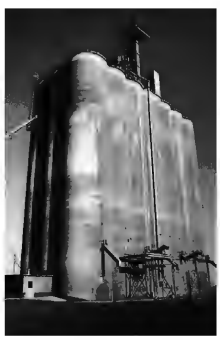
Commercial corrugated bins and bolted tanks are designed and engineered for heavy use. These structures are made of high quality components, and require sophisticated installation techniques. Steel bins and tanks are utilized as independent storage or as an annex to a concrete or wood crib elevator.

Class Illustrations

Class 4

Class 5

Class 6



Commercial Grain Storage
Base Specifications

Item	Class 4	Class 5	Class 6
Base	Reinforced concrete foundation and slab.	Reinforced concrete foundation and slab.	Reinforced concrete foundation slab and hopper bottoms.
Sidewall	Galvanized corrugated steel panels. May have wall stiffeners, access door, ladder.	Bolted smooth steel panels, painted both sides, access door, ladder.	Reinforced concrete slipform construction, multi-silo structure. May have intersticing and fan bin walls, access door, ladder.
Roof	Sloping. Galvanized steel ribbed panels. May have reinforcing ribs or rings, manhole, ladder.	Flat or sloping. Bolted smooth steel panels, painted both sides, manhole, ladder.	Flat or sloping. Reinforced concrete, manhole.
Interior Components	None.	None.	Concrete workroom, concrete passageway for interior manlift and elevator leg.
Electrical	None.	None.	Dust-proof light fixtures with metal conduit wiring in work areas.
Machinery And Equipment	None.	None.	None.
Exterior Components	None.	None.	None.

Commercial Grain Storage
Cost Factor Tables

Base Factors: Table Format

Storage Capacity - Cost Per Bushel

	50,000	100,000	200,000	300,000	400,000	500,000
Class 4	$ 1.45	1.30	1.25	1.20	1.15	1.15
Class 5	2.70	2.45	2.15	2.10	1.90	1.80
Class 6	8.95	7.50	6.55	5.95	5.60	5.35

Adjustment Factors

Interior Components

Apply percentage adjustment to base factor	*Bushel Capacity*			
		50,000	100,000	300,000
Concrete elevator with exterior distribution system, no interior workroom or passageway	–	9%	5%	2%
Concrete annex, single silo	–		30%	

Equipment House

Apply cost to cubic foot of house	*Cubic Feet*						
		2,500	5,000	7,500	10,000	12,000	15,000
Leg Head House or Conveyor Gallery Structures at top of elevator housing distribution equipment, costs include building shell only.							
Concrete	+	$ 17.00	14.20	11.95	10.40	9.30	8.50
Steel	+	7.20	5.90	5.00	4.30	3.70	3.35

Concrete Improvements

Apply cost to grate surface area	*Class 5*		
Receiving Dump Pit Includes excavation, reinforced concrete pit with steel grating and liner, slopes to leg boot or conveyor	+	$ 140	Per square foot
Conveyor Tunnel Includes excavation, reinforced concrete floor, walls and roof, with access oopening, metal cover, and ladder 5' x 6'	+	450	Per linear foot

Commercial Grain Storage
Cost Factor Tables

Adjustment Factors (cont.)

Special Instructions: *All equipment costs include motor, drive, and motor wiring (where applicable), controls, and standard quality installation materials and labor.*

Grain Handling Equipment

Bucket Elevator Leg *(Includes complete steel leg assembly.)*	*Leg Height*						
	40'	60'	80'	100'	120'	140'	160'
Bushel Capacity per hour:							
1,000	$ 570	445	400	375	345	325	300
2,000	645	510	460	415	390	370	350
4,000	710	560	495	475	450	430	410
6,000	775	625	550	530	510	495	475
8,000	890	710	625	560	530	510	495
10,000	860	710	640	595	550	535	520
12,000	870	755	690	635	590	560	530

Elevator Leg Pit	*Class 5*		
Includes excavation, reinforced concrete walls and floor, steel cover, and ladder. 8' x 10' x 10' deep	+	$ 11,200	Per unit

Distributor, Rotary

Transfers grain from elevator leg through spouting to bins. Single leg type, standard quality steel construction. Costs are for manual and electric control units.

	Spouting Diameter									
	8"		10"		12"		14"		16"	
Outlets	Manual	Electric	Manual	Electric	Manual	Electric	Manual	Electric	Manual	Electric
4	$ 1,680	5,290	1,910	5,450	2,290	5,840				
6	1,940	6,120	2,320	6,610	2,780	7,100				
8	2,120	6,680	2,560	7,290	3,070	7,820				
10	2,440	7,670	2,930	8,410	3,520	8,950				
12	2,870	8,330	3,490	9,250	3,910	9,530	5,480	11,020	6,080	11,621
14	3,050	8,780	3,720	9,490	4,280	10,040	5,980	11,660	6,660	12,360
16	3,310	9,210	3,990	9,910	4,640	10,560	6,500	12,360	7,230	13,100
18	3,580	9,630	4,280	10,370	5,030	11,100	7,010	13,020	7,800	13,830
20	3,840	10,060	4,570	10,830	5,400	11,650	7,510	13,660	8,370	14,560
22	4,110	10,490	4,860	11,280	5,760	12,152	8,020	14,350	8,950	15,330
24	4,370	10,910	5,140	11,730	6,150	12,710	8,540	15,030	9,530	16,060

Spouting - Round steel		*Class 5*		
Includes medium gauge spouting and all hardware necessary for erection.				
Diameter	8"	+	$ 45	Per linear foot
	10"	+	65	
	12"	+	95	
	14"	+	105	
	16"	+	115	

Commercial Grain Storage
Cost Factor Tables

Adjustment Factors (cont.)

Grain Handling Equipment (cont.)

Apply cost to each item			*Class 5*
Conveyor, Troughing-Roll Belt			
Includes steel frame, rolls, head and tail pulleys, and rubber belt			
Base length 30'			
Belt width	12"	+	$ 7,630
	16"	+	9,960
	24"	+	12,050
Length Variation			
Each foot from 30' base			
Belt width	12"	±	170
	16"	±	220
	24"	±	360

Apply cost to each item			*Class 5*
Conveyor, Screw Auger			
Includes steel screw, trough and cover			
Base length 50'			
Screw diameter	9"	+	$ 6,000
	12"	+	7,300
	14"	+	8,680
	16"	+	10,800
	18"	+	13,000
Length Variation			
Each foot from 50' base			
Screw diameter	9"	±	60
	12"	±	75
	14"	±	85
	16"	±	110
	18"	±	130

Miscellaneous Equipment

Apply cost to each item			*Class 5*
Automatic Shipping Scale			
Includes hopper inlet and discharge, and weigh beam balance scale with ticket printer			
Bushel capacity	5	+	$ 15,400
	10	+	17,300
	15	+	25,000
	20	+	26,900
	25	+	28,800
Add for receiving scale		+	25%
Add for remote counter		+	1,000

Apply cost to each item			*Class 5*
Truck Hoist, Overhead			
Includes steel frame, track, wheel cradle, gears, pulleys, and cables.			
Hoist capacity,		+	$ 12,100
		+	14,000
		+	22,000
Truck Hoist, Air Lift			
Includes in-floor air cylinder mechanism, steel platform, air compressor with tank, air piping, and fittings.			
Single cylinder		+	21,000
Double cylinder		+	30,000

Commercial Grain Storage
Cost Factor Tables

Adjustment Factors (cont.)

Miscellaneous Equipment (cont.)

Apply cost to each item	*Class 5*	
Manlift, *300 lb. capacity*		
Includes all equipment necessary for a complete installation		
Base height, 50'		
Manual	+	$ 10,000
Electric	+	25,000
Additional height		
Each foot from 50' base		
Manual	+	85
Electric	+	85

Apply cost per bushel	*Class 5*	
Aeration System		
Includes perforated steel floor panels on I-beam frame, air tunnel with centrifugal fan(s)	+	.12
Apply cost per horsepower		
Electrical Power Distribution		
Includes all labor and materials necessary to convey power from the utility source to and including the wall panel closest to the motor. Motor wiring from wall panel to controls and motor is included in equipment costs.	+	270

Group: Specialty Structures
Type: Milking Parlor

Type Features: The milking parlor is a highly specialized type of building designed for two basic functions within a dairy operation: the actual milking of the cows, and the cooling and storage of the milk prior to shipment. These functions require a large amount of built-in equipment and fixtures which contribute to the overall cost of the milking parlor. Therefore, it is important that the cost of all these items are included in the total replacement cost estimate.

Class Illustrations

Class 4

Class 5

Class 6

Milking Parlor
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Continuous concrete	Continuous concrete	Continuous concrete reinforced
Frame	Bearing wall	Bearing wall	Bearing wall
Exterior Wall	Base wall height 10 ft.; concrete block 5' high, balance 2" x 4" stud frame set 24" o.c., plywood or galvanized metal siding; Openings: two wood sliding livestock doors, two access doors, wood framed windows	Base wall height 10 ft., lightweight concrete block wall, painted exterior; Openings: two job-built sliding livestock doors, three access doors, metal framed screened windows	Base wall height 10 ft.; reinforced concrete block wall, painted exterior; Openings: two metal livestock doors, three metal access doors, metal framed screened windows
Roof	Gable roof; 2" x 4" rafters 24" o.c., plywood sheathing, galvanized metal cover, 2" x 4" ceiling joists 24" o.c.	Gable roof; 2" x 6" rafters 24" o.c., plywood sheathing, light composition shingle or metal cover with baked enamel finish, 2" x 6" ceiling joists 24" o.c.	Gable roof; 2" x 6" rafters 16" o.c., plywood sheathing, heavy composition shingle cover, 2" x 6" ceiling joists 16" o.c., gutters and downspouts
Floor	Concrete slab; elevated cow platform in stall area; floors sloped for drainage to gutters; concrete cow entry and exit areas	Reinforced concrete slab; elevated cow platform in stall area; drain gutters, steel gutter grates in stall area; concrete cow entry and exit areas	Reinforced concrete slab; elevated cow platform with sawtooth overhanging ledge in stall area; drain gutters, steel gutter grates in stall area; concrete cow entry and exit areas
Partitions	Stud frame; painted plywood cover for parlor and milk room; unfinished equipment room interior; painted plywood ceiling cover in milk room	Concrete block walls for parlor, milk room, equipment room and bathroom; cement plaster finish in milk handling areas; painted plywood ceiling cover	Concrete block walls for parlor, milk room, equipment room, bathroom and office; special resilient wall finish in milk handling areas; painted sheetrock ceiling cover
Interior Components	None	None	None
Electrical	Entry service, metal conduit wiring, lighting and equipment outlets	Entry service, metal conduit wiring, vaportight fixtures, lighting and equipment outlets	Entry service, metal conduit wiring, vaportight fixtures, lighting and equipment outlets
Plumbing	Water service; two hose bibs, floor drains, 40 gal. hot water tank, lavatory	Full system; four hose bibs, floor drains, 60 gal. hot water tank, individual cow wash hoses, lavatory, toilet, septic tank sewer system	Full system; five hose bibs, floor drains, 80 gal. hot water tank, individual cow wash hoses, lavatory, toilet, metal shower stall, septic tank sewer system
Heating-Cooling	None	Electric wall unit in restroom	Electric wall units in restroom and office
Exterior Components	None	None	None

Milking Parlor
Cost Factor Tables

Special Instructions: Milk handling, feeding equipment, and stall item costs are listed in the adjustment factors tables. These equipment costs must be added to the base cost for a total replacement cost estimate.

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	600	800	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400
Class 4	$ 43.22	38.56	35.76	33.41	31.74	30.50	29.53	28.75	28.12	27.59
Class 5	64.22	56.43	51.76	47.94	45.24	43.22	41.64	40.38	39.35	38.49
Class 6	86.37	74.50	67.38	61.75	57.75	54.76	52.43	50.57	49.05	47.78

	2,600	2,800	3,000	3,200	3,400	3,600	3,800	4,000	4,200	4,400
Class 4	$ 27.08	26.58	26.15	25.77	25.44	25.15	24.88	24.64	24.43	24.23
Class 5	37.68	36.89	36.21	35.61	35.09	34.62	34.20	33.83	33.49	33.18
Class 6	46.59	45.47	44.49	43.64	42.88	42.22	41.62	41.08	40.59	40.15

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 1,000 Sq. Ft.	$ 24.57 +	11,188	33.07 +	18,686	38.90 +	28,484
1,001 – 2,500 Sq. Ft.	21.76 +	13,971	29.04 +	22,683	33.81 +	33,525
2,501 – 4,500 Sq. Ft.	20.12 +	18,082	26.68 +	28,589	30.83 +	40,973

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of ground floor area		600	1,200	2,000
Concrete Block, full wall height				
Class 4	+	$ 7.98	6.06	4.15
End Wall, open to holding pen				
Class 4	–	3.43	2.87	1.28
Class 5	–	3.90	3.25	1.46
Class 6	–	4.15	3.49	1.66

Plumbing

Compare cost to base specifications		All Classes
Fixtures:		
Lavatory	±	$ 400
Toilet	±	445
Stall Shower	±	590
Septic Tank System		
1,000 Gallon Tank, drainfield	±	2,450

Milking Parlor
Cost Factor Tables

Adjustment Factors (cont.)

Plumbing (cont.)

Apply cost to each component	All Classes	
Heat Recovery System:		
Hot water exchange from condensors (includes storage tank and connections)	+	5,000
Warm Water Exchange from milk cooling tubes	+	2,100

Interior Components —Milk Transfer Items

(Includes basic item, fittings, mounting brackets, supports, power connections, and installation costs)

Apply cost to each item	All Classes	
Milking Unit:		
Claw with cup and pulsator	+	550
Stainless Steel Pipeline, per stall		
2" diameter	+	130
3" diameter	+	250
Milk Pump System		
Receiver, pump, and motor for low mounted milkline	+	4,500
Filter Receiver		
Mounted between pump and bulk tank	+	1,000

Apply cost to each item	All Classes	
Bulk Milk Tank		
Refrigerated storage unit with compressor and motor		
500 gallons, 2 HP	+	12,500
750 gallons, 4 HP	+	15,000
1,000 gallons, 5 HP	+	17,500
1,500 gallons, 8 HP	+	25,000
2,000 gallons, 10 HP	+	28,750
3,000 gallons, 10 HP	+	37,500
3,000 gallons, 12 HP	+	43,750
Plate Type Cooling Units		
Small	+	2,500
Large	+	12,000
Automatic Wash System		
Up to 2,000 gallons	+	2,200
Over 2,500 gallons	+	3,500

Interior Components—Vacuum Items

Apply cost to each item or system	All Classes	
Plastic Pipeline		
3" diameter per stall	+	$ 70
Vacuum Reserve Tank	+	450
Vacuum System: motor and connections, per pump		
4 HP	+	3,500
5	+	4,945
7 1/2	+	6,000
10	+	7,500
15	+	9,500

Apply cost to each unit or system	All Classes	
Wash Manifold System		
Per unit *(includes wash tank)*	+	110
Add for automatic operation,		
Per system	+	1,800
Air Gates		
Push button door openers	+	4,500

Milking Parlor
Cost Factor Tables

Adjustment Factors (cont.)

Stall Items

Apply cost to each item	All Classes	
Milking Parlor Units: includes metal dividers, release mechanism, entry and exit gates		
Individual release design	+	$ 600
Group release design	+	1,000
Automatic Detachers *(per stall)*		
Semi-automatic (vacuum)	+	1,100
Pneumatic	+	1,600
Computerized	+	3,000

Feed Items

Apply cost to each item or system	All Classes	
Auger system from exterior bulk feed tank		
Per stall	+	1,100
Manual Stall Feeder Components		
Per stall costs:		
Hopper	+	220
Chute or downspout	+	70
Dispenser	+	110
Dispenser, metered	+	160
Dispenser, button activated	+	160
Box and shields	+	110
Automated Feed Station: includes stainless steel station with feed auger, automatic clean-out, computer and box and keyboard, transmitter and receiver	+	5,000
Neck identifier	+	80

Exterior Components

Apply cost to sq. ft. of pen area		500	750	1,000	1,250	1,500	1,750
Covered Holding Pen: includes concrete foundation; wall height 8', concrete block 5' high, balance 2" x 4" stud frame; galvanized metal cover; concrete slab floor; two full-length steel pipe area dividers; minimal lighting.	+	$ 15.13	14.22	13.59	13.03	12.68	12.47

Apply cost to each unit	All Classes		
Jet Cow Washers: includes floor mounted sprinkler heads, protectors, and connecting plumbing.	+	2.69	Per sq. ft.
Crowd Gate: full width of holding pen, push button controlled			
Electric	+	3,000	Per item
Air	+	10,000	Per item

Milking Parlor
Cost Factor Tables

Adjustment Factors (cont.)

Base Component Cost *(based on a 1,056 sq. ft. building)*

Building Component:	Class 4	Class 5	Class 6
Foundation	$ 2.22	$ 2.34	$ 3.25
Exterior Wall	9.94	14.00	18.65
Roof	6.17	6.75	7.53
Floor	6.80	7.57	8.52
Partitions	5.28	9.33	14.79
Electrical	3.02	4.11	4.88
Plumbing	1.56	5.72	6.91
Heating	.00	.70	1.03
TOTAL	34.99	50.52	65.56

Group: Specialty Structures
Type: Commercial Greenhouse

Type Features: The commercial greenhouse is designed to regulate the climatic conditions for starting and growing various kinds of plants such as potted house plants, bulbs, flowers, shrubs and trees.

The current construction of commercial greenhouses range from light tubular metal frame with polyethylene covering (Class 4) to heavy metal frame with a glass cover (Class 6). Because each greenhouse is individually designed and built, a wide variety of heating-cooling, insulation, and ventilation components are employed. Some of these components are shown in the Class Illustrations:

Double polyethylene sheeting roof cover is shown in the center photo under Class 4. The arched ground to ground style house is usually known as the "poly house" or "hoop house." Common width for this style house is 20' to 40'.

Exhaust fans are shown in the top photo under Class 6. These exhaust fans are used in conjunction with a water saturated cooling pad or cell assembly which would be placed on the other end of the building.

Hinged vents on the exterior wall are shown in the center photo under Class 6.

The bottom photo under Class 6 shows suspended unit heaters, polyethylene tube for air distribution, and if you look closely, an overhead sprinkling system.

Class Illustrations

Class 4 | **Class 5** | **Class 6**

Commercial Greenhouse
Base Specifications

Item	Class 4	Class 5	Class 6
Foundation	Pipe or gravel backfilled holes for pole or pipe construction or mudsill.	Minimal concrete backfilled holes for support posts.	Concrete backfilled holes for support posts or continuous concrete.
Frame	Lightweight wood or pipe material, widespread.	Lightweight pipe columns or wood material.	Lightweight metal channel columns or wood material.
Exterior Wall	Double polyethylene sheeting; fiberglass end walls. Openings: two swinging doors.	Medium weight corrugated fiberglass panels or double heavyweight polyethylene sheeting; fiberglass end walls. Openings: sliding drive-thru access doors; base wall height 8'.	Glass or acrylic panels; glass or acrylic end walls. Openings: sliding drive-thru access doors; base wall height 8'.
Roof	Arched or gable. Widespaced wood or pipe rafters; purlins and wind bracing. Cover: double polyethylene sheeting	Arched or gable. Light tubular metal trusses, channel steel purlins with wind bracing. Cover: medium weight corrugated fiberglass panels or double heavyweight polyethylene sheeting.	Gable. Channel steel trusses and purlins with wind bracing. Cover: glass panels.
Floor	Dirt.	Gravel.	Gravel.
Partitions	None.	None.	None.
Interior Components	None.	None.	None.
Electrical	None.	Entry service, metal conduit wiring, minimal lighting and equipment outlets.	Entry service, metal conduit wiring, vaportight fixtures, lighting and equipment outlets.
Plumbing	Cold water service, one hose bib.	Cold water service, one or two hose bibs.	Cold water service, two hose bibs.
Heating-Cooling	None.	None.	None.
Exterior Components	None.	None.	None.

Commercial Greenhouse
Cost Factor Tables

Base Factors: Table Format

Ground Floor Area - Cost Per Sq. Ft.

	2,000	4,000	6,000	8,000	10,000	12,000	16,000	20,000	24,000	28,000
Class 4	$ 2.38	2.01	1.86	1.78	1.73	1.69	1.64	1.61	1.59	1.57
Class 5	5.06	4.60	4.41	4.31	4.25	4.19	4.13	4.09	4.06	4.04
Class 6	9.87	9.19	8.91	8.76	8.68	8.23	8.23	8.23	8.23	8.23

Base Factors: Square Foot + Lump Sum Format

((Cost Per Sq. Ft. x Square Footage) + Lump Sum) ÷ Square Footage = Base Cost Factor

	Class 4		Class 5		Class 6	
Size Range	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum	Cost Per Sq Ft	Lump Sum
0 – 1,000 Sq. Ft.	$ 2.00 +	1,005	4.62 +	1,220	9.09 +	1,974
1,001 – 2,500 Sq. Ft.	1.75 +	1,250	4.28 +	1,548	8.68 +	2,383
2,501 – 4,500 Sq. Ft.	1.61 +	1,614	4.09 +	2,032	8.44 +	2,989
4,501 – 10,000 Sq. Ft.	1.54 +	1,910	4.00 +	2,427	8.33 +	3,482
10,001 – 25,000 Sq. Ft.	1.48 +	2,478	3.93 +	3,185	8.23 +	4,430

Adjustment Factors

Exterior Wall

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Polyethylene Sheeting				
Single	–	$ .07	1.13	1.40
Double	–		1.06	1.33
Fiberglass				
Medium Weight	±	1.13		.27
Heavy Weight	±	1.26	.20	.07
Polycarbonate or Acrylic	+	2.46	1.33	1.13
Glass Panes	+	1.33	.27	
Apply cost by unit of comparison		**All Classes**		
Vents:				
Hinged Fiberglass, 4' high	+	$ 33.25	Per ln. ft. of vent	
Shutter Type, metal, 4' high	+	99.75	Per ln. ft. of vent	
Gutter Connected Houses	–	5%	Adj. to base factor	
No Side Wall	±	7%	Adj. to base factor	

Commercial Greenhouse
Cost Factor Tables

Adjustment Factors (cont.)

Roof

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Polyethylene Sheeting				
Single	–	$ .07	1.60	1.93
Double	–		1.53	1.86
Fiberglass				
Medium Weight	±	1.53		.33
Heavy Weight	±	1.80	.27	.07
Polycarbonate or Acrylic	+	3.39	1.86	1.53
Glass Panes	+	1.86	.33	
Apply cost by unit of comparison			**All Classes**	
Vents, hinged 3' high				
Manual	+		$ 33.25	Per ln. ft. of vent
Automatic	+		39.90	Per ln. ft. of vent

Floor

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Material Type:				
Dirt	–		$ 1.62	1.62
Gravel	+	1.62		

Electrical

Apply cost to sq. ft. of floor area		Class 4	Class 5	Class 6
Electrical Service				
None	–		$ 1.00	1.33
Apply cost to each unit			**All Classes**	
Light Fixture: Incandescent, metal conduit wiring, vapor tight	+		$ 199.50	

Plumbing

Apply cost to sq. ft. of floor area		**All Classes**
Sprinklers		
Overhead System	+	$ .20
Drip Tube System	+	.33
Electronic Controllers	+	.20
Programmable Controller	+	.47

Commercial Greenhouse
Cost Factor Tables

Adjustment Factors (cont.)

Heating, Cooling, & Ventilation

Apply cost as noted below		All Classes	
Ventiilation:			
Exhaust Fan			
42" x 42" 3/4 HP	+	$ 950	Per item
48" x 48" 1 HP	+	1,050	
Evaporative Cooling System:			
Includes pad, pump, tank, and plumbing	+	1,880	Per system
Suspended Unit Heaters, gas fired:			
50,000 BTU	+	1,300	Per unit
100,000 BTU	+	1,700	
200,000 BTU	+	1,900	
Suspended Unit Heaters, gas fired: With dampering and polyethylene distribution tube			
250,000 BTU	+	2,500	
400,000 BTU	+	2,700	
Hot Water or Steam Unit Heaters	–	15%	From suspended heater
Automatic Controls (for heating & cooling)	+	1,250	For each 40,000 sq. ft.
Hot Water Boiler			
150,000 BTU	+	3,700	Per unit
200,000 BTU	+	4,200	
300,000 BTU	+	4,300	
Bench Heating			
With hot water tubing	+	2,350	For each 4,000 sq. ft.

Miscellaneous Equipment

Apply cost to sq. ft. of floor area		All Classes
Automatic Roof Curtain Assembly	+	$ 2.66
Benching System: Iincludes concrete footing, galvanized steel tubular frame, and slide moving top deck	+	3.33
Fertilizer Injector In-line system, single pump head, blending tank, concentrate tank, valves, and piping	+	998

Accessory Improvements

Instructions

Accessory Categories

The cost schedules in this section are for improvements which are supplemental to the principal farm buildings. These schedules are arranged based on use similarities. For example, the schedules for bulk feed tank, grain bin, bunker silos, and liquid manure tanks are grouped one after the other. Photographs have been inserted if available and considered helpful to an understanding of the improvement.

Cost Factors

The cost factors may represent the cost for the whole improvement or the individual component items making up an improvement system. This breakdown of component items allows you to assemble a cost estimate for the actual combination of components on the property you're appraising. For example, the procedure to assemble the total cost of a corral would be as follows:

Perimeter and Cross Fencing, 5' high wood rail 1,150 lin. ft. @ $9.00 per lin. ft.	=	$ 10,350
Gates, wood 2" x 6" spaced rails, 5' high 5 gates 20' wide = 100 lin. ft @ $18.00 per lin. ft.	=	1,800
Loading Chutes 2 @ $500 each	=	1,000
Cattle Squeeze, metal 1 @ $3,000 each	=	3,000
Cattle Headgate, 1 @ $900 each	=	900
Total Cost Estimate		$ 17,050

Accessory Improvements

Bulk Feed Tank

Base Specifications

Includes concrete base slab with integral footings or piers and metal construction components consisting of legs, tank, center draw bottom hopper, ladder, cone top, center collar and ventilator cap.

Cost Factor Tables
Base Factors

Overall Height	Diameter 6'	Capacity Tons/Bushel	Diameter 9'	Capacity Tons/Bushel
13'	$ 2,200	4.4/175	$ 3,730	7.0/280
15'	2,325	5.5/220	3,955	9.4/375
17'	2,445	6.6/265	4,180	11.7/470
19'	2,570	7.7/310	4,405	14.1/565
21'	2,680	8.8/350	4,655	16.7/670
23'	2,815	10.0/400	4,880	19.1/765

(Note: Approximate capacities based on one cubic foot = 40 pounds and one bushel = 1.244 cubic ft.)

Adjustment Factors

Base

	Apply cost to each unit of comparison		
Concrete Slab:			
None	-	$ 310	Per 6' diameter tank
None	-	630	Per 9' diameter tank
Cylinder Wall:			
Ladder, none	-	$ 21.40	Per linear foot
Filler pipe	+	20.00	Per linear foot

Accessory Improvements

Bulk Feed Tank
Adjustment Factors (cont.)

Equipment

		4" Tube		6" Tube
Unloader *(with auger system, 1 HP motor):*				
10' tube	+	$ 1,220	+	$ 1,470
15' tube	+	1,400	+	1,780
20' tube	+	1,580	+	2,080

Feed Bin Scales

	Apply cost to each unit of comparison		
Feed Bin Scales (includes four load cells, wiring, and electronic microprocessor read-out unit)	+	$ 3,820	Per scale

Accessory Improvements

Grain Bin

Base Specifications

These are light-duty bins for on-farm use. The cost includes a concrete perimeter footing; 6" thick concrete slab floor with rough surface finish; metal construction components consisting of corrugated galvanized wall panels, wall access door, cone roof, roof access door, center collar and ventilator cap, and a ladder.

Cost Factor Tables
Base Factors

Storage Capacity—Cost Per Bushel

10,000	20,000	30,000	40,000	50,000
$ 1.80	1.45	1.30	1.25	1.20

Adjustment Factors

Base

	Apply cost to each unit of comparison		
Aeration System:			
Includes perforated steel panels on I-beam frame, air tunnel with centrifugal fan, motor and drive, wiring, controls, and installation.	+	$ .15	Per bushel
Side Wall:			
Access Door, 18" x 60"	-	$ 255.00	Per door
Dutch Door	+	80.00	Per door
No Ladder	-	21.40	Per linear foot

Accessory Improvements

Grain Bin
Adjustment Factors (cont.)

Roof

	Apply cost to each unit of comparison		
Extra Ventilator			
24"	+	$ 125	Per ventilator
30"	+	130	Per ventilator

Electrical

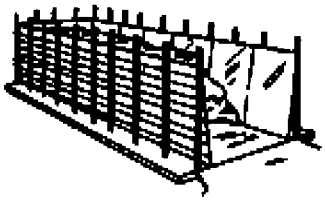
	Apply cost to each unit of comparison		
Power Panel:			
Disconnect switch and wiring	+	$ 425	Per unit

Accessory Improvements

Bunker Silos

Base Specifications

Includes concrete foundation integral with concrete floor, 6" to 9" tilt-up concrete walls with exterior pilasters or precast concrete walls.



Cost Factor Tables
Base Factors

Ground Floor Area - Cost Per Sq. Ft.

1,500	2,000	2,500	3,000	3,500	4,000
$ 10.80	9.90	9.25	8.75	8.40	8.05

Adjustment Factors

Exterior Walls

Apply cost to sq. ft. of floor area		1,500	2,000	2,500	3,000	3,500	4,000
Post and Wood Construction	–	$ 4.05	3.60	3.35	3.05	2.95	2.75
Plywood Lining, none	–	1.00	.90	.80	.70	.60	.50

Roof

	Apply cost to each unit of comparison		
Wood Frame, with galvanized metal cover	+	$ 4.00	Per sq. ft. of floor area

Floor

	Apply cost to each unit of comparison		
Material Type: Asphalt	−	$ 1.60	Per sq. ft. of floor area

Accessory Improvements

Stock Feeding Systems

Feed Bunks: Includes trough material, fittings, brackets, supports, and installation costs. Bars, rails, and feeding equipment are not included.

Trough:			
Wood: 2" thick planks for sides and bottom, 2" x material for supports and framing		$ 24.00	Per linear foot
Concrete: 2" to 4" concrete sides; 2" raised slab bottom; 30" x 8" footing and cow step		55.00	Per linear foot
Concrete Step, 8" high	±	6.25	Per linear foot
Metal welded frame with rounded 30" wide plastic or metal trough		25.00	Per linear foot
Shoulder Bar:			
Wood on metal brackets	+	$ 2.20	Per linear foot
Steel pipe and brackets	+	2.55	
Steel cable and brackets	+	2.55	

Mechanical Feeder: Includes motor, drive assembly, mounting brackets, supports, receiving hopper, power panel, controls, and installation costs.

Trough Auger: Continuous flow open type bunk auger, floor mounted			
Basic Unit, 12" transfer auger 6' long:			
2 HP, up to 50' capacity		$ 3,500	Per unit
5 HP, up to 125' capacity		4,000	Per unit
7 1/2 HP, up to 200' capacity		5,000	Per unit
Additional Length	+	80.00	Per linear foot
Traveling Belt or Chain Conveyor: Cycle distribution, floor mounted or suspended over bunk:			
Traveling Conveyor Unit, 1 to 2 HP		$ 4,500	Per unit
Traveling Conveyor Support System, per length of travel		80.00	Per linear foot
Hopper:			
Concentrate Hopper		$ 1,200	Per unit
Forage Metering Hopper		2,300	

Manger: Includes trough materials, braces, supports, and installation costs. Bars and feeding equipment are not included.

Wood: 2" plank for sides and bottom, 2 x 6" rails and frame support		$ 16.00	Per linear foot
Concrete: 4" thick concrete sides, 2" thick rounded bottom		60.00	
Metal: 1/2" diameter rods and plastic back		52.00	

Accessory Improvements

Stock Feeding Systems (cont.)

Stanchions: Includes item material, brackets, and installation costs.

Wood: 2" material for dividers		$ 21.00	Per linear foot
Metal: Heavy gauge formed and welded yoke		34.00	
Add for metal partitioning	+	15.00	

Watering Items: Includes piping, controls, and installation costs.

Troughs:			
Concrete: 6" thick walls and bottom, 4' wide, 30" deep		$ 50.00	Per linear foot
Metal: galvanized, 2' wide, 24" deep		25.00	
Drinking Bowls:			
Galvanized		$ 85.00	Per unit

Stock Feeding Structure: Long rectangular structure with gable roof cover over manger; 8' to 10' wide.

Metal		$ 100.00	Per linear foot
Wood		50.00	

Lighting:

Switch, Conduit Wiring, and Fixture	+	$ 135.00	Per unit

Metal Stock Feeding Structure

Wood Stock Feeding Structure

Accessory Improvements

Corrals

Fencing: Includes posts, rails, braces, and installation costs. No gates or special items are included.

Wood: 6" x 6" wood posts set 8' o.c. 2" x 6" spaced rails,		
to 5' high	$ 9.00	Per linear foot
Steel: 4" diameter posts		
With 2" pipe rails to 5' high	12.00	Per linear foot
With cable rails	10.00	

Gates: *See Accessory Improvements, Yard Improvements, Fencing*

Loading Chutes: Wood or metal.

10 to 12 foot length	$ 500	Per unit

Cattle Squeeze:

Wood	$ 850	Per unit
Metal *(manual)*	3,000	
Metal *(hydraulic)*	6,000	

Cattle Headgate:

Metal *(manual)*	$ 900	Per unit


Cattle Squeeze - Hydraulic


Loading Chute

Headgate - Manual

Accessory Improvements

Fuel

Storage Tanks: Includes tank, fittings, mounting or excavation and backfill, and installation costs.

Buried or Elevated Fuel Tank: Heavy gauge metal

Gallons:	500	$ 2,200	Per unit
	1,000	3,100	
	1,500	4,000	
	2,000	5,025	
	2,500	5,960	
	3,000	6,900	
	4,000	7,850	

Pump: Includes pump, fittings, concrete base and installation costs:

Single dispenser:		
Gravity with meter	$ 300	Per unit
Light duty - up to 10 GPM	970	
Medium duty - 10 to 15 GPM	1,560	
Heavy duty - 15 to 25 GPM	2,730	

Pressure Fuel Tank: Heavy gauge metal tank horizontally mounted above ground on saddle type foundation or stand.

Gallons:	500	$ 2,650	Per unit
	750	2,870	
	1,000	3,230	
	1,500	4,570	
	2,000	4,860	

Full Code Fueling System: System that could be used for non-farming purposes including retailing.

Small	$ 22,000	Per unit
Large	50,000	Per unit

Elevated Fuel Tank

Pressure Fuel Tank

Full Code Fueling System

Accessory Improvements

Scales

Livestock Scales—Mechanical Beam Type: Includes full capacity mechanical beam, metal beam box, pit foundation, platform and installation costs.

Tons	Platform Size	Deck Type	Cost	
1.5	3' x 8'	Steel	$ 4,700	Per scale
5	8' x 12'	Wood	9,400	
	8' x 14'	Wood	9,800	
	8' x 16'	Wood	10,100	
10	8' x 16'	Wood	10,800	
	8' x 22'	Wood	11,700	
	14' x 30'	Wood	15,900	
	14' x 30'		19,200	
15	14' x 30'	Wood	21,000	
	14' x 30'	Conc	21,800	
Type Registering Beam		+	$ 6,500	Per unit
Stock Racks				
Steel		+	$ 200	Per LF of scale
Wood		+	150	Per LF of scale
Conversion to load cell and electronic indicator		+	$ 2,000	Per scale

Livestock Scales—Self-Contained Electronic Type: Includes load cells, steel stock racks, wood deck, and pit or pitless foundation.

Capacity	Platform Size	Cost	
3,000 lbs.	4' x 8'	$ 7,800	Per scale
5,000	4' x 10'	8,200	
15,000	8' x 15'	14,100	
20,000	8' x 20'	17,000	
20,000	10' x 20'	18,400	
Add for rubber deck mats	+	$ 2.50	Per square foot
Add for digital weight indicator	+	1,000	Per unit

Accessory Improvements

Scales (cont.)

Truck Scales—*Above Ground Fully Electronic* with load cells or *Levertronic* or *Mechanical Beam* scales with either a concrete or steel deck. Costs include scale, foundation, set-up and calibration fees. Costs are for pier, slab,or pit foundation.

Dimensions:	10'	x	10'	$ 22,000	Per Scale
	10'	x	20'	27,200	
	10'	x	40'	43,100	
	10'	x	60'	58,000	
	10'	x	70'	62,700	
	10'	x	80'	74,100	
	10'	x	100'	88,200	

Add-on Options:

Digital Weight Indicator (Standard with truck I.D.storage)	+	$ 1,000	Per unit
Digital Weight Indicator (Programmable)	+	1,800	
Basic Ticket Printer	+	700	
Heavy Duty Ticket Printer	+	1,200	
Remote Digit Display, 4.5", 6 Digit	+	1,500	
Remote Digit Display, 6", 6 Digit	+	2,000	
Steel Guide Rails per LF of Scale	+	45	

Truck Scales

Accessory Improvements

Domestic Water

Cistern: Includes excavation, masonry or plastic tank with cover, inlet piping, outlet, filter box and excavation with backfill.

Rectangular or round, based on gallonage

Gallons:	325	$ 1,200	Per unit
	525	1,400	
	1,200	1,780	
	2,500	4,400	
	5,000	6,300	
	6,500	7,900	
	9,000	12,000	

Well: Includes drilling, casing and permits for a 100 foot well.

Well casing diameter:	6"	$ 8,200	Per unit
	8"	9,200	
Depth adjustment greater than 100'			
Well casing diameter:	6"	$ 40.00	Per foot of depth
	8"	47.50	

Distribution Items: Equipment: Includes basic item, fittings, brackets, and installation costs.

Pumps, electric:

Submersible:	1/2	HP	$ 450	Per unit
	3/4		650	
	1		700	
	2		825	
	3		1,350	
Jet:	1/3	HP	$ 350	Per unit
	1/2		400	
	3/4		500	
	1		550	
	1 1/2		725	
	2		885	

Pressure Tank: Galvanized, glass or bladder lined.

Gallons:	40	$ 350	Per unit
	80	400	
	100	450	

Accessory Improvements

Domestic Water (cont.)

Water Pipe: Includes pipe, trenching, backfill and installation costs.

Galvanized Pipe:	3/4"	$ 3.20	Per linear foot
	1"	3.45	
	1 1/2"	4.45	
	2"	4.80	
Plastic pipe, Schedule 40:	1/2"	$ 2.15	Per linear foot
	3/4"	2.20	
	1"	2.45	
	1 1/2"	2.70	
	2"	3.10	
	2 1/2"	3.50	
	3"	4.55	

Accessory Improvements

Irrigation

Well: Includes drilling, casing and permits for a 100 foot well.

Well casing diameter:	6"	$ 8,200	Per unit
	8"	9,200	
	10"	10,300	
	12"	15,000	
	18"	20,000	
Depth adjustment greater than 100'			
Well casing diameter:	6"	$ 40.00	Per foot of depth
	8"	47.50	
	10"	70.00	
	12"	110.00	
	18"	140.00	

Pumps:

Turbine: Includes pump, motor, and installation costs for 50 feet depth. Does not include electrical service panel.

1,800 RPM	5	HP	$ 9,730	Per unit
	7 1/2		10,530	
	10		12,350	
	15		13,930	
	20		15,800	
	40		17,880	
	50		20,100	
	60		23,100	
	100		30,000	

Centrifugal: Includes pump, motor, and installation costs for 20 foot depth. Does not include electrical service panel or wiring costs.

3,500 RPM	2	HP	$ 1,390	Per unit
	3		1,880	
	5		2,220	
	7 1/2		2,730	
	10		3,100	
	15		3,440	
	20		3,770	
	30		4,340	
	40		5,480	

Electrical: Service panel and wiring costs. See *Electrical, Component Costs Section*

Accessory Improvements

Irrigation (cont.)

Buried Irrigation Pipe: Includes item material, trenching, backfill, and installation costs. No motors, pumps, or sprinkler equipment included.

Steel pipe:

Diameter:	4"	$ 9.15	Per linear foot
	6"	12.25	
	8"	15.25	
	10"	18.00	
	12"	22.45	
	14"	26.00	
	16"	28.90	

Add:
35% for outside coated
10% for welded connections

Diameter:	1 1/2"	$ 1.20	Per linear foot
	2"	1.30	
	4"	2.60	
	6"	4.20	
	8"	5.90	
	10"	9.50	
	12"	11.20	

Valves:

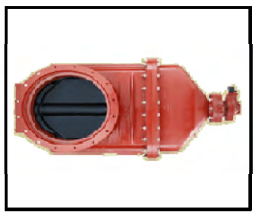
Hydrant Valve: Includes saddle valve riser and hydrant.

Diameter:	6"	$ 300	Per unit
	8"	350	
	10"	400	
	12"	490	

Gate Valve:

Diameter:	6"	$ 380	Per unit
	8"	570	
	10"	850	
	12"	1,290	

Gate Valve



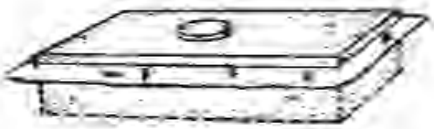
Gate Valve

Accessory Improvements

Liquid Manure Tank — Enclosed Type

Base Specifications

Includes 18" by 12" concrete perimeter footing, 4" concrete floor, 6" reinforced walls, and slab cover with service manhole, concrete interior support columns where necessary.



Cost Factor Tables
Base Factors

Rectangular Type

			Length				
			15'	**20'**	**25'**	**40'**	**50'**
8' Depth with	8'	Width	$ 6,590	8,150	9,730	14,480	17,630
	10'		6,870	8,480	10,040	14,870	18,050
	12'		7,620	9,330	11,080	16,260	19,730
	14'			10,140	11,980	17,520	21,200
	16'			11,120	13,080	19,040	23,000
Depth Variation							
Each foot of depth from base of 8'			± $ 650	840	1,000	1,420	1,690

Round Type

	Diameter				
	18'	**20'**	**22'**	**24'**	**30'**
8' Depth	$ 8,040	9,330	10,680	12,100	16,860
Depth Variation					
Each foot of depth from base of 8'	± $ 650	760	870	990	1,370

Adjustment Factors

Equipment

Plank Cover	–	$ 2.00	Per sq. ft.
Disposal Equipment			
Pit Agitator and Motor, 10 HP	+	$ 7,550	Per unit
Manure Chopper Pump			
5 HP 400 GPM	+	$ 4,000	Per unit
15 HP 1,500 GPM	+	6,080	
Combination Agitator Chopper Pump			
Small capacity	+	$ 9,000	Per unit

Accessory Improvements

Liquid Manure Tank — Enclosed Type
Adjustment Factors (cont.)

Equipment (cont.)

Disposal Equipment (cont.)			
Irrigation or Barn Flush Pump, 40 HP	+	$ 9,300	Per unit
With lagoon flotation system, add	+	5,000	
Manure Separator, includes plumbing			
Small capacity 200 GPM	+	$ 9,400	Per unit
Large capacity 1,500 GPM	+	22,500	

Accessory Improvements

Liquid Manure Tank — Open Type

Base Specifications

Includes 18" by 12" concrete perimeter footing, 4" concrete floor, 6" to 9" reinforced walls, concrete interior control and equipment rooms where necessary, and special membrane cover.

Cost Factor Tables
Base Factors

Rectangular Type

			Length				
			50'	**75'**	**100'**	**150'**	**200'**
8' Depth	Width	25'	$ 20,000	26,250			
		50'	40,000	52,500	60,000		
		75'		72,000	90,000	112,500	
		100'			108,000	126,000	168,000
		200'				252,000	320,000
Depth Variation							
Each foot of depth from base of 8'			± 7.00%	7.00%	7.00%	7.00%	7.00%

Round Type

	Diameter				
	50'	**75'**	**100'**	**150'**	**200'**
12' Depth	$ 16,800	37,800	67,300	151,500	269,000
Depth Variation					
Each foot of depth from base of 12'	± 7.00%	7.00%	7.00%	7.00%	7.00%

Adjustment Factors

Equipment

Disposal Equipment			
Pit Agitator and Motor, 10 HP	+	$ 7,550	Per unit
Manure Chopper Pump			
5 HP 400 GPM	+	$ 4,000	Per unit
15 HP 1,500 GPM	+	6,080	
Combination Agitator Chopper Pump			
Small capacity	+	$ 9,000	Per unit

Accessory Improvements

Liquid Manure Tank — Open Type
Adjustment Factors (cont.)

Equipment (cont.)

Disposal Equipment (cont.)			
Irrigation or Barn Flush Pump, 40 HP	+	$ 9,300	Per unit
With lagoon flotation system, add	+	5,000	
Manure Separator, includes plumbing			
Small capacity 200 GPM	+	$ 9,400	Per unit
Large capacity 1,500 GPM	+	22,500	

Accessory Improvements

Waste Disposal

Septic System: Includes permits, excavating, backfill, item material, and installation costs.

Septic Tanks: Steel, concrete, or plastic material. Includes drain field with bedding gravel and drain line from building.

Gallons:	750	$ 4,400	Per unit
	1,000	4,700	
	1,500	5,300	
	2,000	6,100	

Sand Filter Systems: Includes containment walls and complete drainage system.

Gallons:	750	$ 15,400	Per unit
	1,000	15,700	
	1,500	16,300	
	2,000	17,100	

Sewer Line: Includes pipe material, excavation, backfill, and installation costs. Measure from building to sewer trunk line.

Cast iron pipe:

Diameter:	4"	$ 17.40	Per linear foot
	6"	21.00	
	8"	24.50	

ABS pipe:

Diameter:	4"	$ 12.50	Per linear foot
	6"	14.40	
	8"	15.60	

Accessory Improvements

Yard Improvements

Drainage: Includes item materials, shallow excavation, backfill, leveling, and installation costs.

Plastic Pipe:				
Diameter:	3"		$ 1.55	Per linear foot
	4"		1.75	
	6"		2.00	
	8"		2.50	
	10"		3.45	
	12"		4.55	
Gravel bedding for drainage material			0.75	Per linear foot

Fencing: Includes wire, posts, braces, and installation costs. No gates or special items are included.

Barbed Wire				
Yard or field installation, 4 strand			$ 2.65	Per linear foot
Range land, open and level terrain, 3 strand			2.25	Per linear foot
Chain Link: Heavy guage with steel top rail and posts.				
Height:	4'		$ 8.50	Per linear foot
	6'		10.75	
	8'		14.00	
Steel bottom rail, add		+	$ 1.60	Per linear foot
Steel Wire Mesh: On wood posts 5' high.				
Livestock enclosure			$ 4.25	Per linear foot
Poultry enclosure			2.75	
Boards and Planks: On wood posts 5' high.				
Solid application, 1" material			$ 8.00	Per linear foot
Rough board rails, 1" material			4.00	
Rough plank rails, 2" material			6.00	
Steel Pipe: On cemented steel posts 5' high.			$ 10.00	Per linear foot

Gates: Includes item, posts, hardware, and installation costs.

Access or Walk Through:				
Chain link			$ 150	Per unit
Steel wire mesh			125	
Wood frame and boards, job built			90	

Accessory Improvements

Yard Improvements (cont.)

Gates (cont.)

Equipment or Livestock:			
Wood:			
2" x 6" spaced rails and braces, 5' high		$ 18.00	Per linear foot
Metal:			
Tubular, 2" diameter rails and braces, 5' high		$ 25.00	Per linear foot
Channel, 5" wide rails and braces, 5' high		20.00	
Chain link, single, 5' high		23.00	
Wire mesh, single, 5' high		20.00	

Cattle Guards: Includes pit excavation, foundation, materials, and installation costs.

Wood Construction: 12' opening			
Rough pole stock on mud sills		$ 200	Per unit
Pressure treated material on concrete foundation		500	
Steel Construction: Steel rails on concrete foundation			
12' opening		$ 2,500	Per unit
16' opening		3,000	

Yard Poles and Flood Lights: *See Electrical, Component Costs Section*

Paving: Includes excavation, leveling, gravel base, and material.

Asphalt:			
2" thick		$ 2.60	Per square foot
3" thick		2.90	
Plastic seal coat:		0.15	Per square foot
Concrete:			
4" thick		4.50	Per square foot
6" thick		6.00	
Wire mesh reinforcing		0.17	
Exposed aggregate, add	+	10%	
Stall Curb: 6" wide		6.55	Per linear foot
Walks: Over level terrain in typical widths.			
Asphalt		2.60	Per square foot
Concrete, finished surface		4.50	

Accessory Improvements

Yard Improvements (cont.)

Retaining Walls: Includes concrete footing, basic wall material, drainage, and installation costs.

Note: Cost is per square foot of wall surface area.

Concrete Block:		
8" thick with reinforcing ties, and steel mesh.	$ 7.75	Per square foot
Concrete: Poured in place with reinforcing and pilasters.		
6" thick	8.60	Per square foot
8" thick	10.45	

Component Costs

Instructions

Component Cost Section

The cost schedules in this section are for components which are different than those described in the Base Specifications of the principal farm buildings. These schedules are arranged based on use similarities such as roof, electrical and plumbing.

Composition of Costs

The Component Costs represent the typical costs for items as an integral part of a structure. Cost figures are composed of direct and indirect costs as discussed under General Instructions.

Less significant items of construction, such as nails and bolts, are not itemized. The cost of these minor items are included as part of the cost of major items such as siding, doors and electrical outlets.

Quality Modifier

The Component Costs represent the cost of standard materials and labor for farm buildings. Normally, any cost variance due to quality between farm buildings will be very small. Therefore, any adjustment for quality should be justified by supporting benchmark type data.

Component Costs

Exterior Walls

Exterior Wall Cover: Includes item material, nails, fasteners and material placement costs. Protective finish costs are not included. Square foot costs are based on gross wall area.

Steel Panels - Corrugated or V Crimp:		
Galvanized	$ 1.05	Per square foot
Baked enamel finish	1.25	
Hardboard Siding - Various patterns, 1/2"	1.80	
Plywood Siding - Various style patterns, 1/2":		
3/8" thick	1.60	
5/8" thick	2.00	
Cedar Shingles	4.15	
Fir Siding - Board and batten, 1" material	2.40	

Exterior Wall Openings: Includes item frame or jamb, trim, glazing, hardware and item installation costs. Protective finish costs are not included. Square foot costs are based on gross area of opening.

Doors:		
Access or Walk-In Type:		
Hinge design, wood or metal	$ 245	Per unit
Slider design, wood, job built	420	
Equipment or Livestock Access Type:		
Hinge design, wood frame, job built	2.70	Per square foot
Slider design, wood frame, job built	2.90	
Metal Sectional:		
9' x 7'	340	Per unit
16' x 7'	570	
10' x 12'	960	
12' x 14'	1,240	
14' x 14'	1,460	
16' x 16'	2,130	
Metal Roll-Up	25.00	Per square foot
Windows:		
Slider Design - Vinyl Frame		
3'-0" x 3'-0"	250	Per unit
4'-0" x 3'-0"	280	
6'-0" x 3'-0"	340	
Lite Panels - Corrugated Fiberglass	1.15	Per square foot

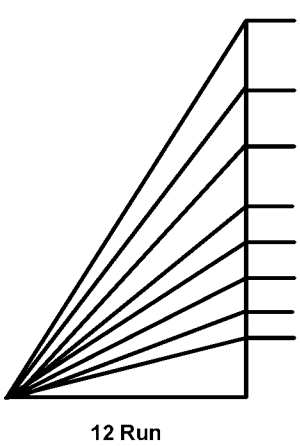
Component Costs

Roof

Roof Cover: Includes item material, nails, fasteners and application costs. No protective finish costs or materials are included except as specified. Square foot costs based on gross roof area.

Vapor/Air Barrier:			
Asphalt Saturated Felt –	15 lb	$ .15	Per square foot
	30 lb	.15	
Plastic Laminated Paper		.20	
Polyethylene Fiber Sheet		.20	
Polyethylene Plastic Film		.10	
Roll Composition - Mineral Surface, 90 lb		.65	
Built-Up Roofing:			
3 ply		2.75	
3 ply with gravel		2.85	
Composition Shingle			
20 year		1.20	
25 year		1.30	
Cedar Shingle		4.25	
Cedar Shake - Medium Tapered Cut		3.80	
Metal Panels - Locked Seam		2.10	
Steel Panels - Corrugated or V Crimp			
Galvanized		1.05	
Baked enamel finish		1.25	
Lite Panels - Corrugated Fiberglass, 8 oz.		1.15	

Roof Pitch Modifier: To estimate the surface square foot area of a pitch roof, apply the applicable percentage modifier to the eave line ground dimension area.



12	12 / 12	1.41
10	10 / 12	1.30
8	8 / 12	1.20
6	6 / 12	1.12
5	5 / 12	1.08
4	4 / 12	1.054
3	3 / 12	1.03
2	2 / 12	1.014
0-1 Rise	Flat Pitch	1.00 Modifier

Electrical

Main Service Panel: Includes entrance conduit, meter base, panel box, wire, fittings, connectors and installation costs.

Wall or Pole Mounting:

3 wire, 60 ampere service for 2 or 3 outlet circuits to serve lighting, small equipment or appliances.	$ 900	Per unit
3 wire, 100 ampere service for lighting and appliance circuits plus additional equipment reserve.	1,000	
3 wire, 150-200 ampere service for lighting, equipment, appliances, heating and extended sub-panel service systems.	1,300	
3 wire, 400-600 ampere service for lighting, equipment, appliances, heating and extended sub-panel service systems.	4,000	

Wiring: Includes circuit wire, fittings, connectors, outlet and junction boxes plus material installation costs. Each plug outlet, switch or receptacle is considered as an outlet.

Nonmetallic Sheathed Cable System:

110 volt circuits, per outlet	$ 70	Per unit
Equipment circuit, 220 volt, per outlet	250	

Yard Pole: For central distribution system, includes wood pole, 5" or 6" top plus cost to set in ground.

Pressure Treated Material:

Height above ground,	20'	$ 500	Per unit
	24'	650	
	28'	750	

Flood Lights: Includes untreated pole, light fixture, mounting brackets, and installation costs.

Incandescent Bulb:

Single light	$ 150	Per unit
Double light	155	
Iodine-Quartz Bulb	180	

Mercury Vapor Bulb:

Single light, 20' pole with photoelectric cell	500	

Component Costs

Plumbing

Service System: Includes 3/4" galvanized pipe connecting line and material placement costs. Cost based on 100' distance to source.

Service System	$ 350	Per unit

Fixtures: Includes item, rough-in materials, typical fittings and installation costs.

Lavatory, Cabinet top mounting, porcelain enameled	$ 400	Per unit
Toilet	445	
Shower, Fiberglass unit	550	
Laundry Tub, On stand, concrete or fiberglass	400	
Hose Bib	90	
Water Heater, Complete hook-up:		
Electric elements, 50 gallons	500	
On demand:		
Gas	1,200	
Electric	600	

Component Costs

Heating

Heating System: Includes item unit, mounting brackets, connections, wiring, piping and installation costs. Fuel tanks and masonry chimneys are not included.

Suspended Units:

Gas fired,	25,000	BTU	$ 1,100	Per unit
	35,000		1,150	
	50,000		1,300	
	100,000		1,700	

Buried Fuel Tanks: Heavy guage underground gasoline or oil storage.

265	Gallons	$	1,250
550			2,420
1,000			3,100
1,500			4,000

Pressure Fuel Tanks: Heavy guage metal tank horizontally mounted on saddle type foundation stand.

100	Gallons	$	860
150			1,100
250			1,560
500			2,650
750			2,870
1,000			3,230

Component Costs

Exterior Components

Gravel: Includes base and fine grading plus material placement costs.

2" thick	$ .95	Per square foot
5"	1.60	

Paving: Includes excavation, leveling, gravel base and material.

Asphalt:

2" thick	$ 2.60	Per square foot
3"	2.90	

Concrete Floor or Service Alley:

4" thick	4.50	
6"	6.00	
Wire mesh reinforcing	.17	

Loading Dock: Includes foundation, walls or underpinning, deck and installation costs.

Concrete Deck: Concrete foundation and walls

Slab on fill, mesh reinforcing	$ 14.10	Per square foot

Elevated slab:

Rod reinforcing	21.20	
Waffle or pan type	15.20	

Wood Deck: Concrete pier foundation, post underpinning and construction.

Plank deck	9.00	
Mill type deck	11.30	

Canopy: Includes framing materials, cover and supports for one side attached to building, plus installation costs.

Wood Frame:

Light frame, nailing strips and metal cover	$ 4.00	Per square foot
Rafters, sheathing and built-up cover	4.55	

Steel Frame:

Steel frame and metal cover	6.80	

Supplementary Information Instructions

Abbreviations and Symbols

A listing of abbreviations and symbols is provided to clarify their usage in this manual. This listing begins on page 137.

Glossary

A glossary of construction terminology defines the terms applied in this book. See pages 139 to 149.

Tables and Formulas

Tables and formulas are provided to help you analyze field data and assist in computing build-up cost estimates. See pages 151 to 157.

Abbreviations and Symbols

Special Instructions

The following abbreviations and symbols are intended to give the appraiser a standard reference for appraisal terms.

acou.	acoustic	convec.	convector	func.	functional
ac.	acre	corr.	corrugated	fur'd	furred
add.	addition	cvr.	cover		
adj.	adjustment	cu.	cubic	gab.	gable
alum.	aluminum			gal.	gallon
amp.	ampere	D.R.C.	depreciated	galv.	galvanized
appr.	appraiser		replacement cost	gamb.	gambrel
apprec.	appreciation	depr.	depreciation	gar.	garage
approx.	approximately	det.	detached	ga.	gauge
asb.	asbestos	deter.	deterioration	gl.	glass
asp.	asphalt	diag.	diagonal	gd.	good
att.	attached	dia.	diameter	grv.	gravel
auto. con.	automatic control	din.	dining	grav.	gravity
ave.	average	d/w	dishwasher	GRM	gross rent multiplier
		disp.	disposal/disposer	grd.	ground
bkd.	backed	dr.	door	gyp.	gypsum
BBQ.	barbeque	dbl.	double		
bsbd.	baseboard	dn. pmt.	down payment	H bm.	"H" beam
bsmt.	basement	dw.	drywall	hbd.	hardboard
bthrm.	bathroom			hwr.	hardware
bdrm.	bedroom	ea.	each	hwd.	hardwood
b.m.	benchmark	eff.	effective	htg.	heating
blktp.	blacktop	elab.	elaborate	hvy.	heavy
blk.	block	elec.	electric	ht.	height
bd.	board	elev.	elevator	hi.	high
b & b	board and batten	enam.	enamel	h & f	hood and fan
b.f.	board feet (foot)	est.	estimate	horiz.	horizontal
BTU	British Thermal Unit	exc.	excavation	hp.	horsepower
bldr.	builder	excel.	excellent	hse.	house
bldg.	building	exp.	exposed	C	hundred
b.i.	built-in	ext.	exterior		
				I bm.	"I" beam
cap.	capacity	f.	fair	imp.	improvement
cld.	ceiled	fam.	family	in.	inch or inches
cld. & pa.	ceiled and paper	ft.	feet	incl.	inclusive
clg.	ceiling	fig.	figure	inc.	income
cmt.	cement	fin.	finish	info.	information
cen.	center	fp.	fireplace	insl.	insulation
cer. Ti.	ceramic tile	1st. sty.	first story	int.	interior
circ.	circular	fixt.	fixture	i.	iron
cir.	circulator	flag.	flagstone	irr.	irrigation
com.	common	flr.	floor		
compo.	composition	fluor.	fluorescent	jt.	joint
conc.	concrete	ft.	foot	junct.	junction
cond.	condition	ftg.	footing		
condo.	condominium	F.A.	forced air	kit.	kitchen
constr.	construction	found.	foundation	k.p.	knotty pine
cont.	continued	fr.	frame		

Abbreviations and Symbols (cont.)

lam.	laminated	porc.	porcelain	M	thousand
ldg.	landing	lbs.	pounds	ti.	tile
ldry	laundry	prefab.	prefabricated	tbr.	timber
L.	length	prefin.	prefinished	tol.	toilet
lt.	light			T & G	tongue and groove
L.F. or	linear feet (foot)	qual.	quality		
lin. ft.		qt.	quart	undgr.	underground
lino.	linoleum			undrlmt.	underlayment
liv.	living	rad.	radiator	unfin.	unfinished
LCM	Local Cost Modifier	raf.	rafter	ur.	urinal
lbr.	lumber	rng.	range	util.	utility
lum.	luminous	recap.	recapture		
l.s.	lump sum	rec.	recreation	vac.	vacuum
		rfg.	refrigeration	ven.	veneer
mach.	machine	reinf.	reinforced	vent.	ventilator
maint.	maintenance	repl.	replacement	vert.	vertical
mas.	masonry	res.	residence	v. ti.	vinyl tile
mat.	material	resil.	resilient	vit.	vitreous (china)
max.	maximum	ret.	retaining	V	volt
med.	medium	rev.	revised	vol.	volume
mtl.	metal	r. rfg.	roll roofing		
min.	minimum	rf.	roof	wsct.	wainscot
misc.	miscellaneous	rm.	room	w.	wall
mod.	modifier	rd.	round	w. bd.	wallboard
mo.	month	rus.	rustic	w. pa.	wallpaper
mult.	multiplier			W.D.	warranty deed
		2nd. Sty.	second story	ws.	weatherstrip
norm.	normal	sect.	section	wt.	weight
no.	number	shk.	shake	wtd.	width
		shtg.	sheathing	w/	with
obsol.	obsolescence	sh. rk.	sheet rock	w/o	without
o.c.	on center	shgl.	shingle	wd.	wood
CWT	one hundred pounds	sdg.	siding	w.i.	wrought iron
O.R.S.	Oregon Revised Statutes	sgl.	single		
oz.	ounce	spec.	specification	yd.	yard
oh.	overhead	spklr.	sprinkler		
		sq.	square	&	and
pt.	paint	sq. ft. or	square feet (foot)	@	at
pr.	pair	S.F.		x	by; times
pa.	paper	sq. yd. or	square yard	ç	degree
parq.	parquet	S.Y.		=	equal
part. Bd.	particle board	stkd.	stacked	‘	foot
pvmt.	pavement	s.s.	stainless steel	“	inch
phys.	physical	stwy.	stairway	−	minus
plk.	plank	std.	standard	#	number, pounds
pls.	plaster			/	per
plas.	plastic	tel.	telephone	%	percent
plt.	plate	temp.	temporary	+	plus
plbg.	plumbing	t.c.	terra cotta	±	plus or minus
ply.	plywood	terr.	terrazzo		
p.	poor	thermo.	thermostat		

Glossary

Special Instructions

The following definitions refer to construction terminology as applied historically within this cost factor book.

This listing is not a complete reference for all building terms. Furthermore the definitions reflect local usage as applied to farm building construction. Therefore, it should be used only as a guide to a better identification and understanding of the items referred to in other sections of the book.

Accessory Improvement: A structure subordinate to and used in conjunction with the main building.

Air Diffusion Ducts: A ventilating system used to circulate air through farm buildings, products, etc.

Anchor Bolt: A bolt embedded on top of a building foundation wall for use in fastening the building to the foundation.

Area: The extent of the surface of a structural component in one plane, measured in square units such as square feet or square yards.

Area Divider: Used in a farm building to channel livestock traffic or separate livestock by areas.

Asphalt: Black top; asphalt binder and stone or other aggregate, used as a hard surface for driveway, walks, building floors, and other paved areas.

Atmosphere Control: Temperature, humidity and air circulation of a building, kept in a certain desired range by a system of mechanical coolers, humidifiers, fans and vents.

Attic: Accessible space between the top of the ceiling joists and the roof.

Augers: A single plate or double plate spiral formed about a turning shaft that moves material along a trough or tube.

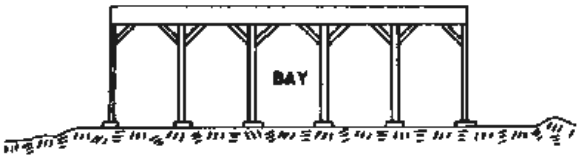
B.T.U.: British Thermal Unit. The amount of heat required to raise one pound of water one degree Fahrenheit. A common measurement of heat used to rate the capacity of building heating units.

Backfill: To replace earth or selected fill material in a previously excavated area required for work space while placing a building foundation, drain line, etc.

Basement: A full story height space below the first floor.

Batten: A narrow strip of wood used to cover vertical joints as between the vertical boards of a wall covering. See Siding illustration.

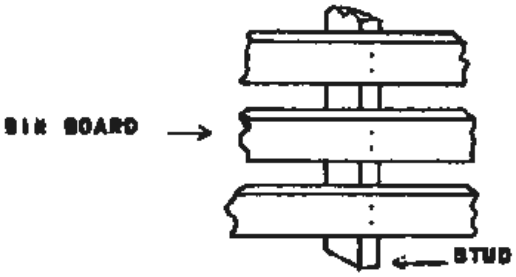
Bay: One of the intervals or spaces into which a building plan is divided by columns, piers, or division walls.



Beam: A principal horizontal load carrying structural timber or steel member of a building.

Beveled Siding: Wood siding which is tapered or beveled so that it is thinner on the upper edge than on the lower edge and which is lapped when applied to an exterior wall. See Siding illustration.

Bin Boards: Quality square cut lumber nailed on studs with spacing between boards for ventilation and confinement of farm product.



Black-Top: Asphalt binder and stone or other aggregate, used to form a hard surface for driveways, walks, building floors, and other paved areas.

Board: Lumber with a nominal thickness of one inch or less.

Board and Batten: Vertical wood siding with narrow wood strips used to cover joints between boards. See Siding illustration.

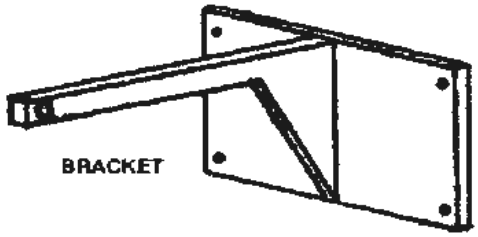
Glossary (cont.)

Board Foot: A lumber measurement equal to a board which is one inch thick, one foot wide and one foot long.

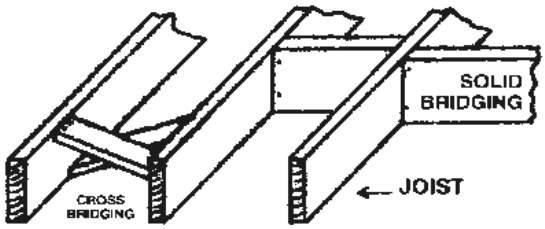
Bond Beam: A continuous beam, usually of reinforced concrete, placed in masonry walls to tie the wall together and add lateral stability. See Pilaster illustration.

Brace: Any minor member designed to steady or stiffen a major member of a structure.

Bracket: A supporting piece for equipment or other building item.



Bridging: Diagonal bracing or solid wood member nailed between joists to resist twisting.



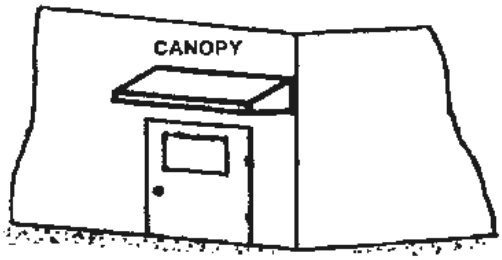
Built-Up Roofing: A roof covering consisting of layers of saturated asphalt felts cemented together with hot asphalt roofing cement.

Bulk Feed Tanks: Free standing metal tank typically 8' in diameter by 16' high mounted on legs with a cone shaped bottom used to store grain type feed for farm animals.

Bunker Silo: A rectangular 3 sided box like structure at ground level usually without cover structure where green fodder is preserved.

Calf Stall: A compartment for one calf which is much smaller in area and made of lighter material than a regular cow stall.

Canopy: A small exterior roof projecting outward over a door, window or dock.



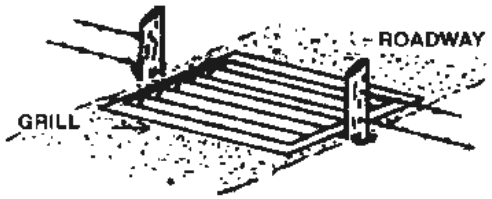
Cantilever: A form of construction where part of the structural frame extends beyond its point of support.

Cap: A top structural member which is usually supported by columns, posts or piling.

Casing: Wood or metal trim around a door or window opening.

Casement Window: A window sash which is hinged to the vertical sides of the frame so the window will open outward.

Cattle Guard: An opening in a fence which is not closed by a gate but having a ground grill over an excavation or pit which livestock will not cross.



Ceiling: The covering of a room applied to the underside of the joists above.

Channel Iron: A grooved rolled steel section used to form columns, beams, girders, trusses, etc.

Chimney: A vertical passageway usually of masonry material for the passage of smoke and fumes.

Cistern: A large tank for storing domestic water supply usually placed in the ground.

Clerestory Roof: A roof design which places one portion of the roof above another thereby providing additional wall area for light and ventilation. See Roof illustrations.

Glossary (cont.)

Collar Beam: A horizontal member running between two rafters on opposite sides of a framed roof and often located above the wall plates. It may act as a tie if the rafters are not so anchored.

Column: A heavy vertical structural member used to support trusses, beams, and girders.

Composition: A covering material formed by impregnating heavy felt paper with hot asphalt and covering the upper surface with finely crushed slate.

Concrete: A mixture of cement, water, sand and gravel which forms into a hard compact material after curing.

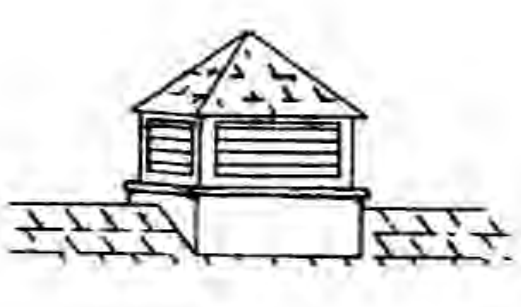
Corral: A fenced enclosure for holding horses, cattle, and other farm animals.

Course: A continuous horizontal layer of stone, brick, or other building material of uniform thickness.

Crawl Space: The space between the ground and the floor joists used for servicing the building and ventilation.

Cribbing: Laminated wood walls usually of 2" material laid horizontally.

Cupola: A small dome or rectangular structure at the ridge of a roof usually placed to provide building ventilation, via louvered side walls.



Curb: A vertical concrete member along the edge of a driveway, service alley or the edge of an opening in a floor.

Cycle Dump: A feed auger system contained in an open sided tube which rotates in a timed cycle to fill the feed bunk evenly along its length.

Dimension Lumber: Usually used to refer to planed 2" x material used in the structural framing of buildings.

Dirt Floor: Floor of bare earth, no covering material.

Double Hung Window: Two sash in the same frame which provide an opening by each sash sliding vertically past the other.

Downspout: A pipe, usually of metal, for carrying rain water from roof gutters.

Drain Field: A system of trenches containing coarse gravel and distribution tile through which septic tank effluent may be absorbed into the surrounding soil.

Dressed Material: Lumber with planed and finished surfaces.

Drop Siding: Tongue and groove wood siding style forming a weather tight wall used as sheathing and siding. See Siding illustration.

Drywall: Gypsum board panels applied to walls and ceilings as an interior cover material.

Eaves: The outer edge of a roof projecting beyond the wall line.

Evaporative Cooler: An electrically powered unit utilizing a water system to cool and circulate air.

Excavation: To remove earth for a foundation, tank, pond, etc.

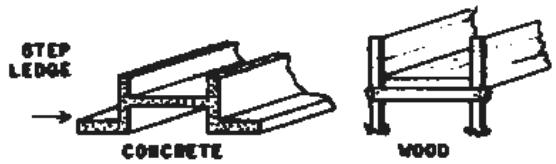
Exterior Plywood: Plywood that has the veneer laminations bonded together with weather resistant

Factory Built: Assembled in a central plant as a commercial project and then transferred to the building site.

Feed Box: The small bin or container mounted in conjunction with milking parlor stalls used for feeding grain or concentrate.

Glossary (cont.)

Feed Bunk: A long narrow trough constructed of concrete, metal or wood used to hold feed for farm animals.



Fiberboard: A low density interior wall or ceiling cover formed from wood fibers by a felting process, dried and pressed to specified thicknesses, length and width.

Field Stone: Rough, undressed rock, native to the building site.

Fill: The material, usually earth or gravel used to raise the ground level up to a desired grade.

Fixed Sash: A stationary, nonmoveable window.

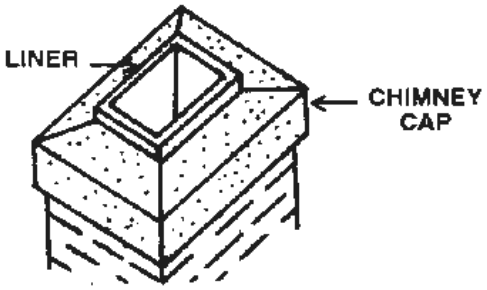
Flashing: Strips usually metal used on roofs and at openings to make joints waterproof.

Flat Roof: A roof having a slope just sufficient to provide for proper drainage. See Roof illustrations.

Floor: The lower surface of a room or building.

Flue: The space or passage in a chimney through which smoke, gas, or fumes pass.

Flue Liner: A smooth one celled hollow pipe placed within a chimney for added fire protection, commonly clay tile or metal.



Foamed Plastic: A light weight material formed by bonding together small plastic cells which is manufactured to a desired thickness, length and width and may be used as insulating material.

Footing: The wide projecting base of a foundation which transmits the building load to the ground.

Forms: Temporary panels or molds, usually of wood, plywood, or steel, which control the shape of the poured concrete until it hardens.

Foundation Wall: A wall, below or partly below grade, providing support for the exterior perimeter wall or other structural parts of a building.

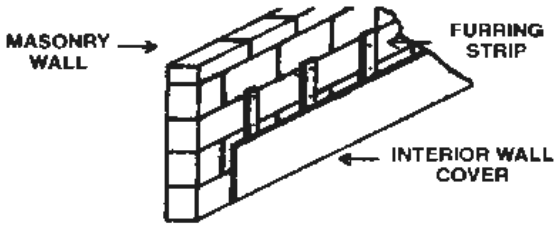
Frame Construction: Generally refers to wall, floor and roof structures formed of wood studs, joists and rafters nailed together in a conventional manner.

Framing: The wood, steel or concrete skeleton of a structure which supports the loads of the building.

Free Stall: One of many individual stalls in a structure that cows occupy while resting which are conveniently aligned for maximum utility and ease of cleaning.

Free Stall Loafing Shed: A minimal type shed occupied by livestock which range at will and may occupy individual free stalls.

Furring Strips: Thin strips of wood or metal, fastened to a masonry wall for attaching a cover material, or to provide an air space.



Gable: The triangular upper portion of an exterior wall extending from the ceiling line to the underside of the roof.

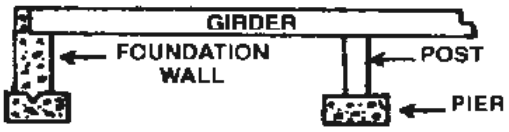
Gable Roof: A ridged roof formed by two sloping surfaces extending up from the outer walls of a structure to meet at the center. See Roof illustrations.

Gambrel Roof: A gable type roof with each side surface broken, making two or more distinct pitches. See Roof illustrations.

Glossary (cont.)

General Purpose Barn: A barn that may be used in connection with a wide variety of farm functions.

Girder: The long heavy beam spanning from one foundation wall to the other. The girder may be supported at intervals by bearing posts on foundation piers.



Girt: Nailing strips used for attaching wall cover which are placed horizontally at intervals on wall posts, columns or studs.

Gothic Roof: An oval or pointed arch roof style with a short outward flare at the eaves. See Roof illustrations.

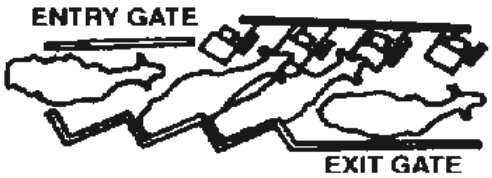
Grain Bin: A small capacity rectangular wood or round metal structure used for storing grain.

Gravel Base: The rock foundation material which is laid and graded in preparation for cement or asphalt paving.

Gross: The total amount, before any deductions.

Ground Area: Total enclosed portion of a building computed from exterior measurements taken at outside of wall.

Group Release Stall: A milking parlor stall system with a single entry and release mechanism which allows a group of cows to enter and then leave after the group has been milked.



Gutter: A shallow channel of metal set below and along the eave line to catch and carry off rain water from the roof. In barns the depression in a floor to carry off effluents.

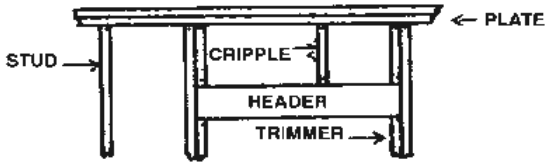
Hardboard: A dense, hard synthetic board formed from wood fibers with added bonding resins which are pressed into specified thicknesses.

Hardware: The lock, hinges, knobs, etc., of doors, windows, etc.

Hay Cover: A tall metal and/or wood roof structure on posts without side walls used as a protective cover for hay, straw, etc.

Hay Storage and Feeder Combination: A structure with livestock feeding mangers or bunks at the sides and interior hay storage.

Header: A framing member placed over a wall opening which serves to transfer the load received from the studs and joists above to the adjacent parallel studs in the wall.



Hip Roof: The hip roof has four surfaces, all sloping toward the center of a building at the same pitch. See Roof illustrations.

Humidifiers: Electrically operated unit used to put moisture into the air.

"I" Beam: A steel beam resembling the letter I in cross section.

Individual Release Stall: A milking parlor stall with a separate entry and release system to allow one cow at a time to enter and then leave after milking.

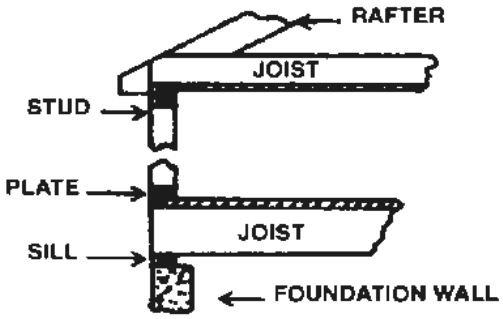
Insulation: Any material used to obstruct the passage of sound, heat, vibration, or electricity from one place to another.

Glossary (cont.)

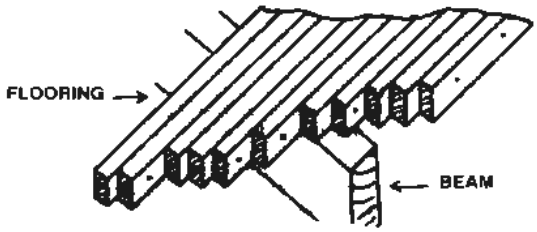
Interior Plywood: Plywood that has the veneer laminations bonded together with a glue which is not weather resistant.

Job Built: Constructed on the building site with readily available material.

Joist: One of several parallel beams comprising a floor or ceiling frame. In a flat roof, sometimes acting as both ceiling joist and rafter.

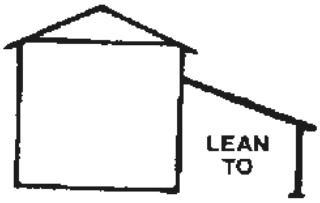


Laminated Floor: Mill type construction; a floor deck made up by spiking 2" x material or planks together with the wide side vertical.



Lath: A building material of wood, metal, gypsum, or masonry material on which a plaster cover is spread.

Lean-To: A smaller addition to a main building which shares a common wall and roof support.



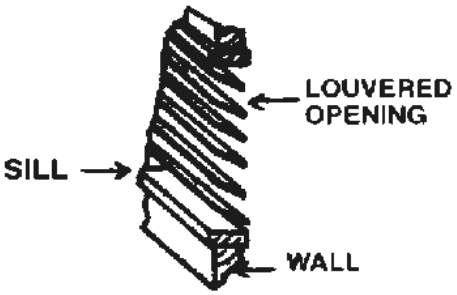
Liquid Manure Tank: A storage tank for manure and washdown water located for convenient filling from paved livestock exercise and holding areas.

Lite: Space in a window sash for a single pane of glass. Also, a pane of glass.

Loading Dock: A covered or uncovered raised platform used as a vehicle loading or unloading area for products or supplies.

Loft: In a barn the floor above the main floor, usually without partitions, used for storing hay.

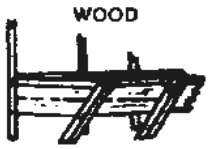
Louvers: An opening utilizing slats spaced at intervals to admit a free current of air, but inclined to prevent weather from entering the opening.

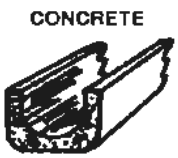


Machine Shed: Usually a long rectangular three sided structure open in the front where equipment and machinery may be stored.

Main Service Panel: Electrical panel and meter base which receives the main electrical current from the utility source.

Manger: An elongated bin to hold feed for farm animals to eat.





Masonry: Stone, brick, concrete, hollow tile, concrete block, or other similar building units bonded together with mortar to form a wall, pier, foundation, or similar mass.

Mechanical Feed System: Mechanical devices including augers, conveyers, belts, etc., used to distribute feed from the storage area to the feeding area.

Glossary (cont.)

Migrant Labor Cabin: Any small minimal type residential facility provided by farmers for occupancy by their seasonal farm labor.

Milk Line System: A milking process employed by dairy farms in which milk taken from the cows is pumped directly from the milking area via a sanitary pipe line to large refrigerated holding tanks.

Milking Parlor: A milking center which includes a separate room where cows are milked via a pipe line system while confined in quick change stalls. A milk room, office, lavatory and grain feeding facility may also be included.

Milking Parlor Stall: A stall system usually elevated above ground level to permit the milking operator to work at a lower level without stooping or bending while attaching milkers, etc.

Mill Type Construction: A type of building construction utilizing a heavy timber frame of bearing wall supports, floor posts and beams and laminated wood floor. See Laminated floor illustration.

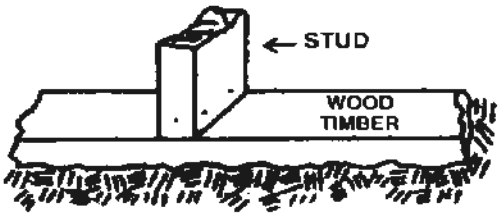
Mink Sheds: A structure where minks are bred and raised for the commercial fur market.

Modifer: Any multiplier used to adjust a base figure upward or downward as circumstances or data warrant.

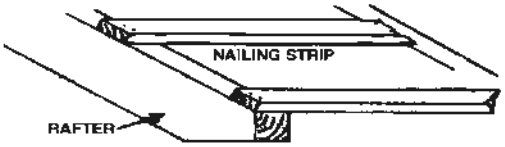
Monitor Roof: A narrow gable roofed structure with short side walls built onto the roof of a building with the function of providing additional light and ventilation. See Roof illustrations.

Mortar: A pasty mixture of cement, lime, sand and water which gradually hardens on exposure; use as a bonding agent for brick, stone or other masonry units.

Mud Sill Foundation: A foundation constructed of heavy wood timbers laid on the ground.

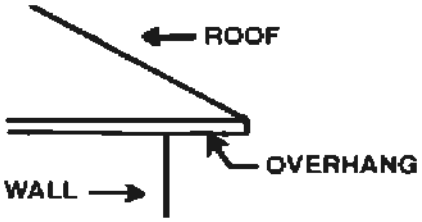


Nailing Strips: One or two inch material laid flat on rafters at spaced intervals to be used as light roof cover supports.



On Center (O.C.): A term describing the spacing between studs, rafters, joists, nailing strips, etc., measured from the center of one member to the center of the next member.

Overhang: A projection of an upper part as a roof, upper story of a building beyond the lower part.



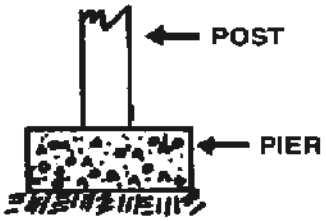
Panel: The term is used to refer to large sections of prefabricated construction material, such as gypsum board, plywood, corrugated metal, etc.

Paper, Building: A building material, generally a kraft or felt paper, used in wall and roof construction as a protection against the passage of air and sometimes moisture.

Partition Wall: A wall that subdivides spaces within any story of a building.

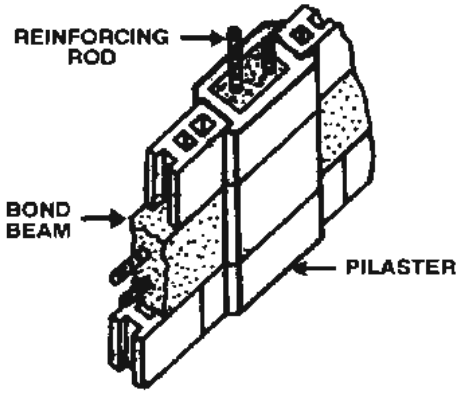
Perimeter: The outer boundary of an area. A fence would mark the perimeter of the field.

Pier: A column of masonry, often rectangular in horizontal cross section, used to support other structural members.



Glossary (cont.)

Pilaster: An upright column or pillar forming a part of a masonry or similar exterior wall providing added strength particularly at points of load concentration such as for a truss support.



Pitch: The slope of a roof commonly expressed as a ratio of its height to its span.

Plank: Generally lumber 2" or more but less than 4" in thickness, and 8" or 10" in width.

Plate: Horizontal wood members located at the top and bottom of studs which provide bearing and anchorage for wall, floor joists, ceiling joists, and rafters. See Joist illustration.

Plywood: A piece of wood material formed of three or more layers of veneer bonded with glue so that the grain of adjoining plies are at right angles.

Post: A vertical structural member resting on a foundation footing, etc., desigend to carry compressive stresses and used to support beams, girders, and trusses. See Pier illustration.

Potato Cellar: A building partly below ground level used to store and protect potatoes until shipment to market.

Poultry Brooder House: A building which may contain temperature control equipment used for raising young fowl.

Poulrty Laying House: A building used to house chickens which lay eggs for the commercial market. The structure may contain an environmental control system.

Pressure Treated Material: Poles, lumber or timbers impregnated with a preservative in heated pressurized tanks.

Prime Coat: The first coat of paint, an undercoat, to prepare the surface for finish coats.

Produce Warehouse: A building used for storing and protecting farm produce until shipment to market. The structure may contain a controlled atmosphere system.

Protective Finish: Refers to the paints, sealers, etc., applied to building materials to serve as a preservative and protective covering.

Purlin: A horizontal beam in a roof structure resting on studs and supporting the common rafters.

Rafter: One of a parallel series of structural members of a roof designed to support roof loads.

Random Material: Refers to a unit of building material, usually lumber, which is delivered in assorted lengths and/or widths.

Reinforcing, Steel Rods: Steel rods imbedded in concrete slabs, footing, beams, or columns to increase the strength of the item.

Reinforcing, Steel Wire Mesh: Small diameter steel wire mesh placed in concrete paving and ground floors to increase the strength of the concrete.

Retaining Wall: A vertical wall usually of masonry material for restricting or confining earth or other material.

Ribbon: A longitudinal board or brace attached to posts or studs to carry the load of joists or rafters.

Rigid Conduit: A metal pipe used as a raceway and protective cover for electrical wiring.

Rigid Pole Building: A building in which pressure treated poles are placed upright in the ground to serve as the foundation and framework of the building.

Rigid Steel Frame Building: A building with a frame formed of steel and bolted to a concrete foundation.

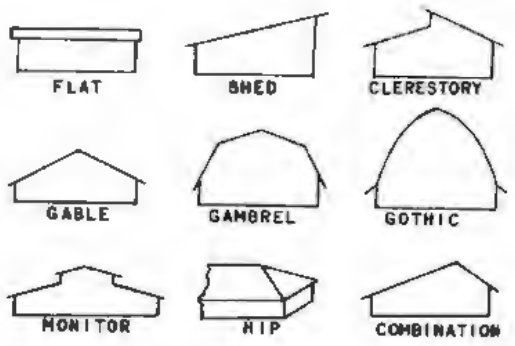
Rise: The vertical height a roof rises in relation to the horizontal distance. In stairs, the perpendicular height of a step or flight of steps.

Glossary (cont.)

Roll Roofing: A lightweight roofing material, composed of fiber saturated with asphalt that is generally applied in one layer.

Roof Covering: Any type of material put on a roof as a weather protection covering.

Roof Design:



Roof Sheathing: The roof structure covering used as the base for the roof covering.

Rough Screeded: A rough surface finish for concrete floors or paving.

Rubble Wall: Masonry constructed wall from rough unfinished stone.

Run: The horizontal distance spanned by a rafter in relation to the vertical height.

S1S: Lumber planed (surfaced) on one side.

S2S: Lumber planed (surfaced) on two sides.

S4S: Lumber planed (surfaced) on four sides.

Safety Switch: A fused switch located between the sub panel and the electrical equipment used to break the current flow in case of overloading.

Sash: A frame for holding panes of glass in a window or door.

Sealer: Waterproofing material used on the surface of masonry construction to keep moisture from penetrating and causing dampness, efflorescence, and disintegration.

Septic Tank: A covered sewage settling tank intended for satisfactory decomposition of settled solids by bacterial action.

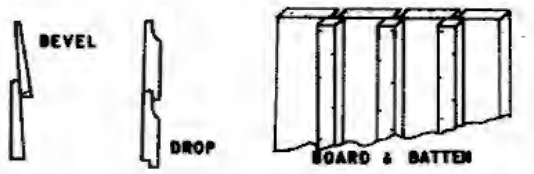
Sheathing: The structural covering, usually wood boards, plywood, or fiberboard, placed over exterior studding or rafters of a building.

Shed Roof: A single slope roof. See Roof illustrations.

Shingles: Roof covering of asphalt, asbestos, wood, or other material cut to stock lengths, widths, and thickness.

Shiplap: Wood exterior sheathing usually of nominal 1" stock with lapped joint at the edges.

Siding: The finish covering on the outside wall of a frame building.



Sill: Wood structural member on top of foundation wall which supports floor framing. See Floor Joist illustration.

Silo: Generally an upright cylinder in which green fodder is preserved. May be sealed or unsealed and constructed of metal, poured concrete, concrete staves or plywood.

Sleeper: Timber laid on the ground to receive joists; strips of wood imbedded in concrete to support finished floor.

Slider: Refers to a door or window sash which travels parallel to the wall on a track or a rail in opening and closing.

Span: The horizontal distance between the supports of a beam, girder, arch, truss, etc.

Specification: A description of the kind, quality and quantity of materials and workman ship that are to govern the construction.

Stable: A building in which horses, etc., are sheltered and fed.

Stairway: One or more flights of stairs and any landings or platforms connected therewith to form a continuous passage from one floor to another.

Glossary (cont.)

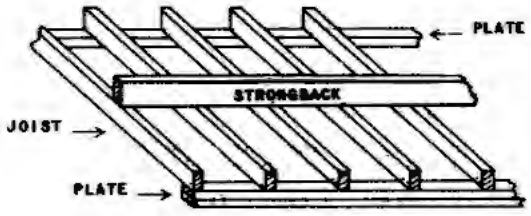
Stall: A bedded compartment for one animal in a barn, shed, etc.

Stanchions: A device usually found in the barn feeding and bedding area which fits loosely around a cow's neck and limits forward and backward motion.

Steel Frame Construction: A rigidly connected frame of steel carrying all external and internal loads and stresses to the foundations.

Steel Mesh Strip: Rigid steel web strip placed in mortar joints which reinforces and stabilizes masonry construction.

Strongback: Framing material placed on edge across a series of ceiling joists at mid span. Used for leveling the joists and adding rigidity to the ceiling.



Stucco: Cement plaster used as a covering for exterior surfaces.

Stud: The parallel vertical wooden framing of walls and partitions.

Subfloor: Boards, planks or sheet material laid on joists or beams over which a finish floor is to be laid. Also often termed floor sheathing.

Subpanel: A secondary electrical panel that receives current from the main service panel.

Sump: A pit or well below floor level in which waste water is collected.

Survey: The process of ascertaining the quantity and/or location of farm improvements on a piece of land; it may include physical features affecting it, such as grades and contours.

Taped Drywall: The joints of gypsum dry wall are covered with a paper tape and bonding paste in preparation for wall finishing.

Textured Drywall: A coating applied on a gypsum drywall as a decorative finish.

Thin Wall Conduit: A metal tube of thin gauge material in which electrical wire is installed. Used as a protective covering for conducting wire.

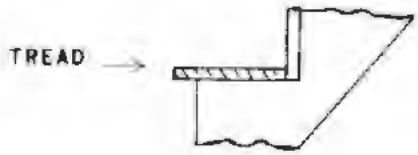
Timber: Wood in forms suitable for heavy mill type construction, specifically, sawed lumber 4 x 4 inches or more in breadth and thickness.

Tongue & Groove: Boards or planks machined in such a manner that there is a groove on one edge and a corresponding tongue on the other.

Transfer Auger: An auger conveyor that transfers feed from the storage facility to feed bunks or other areas.

Transite: Building material made of asbestos fibers and cement under pressure.

Tread: The horizontal part of a stair step.

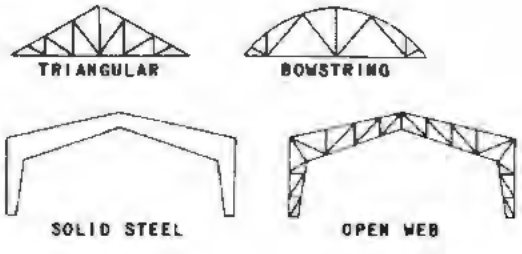


Trenching: A long narrow ditch usually excavated for laying pipe, etc.

Trim: Usually the wood finish material of a room, around doors, or windows, etc.

Trowled Surface: A smooth finished concrete surface.

Truss: A structural member of wood or metal construction either solid or open web design used to support loads such as a roof while supported at both ends by posts, columns, etc.



Trussed Rafter: A light truss usually constructed of regular dimension material where the chord members also serve as rafters and ceiling joists.

Glossary (cont.)

Vapor or Dust Tight Outlet: An electrical outlet that is sealed to prevent vapor or dust from entering.

Vapor Barrier: Material used to retard the passage of vapor or moisture into walls, floors, etc.

V-Crimp Metal Covering: Design of ridges crimped into metal covering which adds rigidity to the material.

Walk Through or Access Door: Passageway or door used by pedestrians.

Waterproofing: A treatment of a surface or structure, which prevents the passage of water.

Wiring: A term used to refer to the electrical circuitry of a structure.

Yard Pole: A pole or timber usually set at some central location on the building site to serve as a distribution point from the main service panel and/or from which the yard flood light system is mounted.

Tables and Formulas

Special Instructions

The following tables and formulas will aid you in your day-to-day computations, particularly when using the Component Cost Section.

Tables

Excavation Volume Factors

Trenching

Cubic Yards Per Linear Foot

Depth	Width				
	6"	12"	24"	36"	48"
6"	.009	.019	.037	.056	.074
1'	.019	.037	.074	.111	.148
2'	.037	.074	.148	.222	.296
3'	.056	.111	.222	.333	.445
4'	.074	.148	.296	.445	.592
5'	.093	.185	.370	.555	.741
6'	.111	.222	.445	.667	.890
7'	.130	.259	.519	.778	.1.038
8'	.148	.296	.592	.889	1.186
9'	.167	.333	.667	1.000	1.333
10'	.185	.370	.740	1.110	1.481

Bulk Excavation

Content Per Square Foot

Depth	Cubic Feet	Cubic Yards
2"	.167	.006
4"	.333	.012
6"	.500	.018
8"	.667	.025
10"	.833	.031
1'	1.000	.037
2'		.074
3'		.111
4'		.148
5'		.185
6'		.222
7'		.259
8'		.296
9'		.333
10'		.370

Masonry Content Factors

Concrete Footing

Content Per Linear Foot

Dimensions	Cubic Feet	Cubic Yards
12" x 6"	.50	.019
x 8"	.67	.025
x 10"	.83	.031
x 12"	1.00	.037
16" x 8"	.89	.033
x 10"	1.11	.041
x 12"	1.33	.049
18" x 8"	1.00	.037
x 10"	1.25	.046
x 12"	1.50	.055
20" x 8"	1.11	.041
x 12"	1.67	.062
24" x 8"	1.33	.049
x 12"	2.00	.074

Concrete Wall

Content Per Square Foot

Thickness	Cubic Feet	Cubic Yards
4"	.333	.0123
5"	.417	.0154
6"	.500	.0185
7"	.583	.0216
8"	.667	.0247
9"	.750	.0278
10"	.833	.0309
11"	.917	.0340
12"	1.000	.0370

Tables and Formulas (cont.)

Masonry Content Factors (cont.)

Concrete Slab

Slab Thickness	Content Per Sq. Ft. Cu. Ft.	Content Per Sq. Ft. Cu. Yd.	Sq. Ft. Covered By One Cu. Ft.	Sq. Ft. Covered By One Cu. Yd.
1/2"	.042	.0015	24.0	648.0
1"	.083	.0031	12.0	324.0
2"	.167	.0062	6.0	162.0
3"	.250	.0092	4.0	108.0
4"	.333	.0123	3.0	81.0
5"	.417	.0154	2.4	64.8
6"	.500	.0185	2.0	54.0
7"	.583	.0216	1.7	46.3
8"	.667	.0247	1.5	40.5
9"	.750	.0278	1.3	36.0
10"	.833	.0309	1.2	32.4
11"	.917	.0340	1.1	29.4
12"	1.000	.0370	1.0	27.0

Masonry Unit Wall

Wall Thickness	Units Per Square Foot: Common Brick 2 1/2" x 3 3/4" x 8"	Concrete Block 8" x 8" x 16"	Clay Tile 6" x 8" x 12"
4"	6.2		
8"	12.3	1.50	2
12"	18.5	2.25	3
16"	24.6	3.00	4

Lumber Conversion Factors

Linear Feet to Board Feet

Material Size	Board Feet Per Linear Foot	Material Size	Board Feet Per Linear Foot
2" x 4"	0.67	6" x 6"	3.0
2" x 6"	1.00	6" x 8"	4.0
2" x 8"	1.33	6" x 10"	5.0
2" x 10"	1.67	6" x 12"	6.0
2" x 12"	2.00	6" x 14"	7.0
3" x 4"	1.5	8" x 8"	5.3
3" x 6"	2.0	8" x 10"	6.7
3" x 8"	2.5	8" x 12"	8.0
3" x 10"	3.0	8" x 14"	9.3
3" x 12"	3.5	8" x 16"	10.7
4" x 4"	1.30	10" x 10"	8.3
4" x 6"	2.00	10" x 12"	10.0
4" x 8"	2.67	10" x 14"	11.6
4" x 10"	3.33	10" x 16"	13.3
4" x 12"	4.00	10" x 18"	15.0

Board Feet (B.F.) = Length in feet x width in feet x thickness in inches.

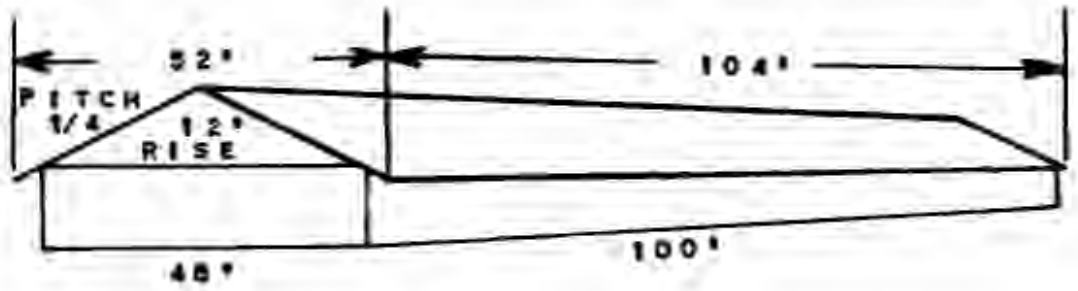
Tables and Formulas (cont.)

Roof Area Conversion Factors

Ground Area to Roof Surface Area

Pitch	Rise	Modifier
1/12	2	1.014
1/8	3	1.030
1/6	4	1.054
5/24	5	1.08
1/4	6	1.12
1/3	8	1.20
5/12	10	1.30
1/2	12	1.41
5/8	15	1.60
3/4	18	1.80
7/8	21	2.02
1	24	2.24

Shed 48' 100' with 2' overhang at eaves. Roof pitch 1/4 or 6" rise per 12" run.



Pitch Modifier x Eaves Line Area = Roof Surface Area: 1/12 x 5,408 sq. ft. (52' x 104') = 6,057 sq. ft.

Also see: Component Costs Section, Roof Pitch Modifier.

Tables and Formulas (cont.)

Tank Volume Factors

Content of Square or Rectangular Tanks in U.S. Gallons Per Foot of Depth

Width	2'	3'	4'	5'	6'	7'	8'	9'	10'
2'	30	45	60	75	90	105	120	135	150
3'		67	90	112	135	157	180	203	224
4'			120	150	180	209	239	269	299
5'				187	224	262	299	337	374
6'					269	314	359	404	449
7'						367	419	471	524
8'							479	539	598
9'								606	673
10'									748

Conversion Factor: To find the capacity of tanks larger than those given in the above table, multiply the content of a tank one-half the size of the subject by 4, the content of a tank one-third the size of the subject by 9, or the content of a tank one-fourth the size by 16.

Example: Liquid manure tank 12' x 24'

Content of 4' x 8' tank (one-third) = 239

239 x 9 = 2,151

Content of 12' x 24' tank = 2,151 gal. per foot of depth.

Volume of Cylindrical Tanks

		Content Per Foot of Depth	
Diameter	Circumference	U.S. Gallons	Cubic Feet
1'	3.1416	5.87	.7854
2'	2.2832	23.50	3.1416
3'	9.4248	52.88	7.0686
4'	12.566	94.00	12.566
5'	15.708	146.88	19.635
6'	18.850	211.51	28.274
7'	21.991	287.88	38.485
8'	25.133	276.01	50.265
9'	28.274	475.89	63.617
10'	31.416	587.52	78.540

The formula to find the gallon capacity of tanks larger than listed above is:

D^2 x 5.8752 = gallons per foot of depth

To find the cubic foot volume, the formula is:

D^2 x .7854 = cubic feet per foot of depth

Tables and Formulas (cont.)

Weights and Measures

Units of Measure

Linear

12	inches	=	1 foot
36	inches	=	1yard
3	feet	=	1 yard

Square

144	square inches	=	1 square foot
1,296	square inches	=	1 square yard
9	square feet	=	1 square yard
100	square feet	=	1 square

Cubic

1,728	cubic inches	=	1 cubic foot
46,656	cubic inches	=	1 cubic yard
27	cubic feet	=	1 cubic yard

Volume

.8036	bushel	=	1 cubic foot
7.481	gallons	=	1 cubic foot
2150.42	cubic inches	=	1 bushel
1.2445	cubic foot	=	1 bushel
231	cubic inches	=	1 U.S. gallon
.1337	cubic foot	=	1 U.S. gallon
31.5	U.S. gallons	=	1 barrel

Commodity Measures and Weights

Item	Unit	Weight
Apples	Box	44 pounds
Cranberries	Barrel	100
Pears	Box	48
Barley	Bushel	48
Corn, husked	Bushel	35
Oats	Bushel	32
Wheat	Bushel	60
Feed Grain	Bulk	Ton
Grass Seed	Bag	100 pounds
Hops	Bale	200
Onions	Bag	50
Potatoes	Bag	100

Capacity of Round Silos

Silage Content in Tons*

	Diameter				
Height	12'	18'	24'	25'	36'
25'	55	75	125		
30'	70	90	155	295	
35'	80	110	180	345	
40'	90	125	205	395	815
45'	100	140	230	440	915
50'		155	255	490	1,020
60'				590	1,220

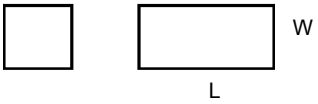
* Based on silage weight at 40 lbs. per cubic foot.

Tables and Formulas (cont.)

Formulas

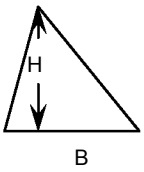
Areas

Squares and Rectangles area equals product of length and width.



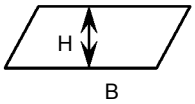
$A = L \times W$

Triangle area equals 1/2 the product of base and height.



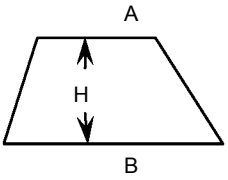
$A = \frac{B \times H}{2}$

Parallelogram area equals the product of base and height.



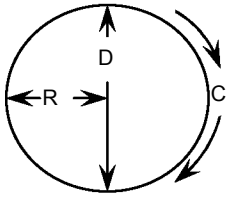
$A = B \times H$

Trapezoid area equals the product of the height and 1/2 the sum of the two parallel sides.



$A = \frac{(A + B)}{2} \times H$

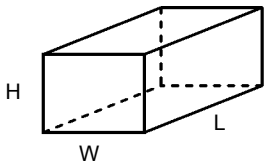
Circle area equals the product of the circumference and 1/4 of the diameter.



$C = D \times 3.1416$ or $D \div .3183$
$D = C \times .3183$ or $C \div 3.1416$
$A = C \times 1/4\ D$ or $D^2 \times .7854$
$C^2 \times .07958$ or $R^2 \times 3.1416$

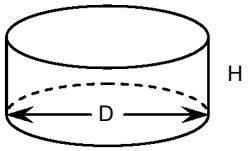
Volumes

Cube or rectangular solid volumes equals the product of the base area and height.



$V = L \times W \times H$ or $A \times H$

Cylinder volume equals the product of the base area and height.



$V = \frac{C}{2} \times R \times H$ or $D2 \times .7854 \times H$

Tanks, pipes: doubling the diameter increases the capacity four times, tripling the diameter increases the capacity nine times, etc.

Tables and Formulas (cont.)

Formulas (cont.)

Height or Length

The height of a structure may be estimated in the following manner:

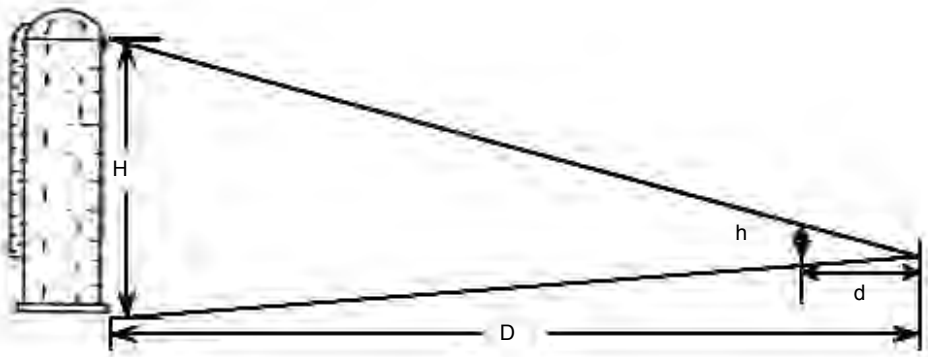
H = Height of structure in feet.

D = Measurement from eye to structure in feet.

h = Measurement on ruler in inches.

d = Measurement from eye to ruler in inches.

$$H = D \times \frac{h}{d}$$



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