State of California

Board of Equalization
Property and Special Taxes Department

Memorandum

To: Honorable Jerome E. Horton, Chairman
Honorable Michelle Steel, Vice Chair
Honorable Betty T. Yee, First District
Senator George Runner (Ret.), Second District
Honorable John Chiang, State Controller

Date: December 2, 2011

From: David J. Gau, Deputy Director
Property and Special Taxes Department

Subject: ***Board Meeting, December 2011—Item N—Administrative Session***
Assessors' Handbook Section 534, Rural Building Costs

I am requesting that Assessors' Handbook Section 534, *Rural Building Costs,* be approved for publication. Revenue and Taxation Code section 401.5 requires that the Board issue to county assessors data relating to costs of property to promote uniformity in appraisal practices and in assessed values throughout the state. Pursuant to that mandate, staff developed the January 2012 version of AH 534 which contains current cost data for rural buildings and equipment. Overall, the costs reflect a slight increase due to the continued increase in the raw cost of materials.

Please place this item on the Board's December 2011 Administrative Session Agenda for approval.

DJG:sk
Attachment
cc: Ms. Diane Olson

Approved:

Kristine Cazadd
Executive Director

Board Approved:

Diane G. Olson, Chief
Board Proceedings Division

ASSESSORS' HANDBOOK
SECTION 534

RURAL BUILDING COSTS

JANUARY 2012

CALIFORNIA STATE BOARD OF EQUALIZATION

BETTY T. YEE, SAN FRANCISCO	FIRST DISTRICT
SEN. GEORGE RUNNER (RET.), LANCASTER	SECOND DISTRICT
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JEROME E. HORTON, LOS ANGELES	FOURTH DISTRICT
JOHN CHIANG	STATE CONTROLLER

KRISTINE CAZADD, EXECUTIVE DIRECTOR

FOREWORD

The 2012 revision of Assessors' Handbook Section 534 (AH 534), *Rural Building Costs*, updates costs contained in previous editions and includes new data. These costs are to be used as of January 1, 2012. The 2012 revision of AH 534 is available only on the Board's website. The entire text, photographs, and drawings of AH 534 are posted to the Board's website at www.boe.ca.gov/proptaxes/ahcont.htm.

Statutory and regulatory considerations, general instructions, and pertinent information concerning the use of this handbook are contained in the *Costing Information* chapter. Comments appropriate to an improvement type are found in some of the introductory pages of the respective chapters of the handbook devoted to a particular improvement type.

Diligent efforts have been made to supply accurate and reliable information. AH 534 should serve as a guide, but it is important for the appraiser to research and analyze permit costs and fees of jurisdictions in the region and to make appropriate adjustments where necessary, due primarily to the wide variance in these costs, both within and among the counties. An appraiser must research the market to determine which costs are most applicable for the appraisal assignment and consider the data provided in AH 534 along with local cost data.

This revision was prepared by County-Assessed Properties Division staff under the direction of the Property and Special Taxes Department.

David J. Gau
Deputy Director
Property and Special Taxes Department
California State Board of Equalization
January 2012

RURAL BUILDING COSTS

TABLE OF CONTENTS

Chapter		Page
534.00	COSTING INFORMATION	1
	STATUTORY AND REGULATORY BASIS	1
	BASIS OF COST	2
	GLOSSARY OF TERMS	3
534.10	BASIC FARM BUILDINGS	1
534.20	DAIRY BARNS	1
534.30	POULTRY HOUSES	1
534.61	IRRIGATION SYSTEMS	1
534.62	PUMPS	1
534.71	CORRALS AND FENCES	1
534.75	GREENHOUSES	1
534.76	LAND DEVELOPMENT AND DRAINAGE TILE	1
534.77	VINEYARD STAKES AND TRELLIS SYSTEMS	1
534.78	STEEL BUILDINGS	1
534.79	MISCELLANEOUS	1
534.80	WIND MACHINES	1
534.90	DEPRECIATION	1
	DEFINITIONS	1
	Percent Good Tables	1
	Average Life Tables	1
	Remaining Life Expectancy Tables	2
	Extended Life Concept	2
	EFFECTIVE YEAR	2
	Physical Condition	2
	AVERAGE LIFE TABLES	4
	NORMAL PERCENT GOOD TABLES	7

AH 534.00: COSTING INFORMATION

STATUTORY AND REGULATORY BASIS

Assessors' Handbook Section 534 (AH 534) was designed and developed for use by the 58 California counties as an aid to assessors in fulfilling their statutory and regulatory requirement in the assessment of all taxable property in the county.[1]

The work in AH 534 is guided by Property Tax Rule 6[2] and Revenue and Taxation Code section 401.5. Rule 6 provides in part:

> (a) The reproduction or replacement cost approach to value is used in conjunction with other value approaches and is preferred when neither reliable sales data (including sales of fractional interests) nor reliable income data are available and when the income from the property is not so regulated as to make such cost irrelevant. It is particularly appropriate for construction work in progress and for other property that has experienced relatively little physical deterioration, is not misplaced, is neither over- nor underimproved, and is not affected by other forms of depreciation or obsolescence.
>
> (b) The reproduction cost of a reproducible property may be estimated either by (1) adjusting the property's original cost for price level changes and for abnormalities, if any, or (2) applying current prices to the property's labor and material components, ***with appropriate additions for entrepreneurial services***, interest on borrowed or owner-supplied funds, and other costs typically incurred in bringing the property to a finished state (or to a lesser state if unfinished on the lien date). Estimates made under (2) above may be made by using square-foot, cubic foot, or other unit costs; a summation of the in-place costs of all components; a quantity survey of all material, labor, and other cost elements; or a combination of these methods. [Emphasis added.]

Section 401.5 reads as follows:

> The board shall issue to assessors data relating to costs of property, or, with respect to commercial and industrial property, shall, after a public hearing, review and approve commercially available data, and shall issue to assessors other information as in the judgment of the board will promote uniformity in appraisal practices and in assessed values throughout the state**. *An assessor shall adapt data received pursuant to this section to local conditions and may consider that data together with other factors as required by law in the assessment of property for tax purposes.*** [Emphasis added.]

[1] Revenue and Taxation Code section 405.
[2] Title 18, Public Revenues, California Code of Regulations, section 6.

BASIS OF COST

Costs to construct improvements such as barns, greenhouses, steel buildings, etc., in this handbook are based on the cost to build on a level and cleared site in California as of the date in the lower right-hand corner of each page. The costs are contingent on the following assumptions:

- A clear site
- Normal soil conditions
- Adequate site drainage
- No off-site improvement cost

The costs in this handbook include normal expenses incurred in placing the improvement or component in the hands of the ultimate consumer, including the following:

1. Excavation for foundations, piers, and other structural foundation components, considering a level site
2. Materials
3. Labor
4. Architectural fees
5. Engineering fees
6. Supervision
7. Permits for improvements, land use, environmental impact, etc.
8. Normal utility hook-ups, if any
9. Contractor's overhead and profit
10. Contingencies
11. Carrying charges during construction
    - Taxes
    - Interest
    - Insurance
12. Legal expenses

All data are in the form of in-place costs for improvements and additives that may differ between various structures.

The costs in this handbook do not include entrepreneurial profit except where noted. It is, therefore, necessary for the appraiser to add an appropriate market adjustment for entrepreneurial profit where appropriate for real property improvements.

GLOSSARY OF TERMS

Term	Definition
A-Frame Cages	Cages stacked in an "A" formation which house chickens for the purpose of egg production.
Battery Cages	Vertically stacked cages which house chickens for the purpose of egg production.
Bent	A framework that is perpendicular to the length of a building.
Breeder	A chicken that produces eggs for the purpose of producing day-old chicks.
Breeder house	A structure which houses breeder chickens.
Broiler	A chicken farmed for retail food products.
Broiler house	A structure which houses broiler chickens.
Chime Joists	Wooden support members that are placed under the bottom of a redwood storage tank.
Cistern	An artificial reservoir or tank, often underground, which stores rain water collected from a roof.
Cordon	Shoots or canes originating from the crown of a grapevine that are trained along wire on trellis systems.
Crown	Termination of grapevine trunk where cordons emerge.
Cwt	A unit of weight measurement which is equal to 100 pounds.
Free-stall Barn	A structure that contains individual stalls cows may enter, lie down, or leave without restriction.
Gable roof	A ridged roof that slopes up from only two walls. A gable is the triangular portion of the end of a building from the eaves to the ridge.
Gas Brooder	A small, gas-fueled circular heater used to keep young chickens warm.

GLOSSARY OF TERMS

Gear Head Housing enclosing gears used to provide positive power transmission to a pump.

Girts A secondary horizontal framing member located between studs or columns. They are designed to stiffen the framing system and often provide support for siding or sheathing.

Grapevine Trunk The main structural member that supports all upper growth of the grapevine that is supported by and is directly attached to the roots. The trunk develops from a single shoot that is selected from several that grow from the grape cutting in the first season of growth. This selected shoot is then trained up the stake to form the trunk.

Hopper An elevated bin with a cone-shaped bottom. A gate at the bottom, when opened, allows the stored material to be emptied due to the sloping sides of the cone.

J-R Clip A type of clip used on T-Posts to attach wires to trellis systems that are commonly used for vertical trellis systems.

Layer House A structure which houses chickens for the purpose of egg production.

Loam A rich soil composed of clay, sand, and organic matter. Generally any rich, dark soil.

Mangers A box or trough that holds animal feed.

Mudsills The lowest sill of a structure. As a foundation, timber placed directly on the ground or foundation.

Nipple System A system that uses mechanical nipples to provide fresh drinking water to chickens.

Pencil Rod Metal stake of approximately 3/8" used to train new grapevines.

Pole Building A structure whose main frame and foundation are treated posts or piles sunk into the ground with prefabricated trusses.

Polycarbonate A class of resins that are used to produce tough, transparent items such as roof material and siding of greenhouses.

GLOSSARY OF TERMS

Polyethylene A type of plastic with a wide array of applications. One common use is to insulate greenhouses.

Purlin Horizontal structural members that support the common rafters in roofs.

Quonset Building A prefabricated metal building with a curved roof that extends to the ground forming the sides of the building. Common uses are for storage of agricultural equipment or products such as baled hay.

Ripping The term used in agriculture to indicate plowing or breaking up of soil. The result is a reduction in compacted soil.

Sash The frame in which window lights are set.

Silage A type of foodstuff for livestock prepared from green crops (for example, grass). The crops are stored in a pit or silo. The bacteria on the plants carry out fermentation resulting in the preservation of the plant material from further decay and loss of nutritional value.

Solid Set Irrigation Irrigation system where the pipe may be left in place during the irrigation season.

Spurs Pruned section (usually to two buds) of growth that originates from cordons that are last season's growth that will produce the following season's fruit and growth. Some spurs (non-fruiting) are also maintained to replace the cordons.

T-1-11 A registered trademark name for a common plywood siding. The 4' by 8' sheets have a distinctive rough texture on the exterior side with vertical grooves spaced regularly across the face.

Vertical Line Post Used in vertical shoot positioning trellis systems. The built-in wire slots make it a good choice for mechanized harvesting.

Unloading Auger A screw-like device that rotates, resulting in the horizontal movement of stored material out of a storage bin.

Wind Machines Powered fans used to provide frost protection for crops. They are used when temperatures approach freezing and sufficient temperature inversion in the frost area makes warmer air available to either mix with or displace colder lower lying air.

AH 534.10: BASIC FARM BUILDINGS

Basic farm buildings and outbuildings vary depending on use and type of farm operation. This chapter covers many of the structures that may be used in agricultural farming and also contains specifications and costs of various buildings which include the following:

- Prefabricated horse barns/riding arenas
- Steel frame riding arena
- General purpose barns
- Hay storage barns
- Feed barns
- Pole buildings
- Shops
- Machinery and equipment sheds
- Prefabricated wood storage sheds
- Small sheds

Photographs showing examples of the buildings discussed are located at the end of this chapter.

BASIC FARM BUILDINGS

PREFABRICATED HORSE BARNS

Prefabricated barns have many benefits that make them desirable for horse accommodation. They are very strong and easier to build because they have fewer pieces to assemble than wood structures. They are more cost-effective than their wood counterparts, in part because they have most of the detail work already completed. The material used in prefabricated horse barns is generally not subject to problems such as warping, twisting, cracking, rotting, or deterioration. Prefabricated horse barns are also more resistant to damage from vermin and termites and are non-flammable, making them very safe. Property and fire insurance costs tend to be lower for prefabricated barns than for wood structures.

SPECIFICATIONS

Structure	6" steel purlins on 6' centers; enamel exterior
Foundation	Concrete piers
Floor	Dirt
Door	Sliding stall (inside track)
Roof	2" x 12" pitch; skylight in each stall
Roofing	White 26 gauge steel hi-rib
Walls	Laminated wall panels; grilled fronts; top 4'; 5" colored gutter trim

IN-LINE SHED ROW BARN

Stall Size	First Stall	Each Additional Stall
12' x 12'	$4,000	$3,600
12' x 16'	4,600	4,000

Shed roof overhang per square foot: 8' — **$5.00**
12' — **$5.60**

(Photographs shown on AH 534.10, pages 14 and 15)

BASIC FARM BUILDINGS

PREFABRICATED HORSE BARNS

GABLE ROOF BARN—STANDARD BREEZEWAY

Stall Size	First Two Stalls	Each Additional Two
12' x 12' with 12' breezeway	$10,200	$8,600
12' x 12' with 16' breezeway	10,600	8,900
12' x 16' with 12' breezeway	11,600	10,100
12' x 16' with 16' breezeway	12,000	10,700

GABLE ROOF BARN—RAISED BREEZEWAY

Stall Size	First Two Stalls	Each Additional Two
12' x 12' with 12' breezeway	$11,000	$9,500
12' x 12' with 16' breezeway	11,800	10,200
12' x 16' with 12' breezeway	12,500	11,200
12' x 16' with 16' breezeway	12,700	12,000

Roof extension per square foot—**$5.80**
12-foot breezeway doors—**$780** each
16-foot breezeway doors—**$890** each

(Photographs shown on AH 534.10, pages 14-15)

ADDITIVES

Item	Cost
Concrete floor	$4.60 - $5.00 per square foot
Full footing	$13.00 per linear foot
Portable 5' x 12' – 4 rail corral panels	$8.00 - $11.00 per linear foot
Portable 5' x 12' – 5 rail corral panels	$9.00 - $12.00 per linear foot
Portable 6' rail corral panels with metal roof	$5.60 - $6.70 per square foot

STEEL FRAME RIDING ARENA

Frame	Good quality steel frame, 14' to 16' eave height
Roof	Gable roof with 26-gauge panels
Walls	None
Floor	Sand
Plumbing	Minimum water outlets
Electrical	None—or add **$.60** to **$1.00** per square foot
Cost	**$10.00** to **$11.25** per square foot
Add for vinyl fencing	**$8.00** to **$12.00** per linear foot

(Photographs shown on AH 534.10, page 16)

BASIC FARM BUILDINGS

GENERAL PURPOSE BARNS

General purpose barns are usually the center of a farming operation. They can be used to house animals, provide refuge for animals in poor weather, store food and equipment, or provide indoor working areas. Areas within a barn can be constructed with stalls, grooming areas, tack rooms, or storage rooms for supplies. Other possible uses include areas for birthing, sheering, milking, or equipment maintenance.

BUILDING SPECIFICATIONS

Components	Class 1 Fair Quality	Class 2 Average Quality	Class 3 Good Quality
Foundation	Redwood or cedar mudsills	Concrete or masonry piers	Continuous concrete
Floor	Dirt	Dirt/some concrete	Concrete
Wall Structure	Light wood frame, 10' eave height	Average wood frame, 10' eave height	Good wood frame, 10' eave height
Roof Construction	Medium to high pitch—2" x 4" rafters, 24" to 36" on center, or light wood trusses	Medium to high pitch—average wood trusses	Medium to high pitch—good wood trusses
Roof Cover	Light aluminum	Standard gauge corrugated iron or aluminum	26-gauge steel
Electrical	None	Two outlets per 1,000 square feet	Four outlets per 1,000 square feet
Plumbing	None	One cold water outlet	Two cold water outlets

(Photographs shown on AH 534.10, pages 17, 18, and 19)

SQUARE-FOOT COSTS

	Square-Foot Area					
Class	**1,000**	**3,000**	**5,000**	**7,000**	**9,000**	**11,000**
1	16.00	12.40	11.45	11.00	10.60	10.40
2	21.30	17.35	16.15	15.55	15.20	14.65
3	32.20	26.40	24.35	23.50	23.00	22.40

BASIC FARM BUILDINGS

HAY STORAGE BARNS

Outbuildings for most farms with animals typically include a hay barn. It is important to have a separate building for hay because hay may spontaneously combust endangering livestock. A separate grain room or supplemental feeding area is also important within the hay barn.

BUILDING SPECIFICATIONS

Components	Class 1 Fair Quality	Class 2 Average Quality	Class 3 Good Quality
Foundation	Redwood or cedar mudsills	Concrete or masonry piers	Continuous concrete
Floor	Dirt	Dirt	Concrete
Wall Structure	Light wood frame, 20' eave height	Average wood frame, 20' eave height	Good wood frame, 20' eave height
Exterior Wall Cover	Light aluminum or low cost boards	Standard gauge corrugated iron or aluminum	Good wood siding, painted or 26-gauge steel
Roof Construction	Medium to high pitch—2" x 4" rafters, 24" to 36" on center, or light wood trusses	Medium to high pitch—average wood trusses	Medium to high pitch—good wood trusses
Roof Cover	Light aluminum	Standard gauge corrugated iron or aluminum	26-gauge steel
Electrical	None	Two outlets per 1,000 square feet	Four outlets per 1,000 square feet
Plumbing	None	One cold water outlet	Two cold water outlets
Shape	Nearly square, length between one and two times width	Nearly square, length between one and two times width	Nearly square, length between one and two times width

(Photographs shown on AH 534.10, page 20)

SQUARE-FOOT COSTS

	Square-Foot Area					
Class	**1,000**	**3,000**	**5,000**	**7,000**	**9,000**	**11,000**
1	12.45	10.45	9.50	8.75	8.45	8.00
2	14.40	11.85	10.80	10.10	9.60	9.25
3	23.50	19.50	18.00	16.50	15.75	15.10

Adjustments: Pole Buildings – Deduct 10 percent from above costs
No Electricity/No Water – Deduct **$.75** to **$1.00** per square foot

BASIC FARM BUILDINGS

FEED BARNS

Feed barns are designed for livestock shelter and feeding. They are typically open on all sides but may be enclosed on the ends. A center aisle is used to transport feed to the feeders which are usually located on both sides of the center aisle. The barns can be built using either wood posts or steel frames with a pitched roof of steel or aluminum.

BUILDING SPECIFICATIONS

Components	Class 1 Fair Quality	Class 2 Average Quality	Class 3 Good Quality
Foundation	Redwood or cedar mudsills	Concrete or masonry piers	Continuous concrete
Floor	Dirt	Concrete in center section	Concrete
Wall Structure	Light wood frame, 8' eave height at drip line	Average wood frame, 8' eave height at drip line	Good wood frame, 8' eave height at drip line
Exterior Wall Cover	Open sides and ends	Open sides, standard gauge corrugated iron, aluminum, or average wood siding on ends	Open sides, good siding painted on ends
Roof Construction	Medium to high pitch— light wood trusses	Medium to low pitch—average wood trusses	Medium to low pitch—good wood trusses
Roof Cover	Light aluminum	Standard gauge corrugated iron or aluminum	26-gauge steel
Electrical	None	Two outlets per 1,000 square feet	Four outlets per 1,000 square feet
Plumbing	None	One cold water outlet	Two cold water outlets

(Photographs shown on AH 534.10, page 21)

SQUARE-FOOT COSTS

	Square-Foot Area					
Class	**1,000**	**3,000**	**5,000**	**7,000**	**9,000**	**11,000**
1	8.40	7.55	7.20	7.05	7.00	6.85
2	13.30	12.20	11.80	11.60	11.50	11.40
3	16.00	14.45	14.40	14.10	13.95	13.90

BASIC FARM BUILDINGS

POLE BUILDINGS

A pole building is basically a series of upright poles supporting a roof. These buildings are generally rectangular with a gabled roof. The poles make up the outside perimeter of the barn, and often have no outside walls. Storage of goods like hay or livestock is the main purpose of these structures. The major advantages of pole barns over other agricultural storage building options are their low cost and easy accessibility for storage.

BUILDING SPECIFICATIONS

Structure	Poles: 15' to 20' on center; wood or steel
Floor	Dirt
Roof	Light trusses; low to medium pitch; wood or steel
Roofing	Galvanized steel or colored steel with gutter
Walls	None, wall height: 18' - 21' to plate

(Photographs shown on AH 534.10, page 22)

SQUARE-FOOT COSTS **ALL SIDES OPEN** **GOOD QUALITY**

	Side Length									
End Width	**30**	**50**	**80**	**100**	**120**	**140**	**150**	**160**	**180**	**200**
20	7.60	7.45	7.30	7.15	7.05	6.90	6.85	6.75	6.70	6.65
30	7.30	7.15	7.00	6.85	6.80	6.70	6.60	6.50	6.45	6.40
40	7.00	6.90	6.70	6.60	6.55	6.35	6.30	6.25	6.20	6.15
50	6.70	6.60	6.45	6.35	6.30	6.10	6.05	6.00	5.95	5.90
60	6.45	6.35	6.20	6.10	6.05	5.85	5.80	5.75	5.70	5.65
70	6.20	6.10	5.95	5.85	5.80	5.60	5.55	5.50	5.45	5.40
80	5.95	5.85	5.70	5.60	5.55	5.40	5.35	5.30	5.25	5.20

Deduct 15 percent for light duty, fair quality construction.

Skylights (3' x 10')	**$82 - $102** each
Vents (14", Rotary)	**$200** each
Poles, In-Place	**$168 to $230** each
Covered wall area add	**$3.85** per square foot of wall surface
Reinforced Concrete Floors:	
4"	**$5.00** per square foot
6"	**$5.60** per square foot

BASIC FARM BUILDINGS

SHOPS

Shops provide a center for repair and maintenance of machines and equipment. They are a place for orderly tool storage, supply and spare part storage, and shelter when work cannot be done outside. Workshops are usually present on most farms. Size and design should complement the type of farm and the work to be done.

BUILDING SPECIFICATIONS

Components	Class 1 Fair Quality	Class 2 Average Quality	Class 3 Good Quality
Foundation	Light concrete	Light concrete	Standard concrete
Floor	3" concrete	4" concrete	4" reinforced concrete
Wall Structure	Light wood frame, 15' eave height	Average wood frame, 15' eave height	Good wood frame, insulated, 15' eave height
Exterior Wall Cover	Light aluminum or low cost boards	Standard gauge corrugated iron, aluminum, or average wood siding	Good wood siding painted or 26-guage steel
Roof Construction	Low to medium pitch— 2" x 4" rafters, 24" to 36" on center, or light wood trusses	Low to medium pitch— average wood trusses	Medium pitch— good wood trusses, insulated roof
Roof Cover	Light aluminum corrugated	Standard gauge corrugated iron or aluminum	26-gauge steel, with skylights
Electrical	Two outlets per 1,000 square feet	Two outlets per 1,000 square feet	Excellent lighting and ample outlets
Plumbing	None	One cold water outlet	Two cold water outlets
Doors	One light sliding or swinging door per 2,000 square feet	One average sliding or swinging door per 2,000 square feet	One drive-thru door per 1,000 square feet plus one walk-thru door
Windows	None	None or few low cost	5 percent of floor area
Shape	Nearly square, length between one to three times width	Nearly square, length between one to three times width	Nearly square, length between one to three times width

(Photographs shown on AH 534.10, page 23)

BASIC FARM BUILDINGS

SHOPS

SQUARE-FOOT COSTS

	Square-Foot Area									
Class	**1,000**	**1,500**	**2,000**	**2,500**	**3,000**	**4,000**	**5,000**	**6,000**	**8,000**	**10,000**
1	18.60	17.00	15.95	15.15	14.45	14.15	13.70	13.00	12.95	12.60
2	23.20	21.20	20.00	19.30	18.60	17.75	17.00	16.70	16.30	15.95
3	26.85	26.20	25.40	24.25	23.25	22.55	21.85	21.05	20.35	19.60

BASIC FARM BUILDINGS

MACHINERY AND EQUIPMENT SHEDS

It is important to have a building to store machinery, tools, and farm vehicles such as tractors and their attachments for protection from the elements. Smaller pieces of equipment also need a place to be stored during poor weather. In some instances, these buildings are enclosed to prevent theft and vandalism, but most are open to provide easy access.

BUILDING SPECIFICATIONS

Components	Class 1 Fair Quality	Class 2 Average Quality	Class 3 Good Quality
Foundation	Redwood or cedar mudsills	Concrete or masonry piers	Continuous concrete
Floor	Dirt	Concrete	Concrete
Wall Structure	Light wood frame, 10' to 12' eave height	Average wood frame, 10' to 12' eave height	Good wood frame, 10' to 12' eave height
Exterior Wall Cover	Light aluminum or low cost boards	Standard gauge corrugated iron or aluminum	Good wood siding, painted or 26-gauge steel
Roof Construction	Low to medium pitch—shed type, light wood framing	Low to medium pitch—gable or shed type, average wood framing	Low to medium pitch—gable or shed type, good wood framing
Roof Cover	Light aluminum	Standard gauge corrugated iron or aluminum	26-gauge steel, with skylights
Electrical	None	Two outlets per 1,000 square feet	Four outlets per 1,000 square feet
Shape	Usually elongated, width between 20 and 40 feet, any length	Usually elongated, width between 20 and 40 feet, any length	Usually elongated, width between 20 and 40 feet, any length

(Photographs shown on AH 534.10, page 24)

BASIC FARM BUILDINGS

MACHINERY AND EQUIPMENT SHEDS

SQUARE-FOOT COSTS—TYPE I, ALL SIDES CLOSED

	Square-Foot Area										
Class	**500**	**1,000**	**1,500**	**2,000**	**2,500**	**3,000**	**3,500**	**4,000**	**4,500**	**5,000**	**6,000**
1	11.20	10.10	9.40	9.10	8.95	8.80	8.75	8.70	8.60	8.50	8.35
2	16.55	14.45	13.65	13.40	13.10	13.00	12.85	12.65	12.60	12.55	12.15
3	21.40	19.30	17.95	17.65	17.25	17.15	16.95	16.80	16.70	16.60	16.30

SQUARE-FOOT COSTS—TYPE II, ONE SIDE OPEN

	Square-Foot Area										
Class	**500**	**1,000**	**1,500**	**2,000**	**2,500**	**3,000**	**3,500**	**4,000**	**4,500**	**5,000**	**6,000**
1	9.90	8.30	7.80	7.55	7.45	7.30	7.20	7.15	7.10	7.05	7.00
2	15.15	13.00	12.00	11.60	11.25	11.15	11.05	11.00	10.85	10.75	10.70
3	19.75	18.50	17.85	17.15	16.65	16.40	16.25	16.10	16.05	15.90	15.85

Pole Buildings – Deduct 15 to 20 percent from above costs.

BASIC FARM BUILDINGS

PREFABRICATED WOOD STORAGE SHEDS

Prefabricated wood storage sheds are normally purchased at lumber yards and home improvement centers. They are commonly used to house small machinery and equipment.

BUILDING SPECIFICATIONS

Foundation	4" x 4" pressure treated skids
Floor	Plywood or particleboard on 2" x 6" floor joists
Walls Structure	2" x 4" framing on 24" centers, 7' to 8' eave height
Exterior Wall Cover	Plywood or T-1-11 with one 4' x 6' door
Roof	Gable low to medium pitch, 2" x 4" rafters
Roof Cover	Metal or composition shingles

(Photographs shown on AH 534.10, page 25)

SQUARE-FOOT COSTS

Square Feet	Price Per Square Foot
50 to 74	$27.50
75 to 99	$24.10
100 to 139	$21.90
140 to 199	$20.75
200 and up	$17.95 - $20.20

ADDITIVES

Windows	2' x 2'	**$135 each**
	3' x 2'	**$165 each**
Doors—Double 6' Wide		**$150**
Skylight—2' x 2'		**$165**
Turbine Vent		**$85**
Shelves—16" wide		**$4.25** per linear foot
Shelves—24" wide		**$5.25** per linear foot
Workbench—24" wide		**$6.25** per linear foot
Steel roll-up door		**$75** per foot (width)
Loft		**$3.00** per square foot
Extra Concrete		**$5.50 - $6.60** per square foot

BASIC FARM BUILDINGS

SMALL SHEDS

BUILDING SPECIFICATIONS

Components	Class 1 Fair Quality	Class 2 Average Quality	Class 3 Good Quality
Foundation	Redwood or cedar mudsills	Concrete or masonry piers	Continuous concrete
Floor	Dirt	Boards	Concrete
Wall Structure	Light wood frame, 8' eave height	Average wood frame, 8' eave height	Good wood frame, 8' eave height
Exterior Wall Cover	Light aluminum or low cost boards	Standard gauge corrugated iron or aluminum, or average framing	Good wood siding, painted, or steel
Roof Construction	Low to medium pitch—shed type, light wood framing	Low to medium pitch—gable or shed type, average wood framing	Low to medium pitch—gable or shed type, good wood framing
Roof Cover	Light aluminum	Standard gauge corrugated iron or aluminum	Good steel cover; composition shingles
Electrical	None	None	None
Shape	Usually elongated, width between 6 and 12 feet, any length	Usually elongated, width between 6 and 12 feet, any length	Usually elongated, width between 6 and 12 feet, any length

SQUARE-FOOT COSTS—TYPE I, ALL SIDES CLOSED

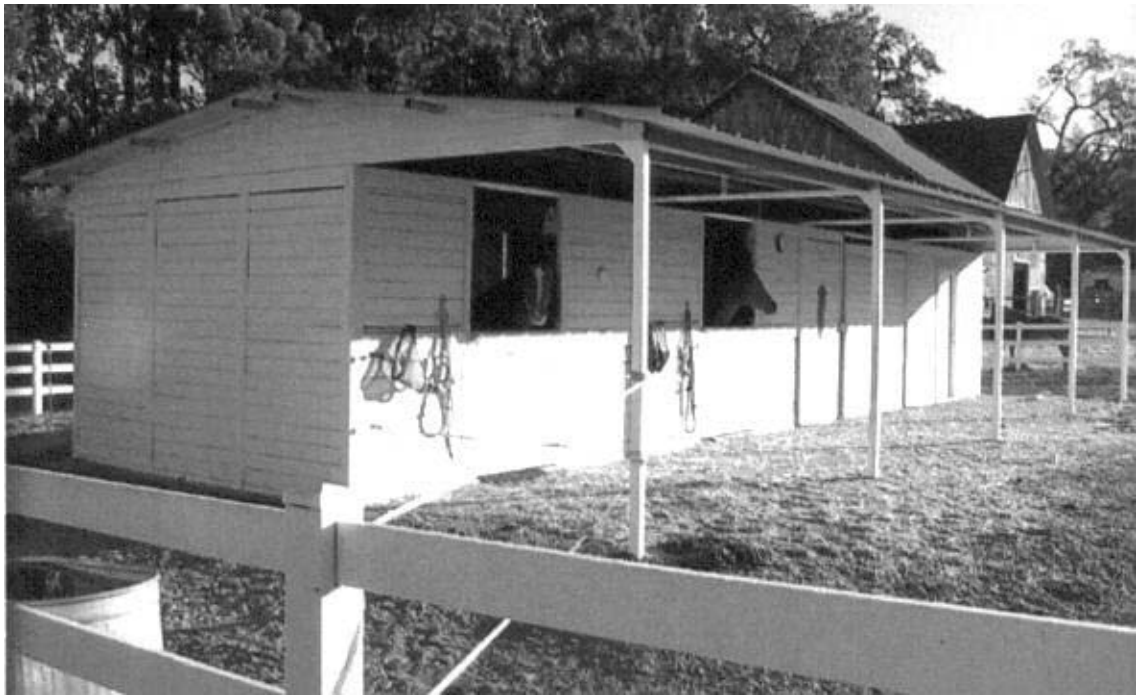
	Square-Foot Area										
Class	50	60	80	100	120	150	200	250	300	400	500
1	19.40	17.60	15.70	13.40	12.90	12.00	11.60	11.15	10.55	10.20	9.75
2	27.30	24.60	22.25	20.50	19.50	18.50	17.70	16.70	15.70	15.25	14.90
3	33.55	30.15	28.75	26.90	25.00	23.00	21.75	20.90	19.90	19.50	19.00

SQUARE-FOOT COSTS—TYPE II, ONE SIDE OPEN

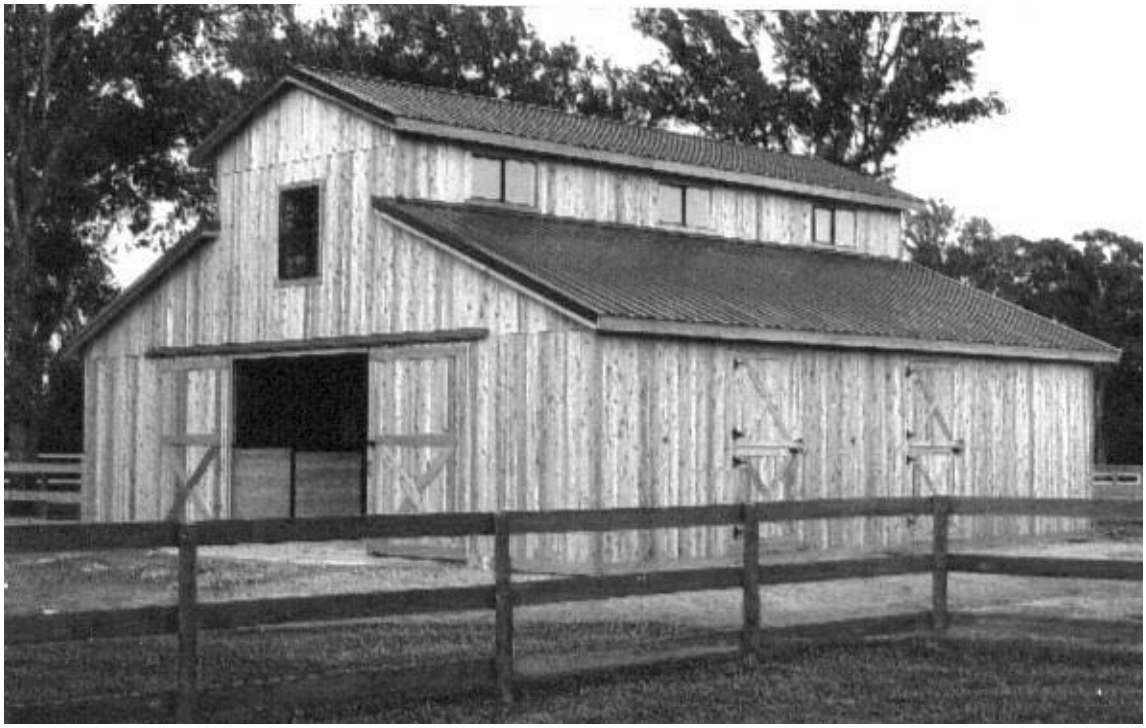
	Square-Foot Area										
Class	50	60	80	100	120	150	200	250	300	400	500
1	13.60	12.30	11.00	9.40	9.00	8.40	8.10	7.80	7.40	7.15	6.80
2	19.15	17.20	15.55	14.30	13.60	13.00	12.40	11.70	11.00	10.70	10.40
3	23.50	21.10	20.10	18.80	17.50	16.15	15.20	14.60	13.90	13.60	13.30

BASIC FARM BUILDINGS

PREFABRICATED HORSE BARNS



SHED ROW WITH 8 FOOT ROOF EXTENSION



GABLE ROOF WITH RAISED BREEZEWAY

BASIC FARM BUILDINGS

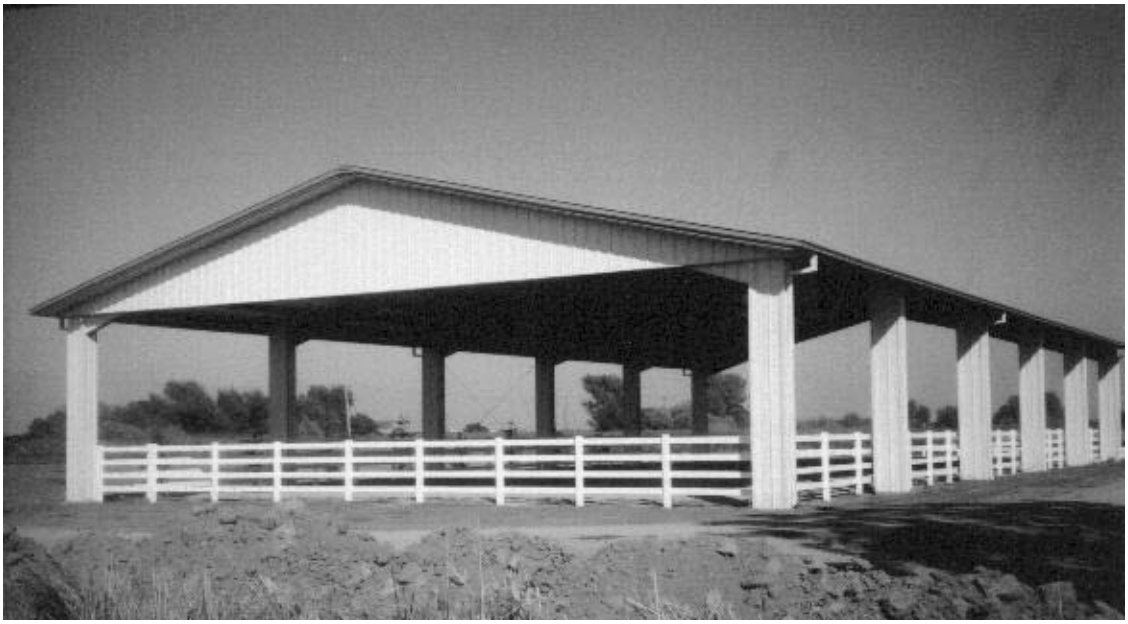
PREFABRICATED HORSE BARNS

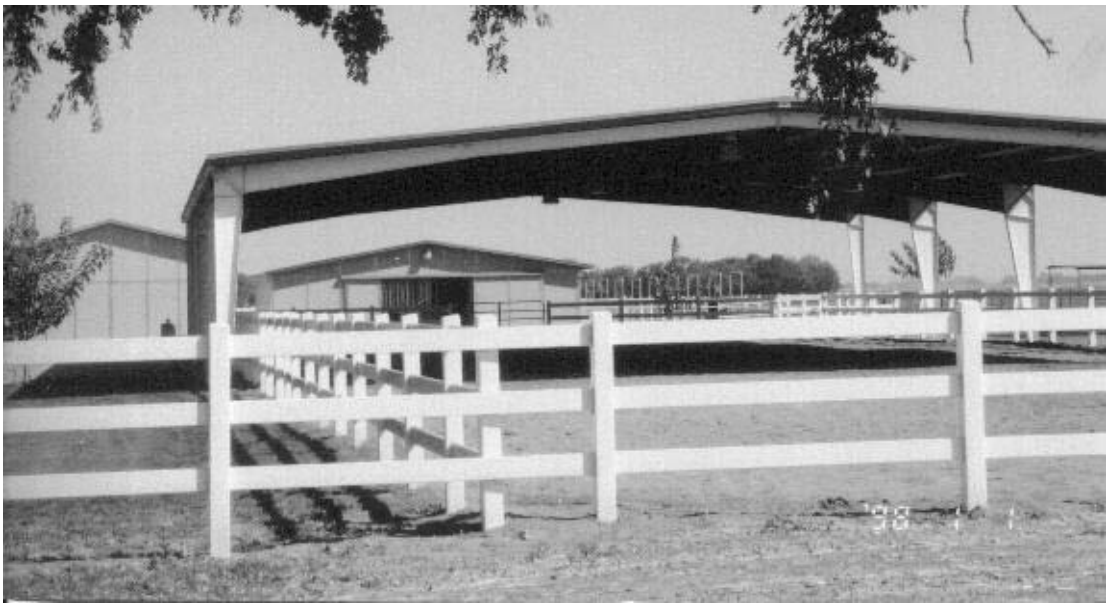
GABLE ROOF—RAISED BREEZEWAY WITH ROOF EXTENSION

12' X 12' STALL

BASIC FARM BUILDINGS

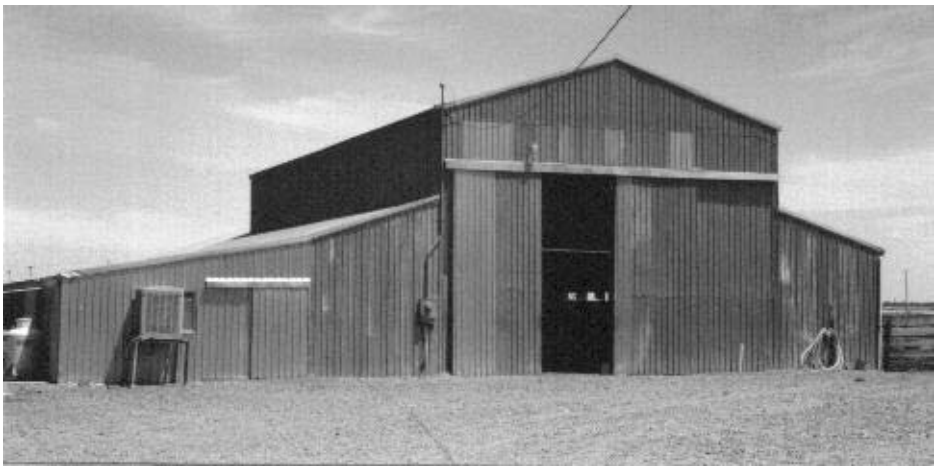
STEEL FRAME RIDING ARENA





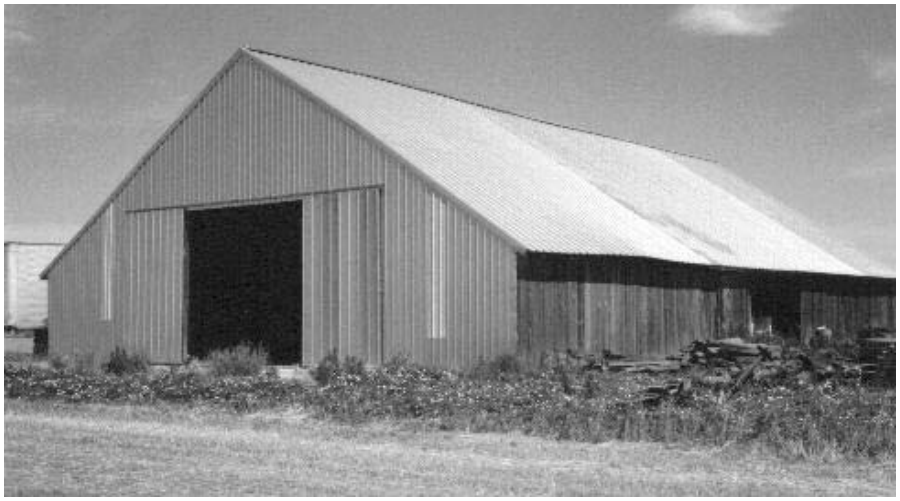
BASIC FARM BUILDINGS

GENERAL PURPOSE BARNS



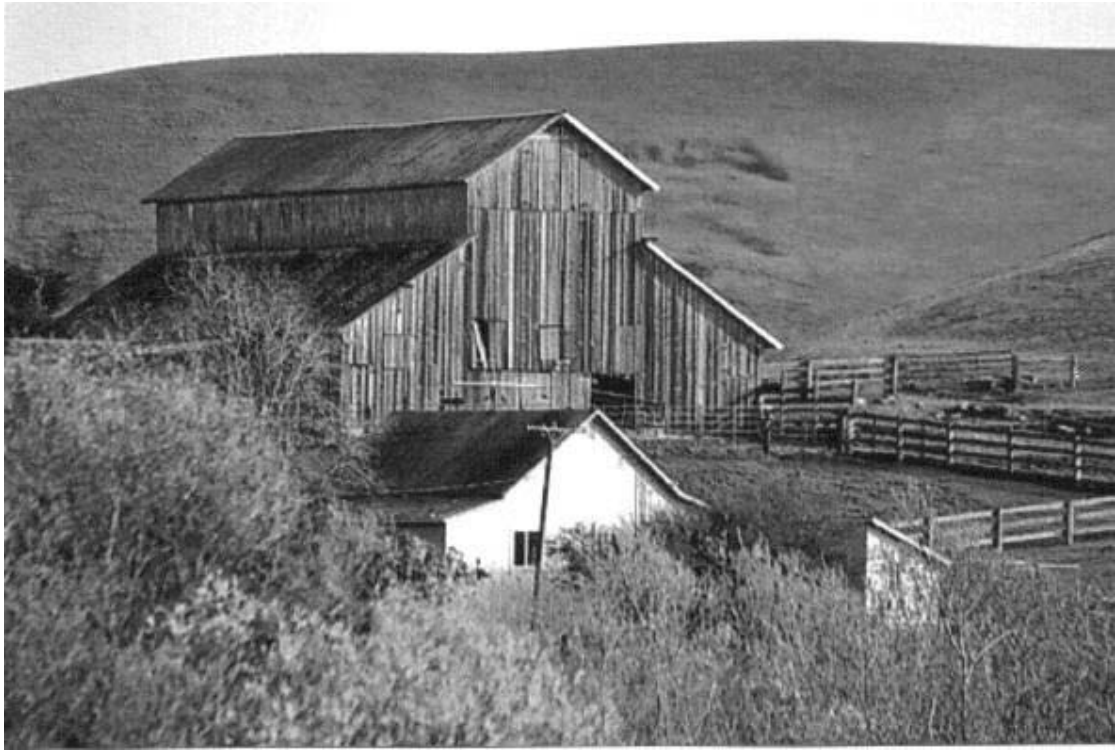
BASIC FARM BUILDINGS

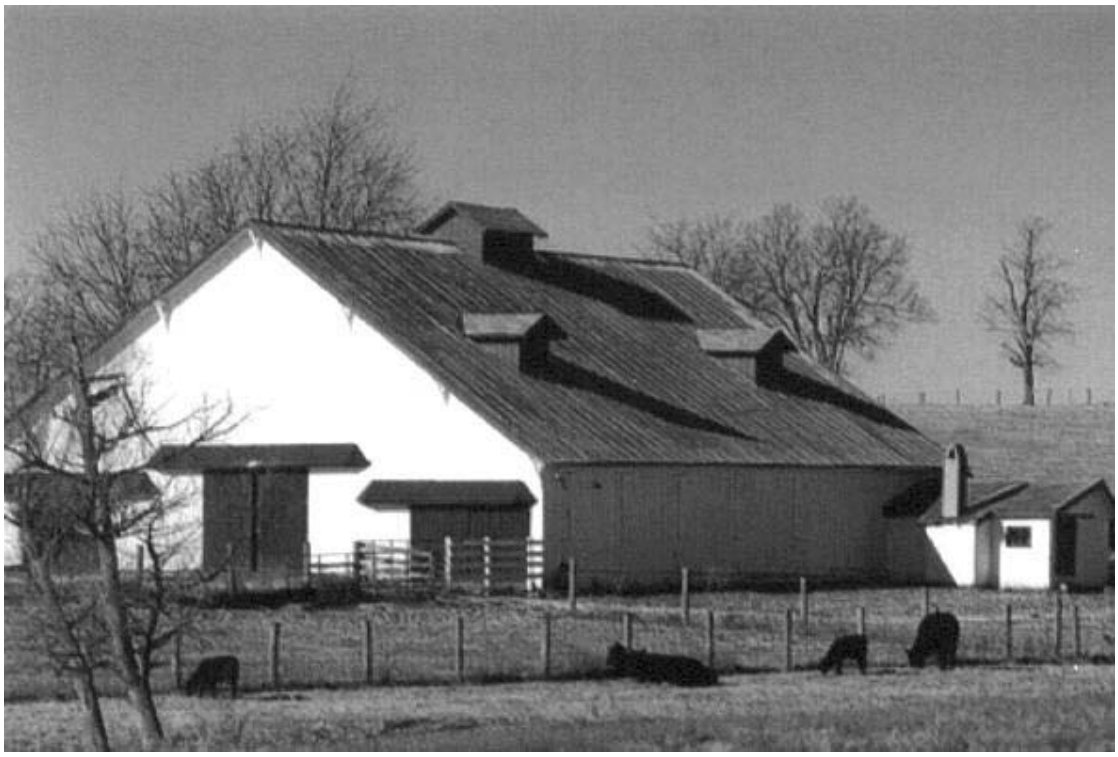
GENERAL PURPOSE BARNS



BASIC FARM BUILDINGS

GENERAL PURPOSE BARNS



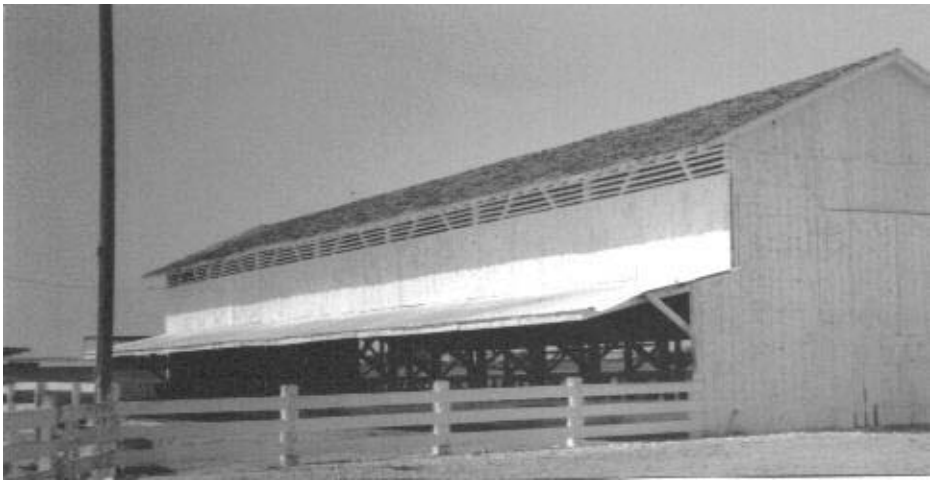


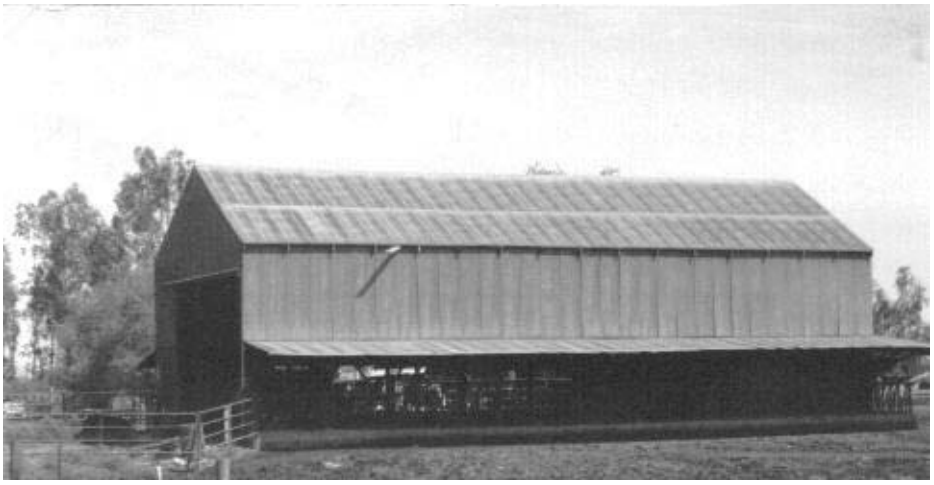
BASIC FARM BUILDINGS

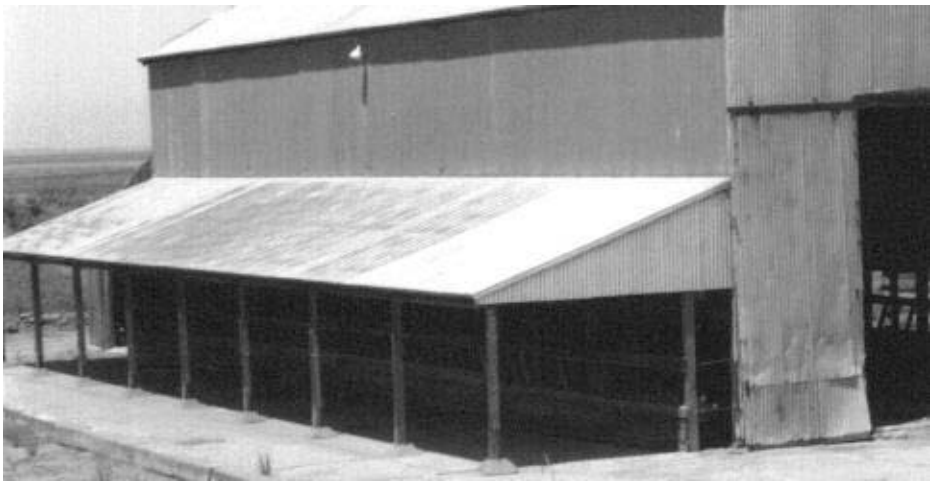
HAY STORAGE BARNS

BASIC FARM BUILDINGS

FEED BARNS





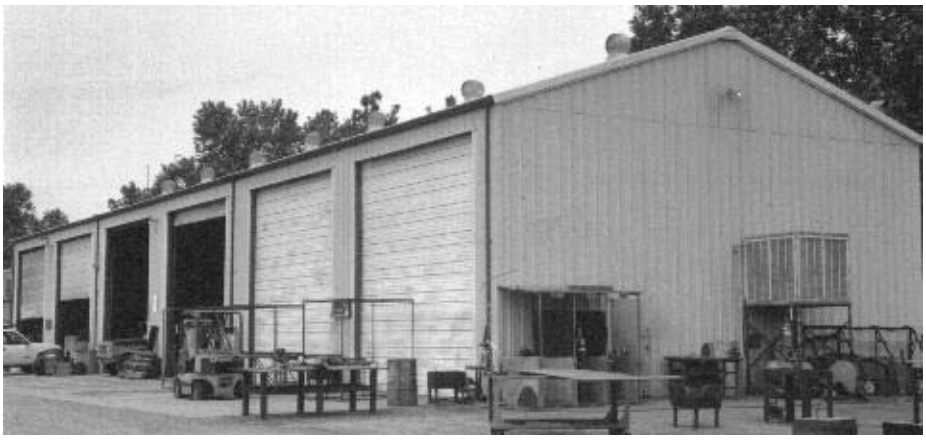


BASIC FARM BUILDINGS

POLE BUILDINGS

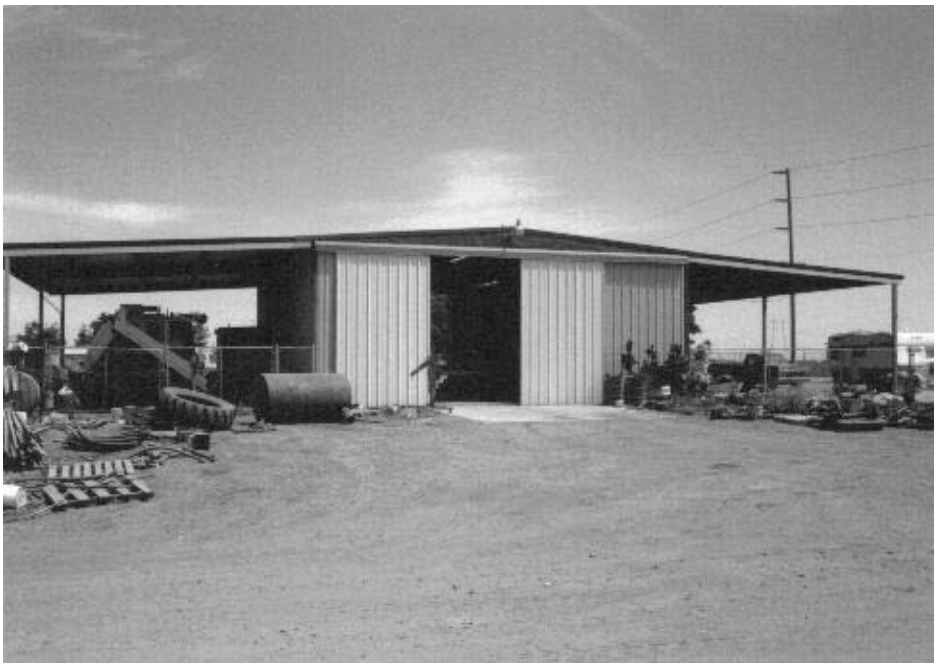
BASIC FARM BUILDINGS

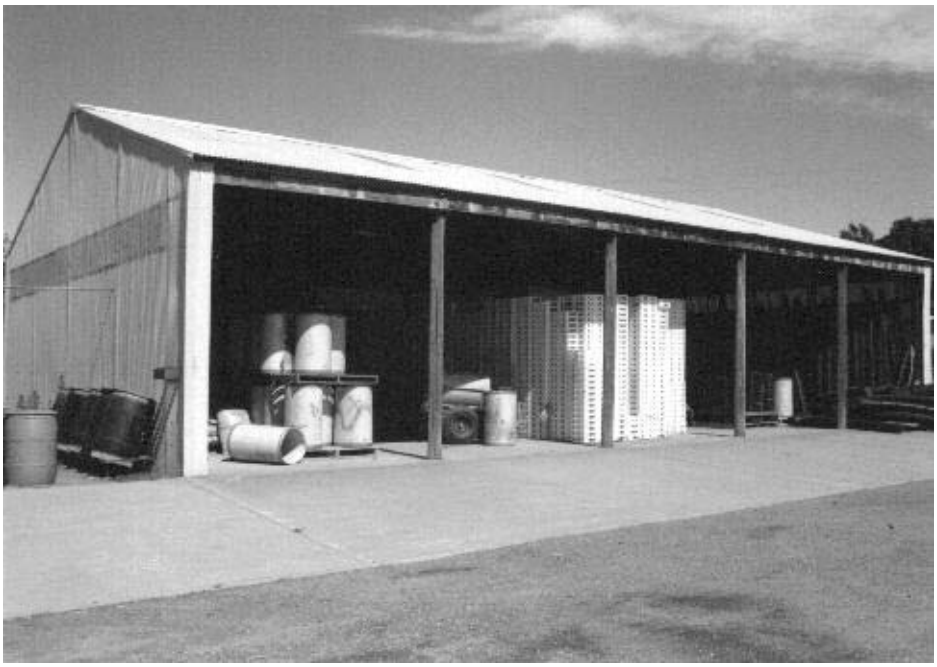
SHOPS



BASIC FARM BUILDINGS

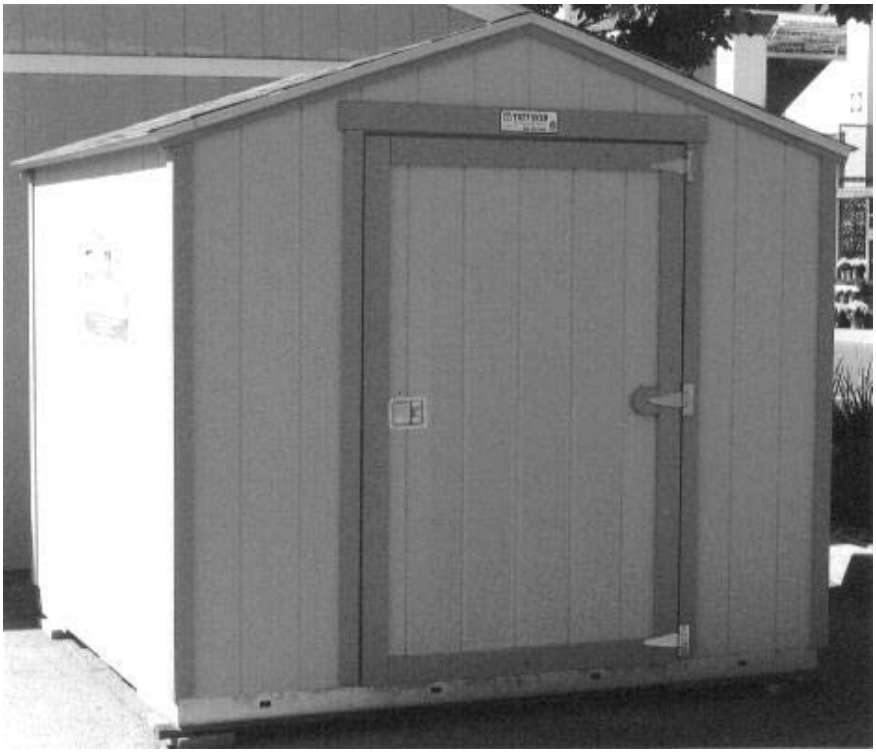
MACHINERY AND EQUIPMENT SHEDS

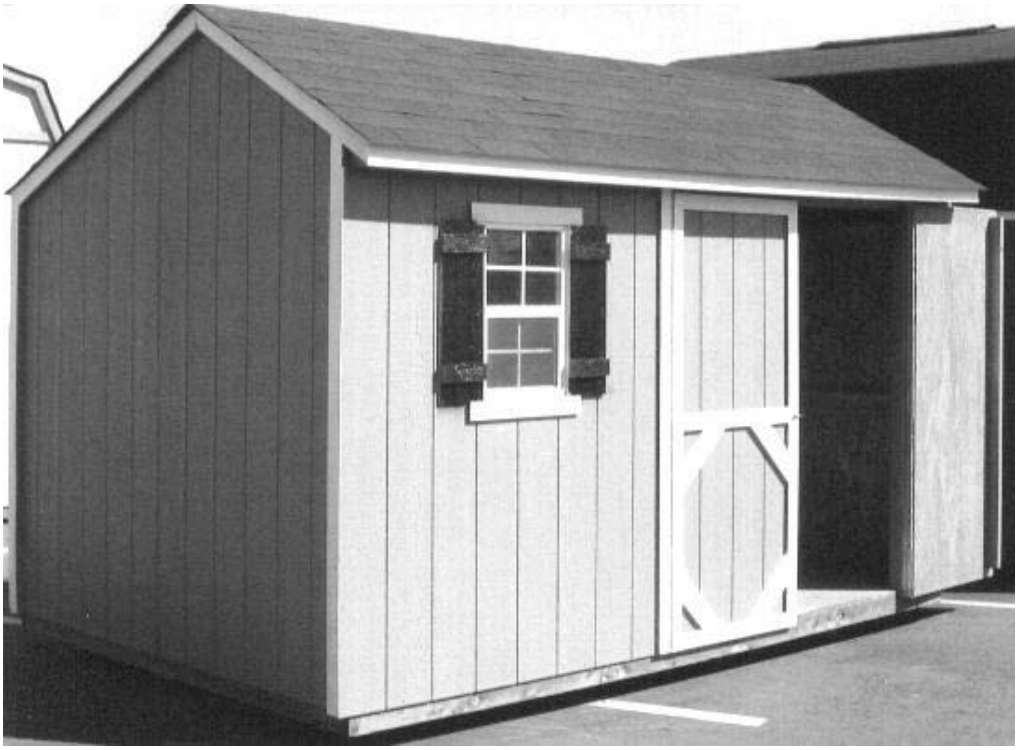




BASIC FARM BUILDINGS

PREFABRICATED WOOD STORAGE SHEDS





AH 534.20: DAIRY BARNS

This chapter contains structures and equipment typically used at a dairy. Specifications and costs are provided for the following:

- Commonly used milking parlors
- Modern Herringbone barns
- Parallel barns
- Rotary barns
- Milking parlor
- Holding, wash, and drip area equipment
- Dairy equipment
- Freestall barn
- Hospital barn
- Corrals
- Commodity barns
- Hay barns
- Miscellaneous equipment
- Septic tanks
- Barn fans
- Feedlane stanchions with curb
- Silage pits
- Liquid manure systems
- Painted steel bulk feed tanks on concrete pad/with hopper bottom
- Grade "B" barns
- Stanchion barns
- Walk-through type barns

Photographs or drawings showing examples of the buildings discussed are located at the end of the chapter.

DAIRY BARNS

COMMONLY USED MILKING PARLORS

Three of the most common styles of milking barns found in California are referred to as the Herringbone, the Polygon, or the Parallel because of their design. The type most frequently found is the Herringbone or sawtooth design which also has several variations. For instance, the Polygon design is a parlor using multiple sets of Herringbone stalls. The Parallel design is gaining in popularity, especially in larger parlors. All three of these parlors have a central pit for the milker, with the cows elevated on one or all sides. An additional type is the Rotary parlor.

(Drawings with descriptions shown on AH 534.20, pages 14 - 16)

MODERN HERRINGBONE, PARALLEL, OR ROTARY

The high end of the cost range is for Sacramento and Northern California

The major electrical components to run the milking equipment—mains and subpanels, breakers and master start switches—are considered fixtures and are not included in building costs.

EQUIPMENT ROOM, OFFICE, BREEZEWAY, MILK ROOM, RESTROOM, BATH

Components	Average Quality	Good Quality
Foundation	Reinforced concrete	Reinforced concrete
Floors	Concrete slab	Concrete slab, reinforced
Walls	8" concrete block	Concrete block
Exterior	Stucco or concrete block	Stucco and masonry veneer, split face
Roof Structure and Roofing	Average wood frame, corrugated iron roofing	Good wood frame, good quality roofing or steel beams and good steel roofing or tile, skylights, gutters
Windows	Metal sash, 10 percent of wall area	Metal sash, 10 percent of wall area
Interior	Smooth finish plaster—cove base	Tile floors and walls, many areas
Electrical	Conduit—average fixtures	Conduit—excellent lighting and ample outlets
Plumbing	One stainless steel sink, one water heater, one lavatory, one water closet, usual floor drains	One stainless steel sink, one water heater, ¾ bath, vinyl floor and tape, textured walls, usual floor drains
Square-Foot Cost	**$57.75 to $66.00** per square foot	**$66.00 to $72.60** per square foot

(Drawings and photographs shown on AH 534.20, pages 15 – 20)

DAIRY BARNS

MILKING PARLOR

Foundation	6" reinforced concrete
Floors	Concrete slab—well-formed gutters and mangers
Walls	6" or 8" concrete block or reinforced concrete 60" high with 2" x 6"—16" on center framing above, or all concrete block
Roof Structure and Roofing	Average wood frame, corrugated iron roofing or steel beams, good steel roofing, skylights
Windows	Metal sash or metal louvers
Interior	Smooth plaster on entire surface of block walls or some combination of tile and plaster of good quality
Electrical	Conduit—average fixtures; ample lighting
Plumbing	Usual floor drains and hose bibs
Square-Foot Cost	**Without gates and feeding equipment—$38.50 to $48.00** per square foot

Total Building Cost: includes equipment room, milk room, office, bath, supply, milking parlor, and wash and drip area—Average quality **$45.00 to $57.00** per square foot
Good quality **$58.00 to $63.00** per square foot

HOLDING, WASH, AND DRIP AREA EQUIPMENT

Floor or Ramp	Sloping concrete with carborundum finish. **$3.60 - $4.20** per square foot
Walls	Concrete block 5' to 6' high with smooth plaster. **$45.00 to $50.00** per linear foot
Metal Rail Fence	Welded pipe 7'—10' o.c. in concrete. **$12.00 - $14.00** per linear foot
Cable Fence	1 1/4" top rail, 2 7/8" post, 7' o.c. 3 cable—**$9.00 to $9.70** per linear foot 4 cable—**$10.00 to $11.00** per linear foot
Gates	54" high, pipe with bracing. **$15.00** per linear foot of gate width
Sprinkler System	Hooded sprinkler, including pump. **$152 - $185** per sprinkler, or per double 30 barn—60 cows **$19,160 - $21,525**
Roof Structure and Roofing	Average quality: Pipe supports, wood or light steel frame and corrugated iron roofing—**$5.25 to $7.90** per square foot Good quality: Box beam columns, hot-dip galvanized and box beam galvanized rafters and purlins; quality steel roofing with skylights and electric lighting—**$8.60 to $10.10** per square foot
Total Area Cost Including All Components	**$21.50 - $25.90** per square foot

(Photograph shown on AH 534.20, page 21)

DAIRY BARNS

DAIRY EQUIPMENT

PARALLEL STALLS (DOUBLE 30)

2' x 30' parallel stall package includes galvanized reels, reel support post, sequencing panels, galvanized rump rail assembly, kick bar support, entrance gate, and hardware. 2' x 30' parallel drive kit includes air controls, air tubing, rump panels, drive guards, air cylinders, hardware, stainless steal curbing, and top rail. Air operated catch lane gates include air control ram, hardware to mount, step ladders with hand rails (front), and miscellaneous hardware.	$107,400

VACUUM PUMP

Air vacuum pump with 30 HP motor, stand, pulleys, belts, guards, filter assembly, miscellaneous pipe valves, and electrical.	$11,550

PIPELINE AND EQUIPMENT

Claws with pulsators and pulsator controller, master control panel, 2 HP milk pump, milk receiver, jetter assembly and hose, fresh air kit, clean-in-place sink. Also includes all stainless steel pipelines, elbows, valves, all PVC lines, electrical wiring and panels, and miscellaneous hardware.	$93,900

MILK TRANSFER SYSTEM

Control assembly and miscellaneous equipment.	$4,900

DETACHERS

Air operated retraction with both manual and automatic operation, indicator lights indicating milking mode and milk flow, air operated shutoff valve/sensor combination, all related electric wiring, air filter, and hardware.	$81,600

MILK TANKS (7,000 GALLON)

2 stainless steel 7,000-gallon tanks with agitators and wash pumps. Includes control panel, calibration gauge, temperature recorder with probe assembly, hot milk alarm, miscellaneous piping, and electrical.	$116,300

REFRIGERATION SYSTEM

Freon compressor, air condensers, related hardware, pipes, valves, and electrical. Plate cooler with 100 plates and all hardware.	$52,500

Above costs include tax and labor

DAIRY BARNS

DAIRY EQUIPMENT

HEAT RECOVERY SYSTEM

Heat recovery system and all hardware.	$11,600

HOT WATER SYSTEM

Boiler with insulated 500-gallon storage tank, insulated piping, and electrical.	$16,400

SPRINKLER PEN HARDWARE

Pumps, sprinklers, and all related pipelines and miscellaneous hardware.	$22,100

AIR COMPRESSOR

10 HP air compressor with 120-gallon tank. Includes miscellaneous hardware and electrical.	$8,700

ELECTRIC OR AIR CROWD GATE

30 to 50 foot electric gate with track and control kit, motor, panel, and electrical.	$23,600

Above costs include tax and labor

EQUIPMENT ONLY (Including tax and labor)

Double 14' Parallel	Total - **$311,000 to $326,400**
Double 16' Parallel	Total - **$342,700 to $357,000**
Double 18' Parallel	Total - **$367,200 to $408,000**
Double 24' Herringbone	Total - **$448,800 to $484,500**
Double 25' Parallel	Total - **$464,100 to $489,600**
Double 30' Parallel	Total - **$510,000 to $555,900**
50-Cow Rotary Barn	Total - **$622,200 to $714,000**
70-Cow Rotary Barn	Total - **$867,300 to $997,400**

DAIRY BARNS

FREESTALL BARN

STANCHIONS, LOOPS, AND FENCES

Foundation	Reinforced concrete
Floors	Sloping concrete with dirt in loop areas. Concrete drive lanes and flush areas.
Walls	Open; poles with steel supports
Roof Structure	Steel frame with steel cover; good quality, with gutters
Electrical	Minimum lighting
Plumbing	Water troughs in each pen with underground flushing
Stanchions	Steel; self locking – 5 hole per 10 feet
Fencing	Cable with steel or wood posts
Capacity	250 to 600 cows; one stanchion per cow
Cost	**$915 to $1,170** per stanchion **or $9.15 to $11.70** per square foot

Some barns now have 10 percent more stanchions and cows than beds.

Hot dipped galvanized steel framed barns – add 5 percent to above costs.

Cow water beds – **$153 to $188** each

(Photographs shown on AH 534.20, page 22)

HOSPITAL BARN

AVERAGE QUALITY

Floors	Concrete slab with flush curbs
Walls	Light steel poles, all sides open
Roof	Average wood frame or light metal, with metal cover
Interior	Several small pens with metal pipe fencing and gates and water troughs
Electrical	Average light fixtures
Plumbing	Concrete water troughs
Cost	**$7.40 to $8.00** per square foot

Hospital barns without small divided pens, with dirt floors, low to average quality: **$5.00 to $6.00** per square foot

(Photograph shown on AH 534.20, page 23)

DAIRY BARNS

CORRALS

Components	Cost
Concrete Flatwork Large areas/not reinforced	4" to 4½"—**$2.10 to $2.40** per square foot 6"—**$2.50 to $3.05** per square foot
Rubber Belting	**$1.55 to $2.35** per square foot
Curbs	8" x 16"—**$7.35** per linear foot 8" x 24"—**$8.90** per linear foot
Cable Fence	2 3/8" top rail, 2 7/8" post—10' o.c. 3 cable—**$9.15 to $9.70** per linear foot 4 cable—**$9.75 to $11.00** per linear foot
Concrete Water Tank	**$575 to $630** each
Steel Stanchions Without Stanchion Curb	**$45.15 to $50.40** each hole **$24.60 to $27.80** per linear foot
Steel Self-Locking Stanchions Without Stanchion Curb	**$48.00 to $52.00** each hole **$23.50 to $26.50** per linear foot
12" PVC Flush Line	**$11.55 to $13.10** per foot
Sump Pumps	3 HP **$2,845 to $3,045** 5 HP **$3,830 to $4,040**
Floating Agitator Pump	75 HP **$18,375 to $20,575** 40 HP **$14,175 to $15,225**
Gates	12' to 16'—**$180 to $225** each
Loafing Sheds	Wood—**$4.40 to $5.65** per square foot Steel—**$5.25 to $6.70** per square foot

COMMODITY BARNS

	Per Square Foot
With Dividers	$12.45 - $18.50
Without Dividers	$10.75 - $14.40

(Photograph shown on AH 534.20, page 23)

COMMODITY BARN ADDITIVES

Concrete Dividers—8' high 6" thick	**$127.00** per linear foot or **$15.90** per square foot

HAY BARNS

Floors	Dirt
Walls	Open; used oil field pipe to support roof
Roof	20' eve; low pitch; light wood or steel frame; metal cover
Electrical	None
Plumbing	None
Cost	**$3.65 to $4.50** per square foot

(Photograph shown on AH 534.20, page 24)

DAIRY BARNS

MISCELLANEOUS EQUIPMENT

CURBS

	Per Linear Foot
8" x 8"	$3.60 to $4.70
8" x 16"	$7.20 to $8.20
8" x 20"	$8.20

CABLE FENCE

	Per Linear Foot
2 3/8" top rail with	3 cable—$9.00 to $9.50
2 7/8" post 10' o.c.	4 cable—$9.50 to $10.50
	5 cable—$10.00 to 11.00
Cattle guard	$1,287.50 to $1,854.00 each

SOLID RAIL FENCE

	Per Linear Foot
(4) 2 3/8" rails with 2 7/8" post 10' o.c.	$12.35 to $13.95

TANKER PAD

	Per Square Foot
6" to 7" rebar reinforced concrete with footings	$2.85 to $3.35

WATER TROUGHS

Concrete water troughs - 2' x 12'	$440 to $460
Concrete water troughs - 2' x 16'	$490 to $595
Mineral troughs - 20'	$165 to $195

CORRAL SHADES

	Per Square Foot
Pipe poles, wood frame, metal cover	$2.20 to $2.45
Pipe poles, steel frame, metal cover	$2.45 to $2.95

WATER LINES

2" Water line	$2.35	per linear foot
3" Water line	$2.60	per linear foot
12" Flush line	$12.60	per linear foot
18" Drain line	$22.00	per linear foot
Flush valves	$1,575	each
Drain boxes	$1,680	each

DAIRY BARNS

SEPTIC TANKS

1,000 – 1,500 gallon with lines	$3,675 to $4,200
Cistern - per gallon	$.65 to $.70

BARN FANS

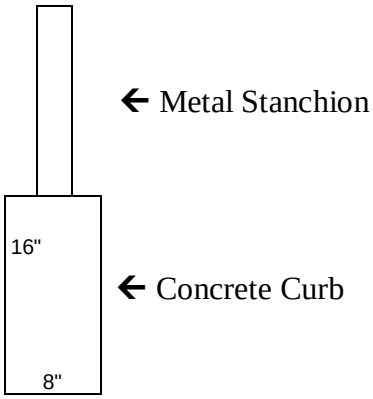
With misters and automatic controls	$735 to $945 each—installed

FEEDLANE STANCHIONS WITH CURB

Galvanized stanchions, 5–hole/10'
Cow-type self-locking with release
with 2 7/8" post in 8" x 16" concrete curb

Cost Per Linear Foot: **$33.90 to $35.50**, stanchion and curb only

Additional concrete
- Drivelane 6" reinforced - **$2.50 to $3.05** per sq. ft.
- Walklane 4" concrete - **$2.10 to $2.35** per sq. ft.
- Flush curb 8" x 8" - **$4.00** per linear foot



Cow lane 12' wide with locking stanchions and stanchion curb and 10' feed lane	**$84.00 to $86.00** per linear foot

(Photograph shown on AH 534.20, page 25)

SILAGE PITS

Tilt-up of 6" concrete or 8" reinforced concrete block, 8' high, and enclosed on three sides with 6" concrete slabs.

Size	Price Per Square Foot
75 x 100	$5.75
100 x 200	$4.80
100 x 300	$4.55

Concrete Silage Slab Only
5 ½" to 6" reinforced with footings - **$3.10 to $3.60** with footings
6" rebar reinforced with footings - **$3.70 to $4.20**

(Photograph shown on AH 534.20, page 25)

DAIRY BARNS

LIQUID MANURE SYSTEMS (MANURE SEPARATOR)

Cost includes tanks, pumps, screens, valves, pipes, sump, and drainage system, but excludes cost of all holding ponds or lagoons. Typically one unit per 800 to 1,000 cows. **$42,000 to $55,000**

(Drawing shown on AH 534.20, page 26)

STEEL BULK FEED TANKS ON CONCRETE PAD WITH HOPPER BOTTOM

Components	Cost
5 Ton	$1,980
9 Ton	2,750
10.5 Ton	2,700
13 Ton	3,300
15 Ton	3,900
20 Ton	4,750
25 Ton	5,180
31 Ton	6,260
34 Ton	6,300
40 Ton	7,140
45 Ton	8,190
60 Ton	9,000

(Photographs shown on AH 534.20, page 27)

ADDITIVES AND ACCESSORIES

Feeder lines (Per linear foot)	$7.00
Partition	$3.10
Ladder	$205 to $255
Augar	$305 to $405

DAIRY BARNS

GRADE "B" BARNS

Use upper end of cost range for Sacramento Valley and north

MILK HOUSE

Foundation	Concrete
Floors	Concrete slab
Walls	6" or 8" concrete block 36" high with 2" x 4"—16" on center framing above
Roof	Average wood frame, corrugated iron, or aluminum cover
Windows	Metal sash or metal louvers, 5 percent of wall area
Interior	Smooth finish plaster
Electrical	Fair fixtures
Plumbing	One wash basin
Square-Foot Cost	**$39.00 to $54.00** per square foot (including breezeway)

MILKING BARNS

Foundation	Light concrete
Floors	Concrete—cow stands
Walls	Box frame, 4" x 6"—10' on center
Roof	Average wood frame, wood shingles, corrugated iron, or aluminum cover
Windows	Barn sash
Interior	Unfinished
Electrical	None
Plumbing	None
Stanchions	Wood stanchions
Square-Foot Costs	**$16.50 to $20.90** per square foot

Building costs do not include milking equipment

(Drawing with labels shown on AH 534.20, page 28)

DAIRY BARNS

STANCHION BARNS

High end of range in cost is for Sacramento and Northern California

MILK, WASH, AND EQUIPMENT ROOMS

Foundation	Reinforced concrete
Floors	Concrete slab
Walls	6" or 8" concrete block 36" high with 2" x 4"—16" on center framing above
Roof	Average wood frame, corrugated iron, or aluminum cover
Windows	Metal sash or metal louvers, 10 percent of wall area
Interior	Smooth finish plaster—cove base
Electrical	Conduit—average fixtures
Plumbing	One wash basin—usual floor drains
Square-Foot Cost	**$41.00 to $49.60** per square foot (including breezeway)

MILKING BARNS

Foundation	Reinforced concrete
Floors	Concrete—well-formed gutters and mangers
Walls	6" or 8" concrete block 36" high with 2" x 4"—16" on center framing above
Roof	Average wood frame, corrugated iron, or aluminum cover
Windows	Metal sash or metal louvers
Interior	Smooth plaster 36" high
Electrical	Conduit—average fixtures
Plumbing	Usual floor drains and hose bibs
Stanchions	Metal stanchions
Square-Foot Cost	**$41.00 to $49.00** per square foot

FEED ROOM

Foundation	Reinforced concrete
Floors	Concrete slab
Walls	2" x 4" or 2" x 6"—16" on center framing
Roof	Average wood frame, corrugated iron, or aluminum cover
Windows	None
Interior	Unfinished
Electrical	Conduit—average fixtures
Plumbing	None
Square-Foot Cost	**$16.00 to $27.00** per square foot

Building costs do not include milking equipment

(Drawing with labels and descriptions shown on AH 534.20, page 29)

DAIRY BARNS

WALK-THROUGH TYPE BARNS

High end of the range in cost is for Sacramento and Northern California

MILK, WASH, AND EQUIPMENT ROOMS

Foundation	Reinforced concrete
Floors	Concrete slab
Walls	6" or 8" concrete block 36" high with 2" x 4"—16" on center framing above or all concrete block
Roof	Average wood frame, corrugated iron, or aluminum cover
Windows	Metal sash or metal louvers, 10 percent of wall area
Interior	Smooth finish plaster—cove base
Electrical	Conduit—average fixtures
Plumbing	One wash basin—usual floor drains
Square-Foot Cost	**$34.50 to $36.75** per square foot (including breezeway)

MILKING BARNS

Foundation	Reinforced concrete
Floors	Concrete—well-formed gutters and mangers
Walls	6" or 8" concrete block 36" high with 2" x 4"—16" on center framing above, or all concrete block
Roof	Average wood frame, corrugated iron, or aluminum cover
Windows	Metal sash or metal louvers
Interior	Smooth plaster 36" high
Electrical	Conduit—average fixtures
Plumbing	Usual floor drains and hose bibs
Stanchions	Metal stanchions
Square-Foot Cost	**$31.50 to $34.50** per square foot

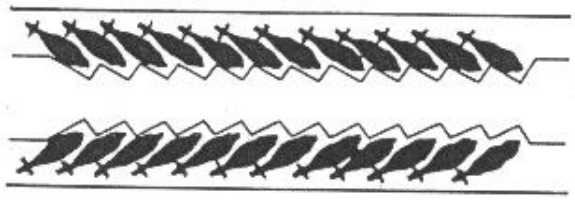
Building costs do not include milking equipment

(Drawing with labels and descriptions shown on AH 534.20, page 30)

DAIRY BARNS

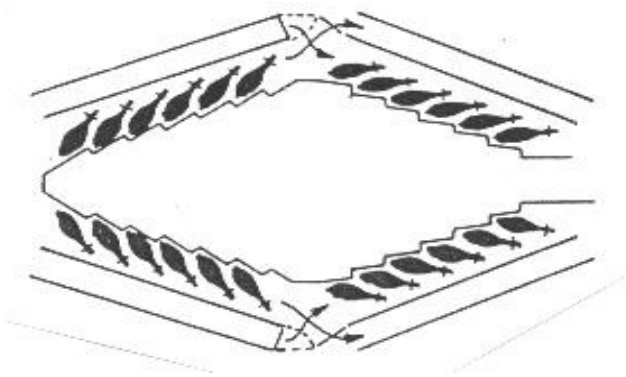
COMMONLY USED MILKING PARLORS

HERRINGBONE (DOUBLE 12)



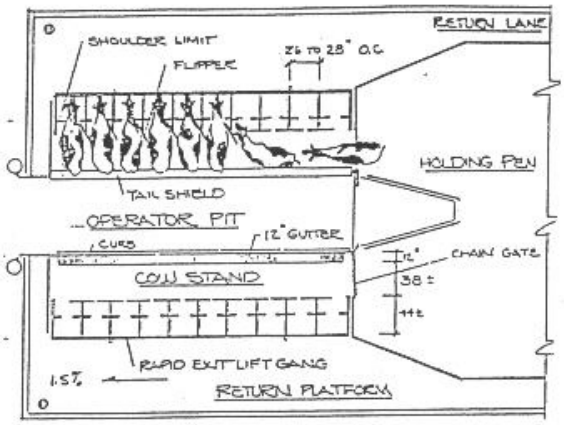
All cows on either side of the pit enter and leave as a group. Newer parlors may have 20 to 30 cows to a side. Some have rapid exit group side release.

POLYGON



Each of the four sides has separate group entry and exit. Usually each side is a herringbone configuration, but can have angle modifications.

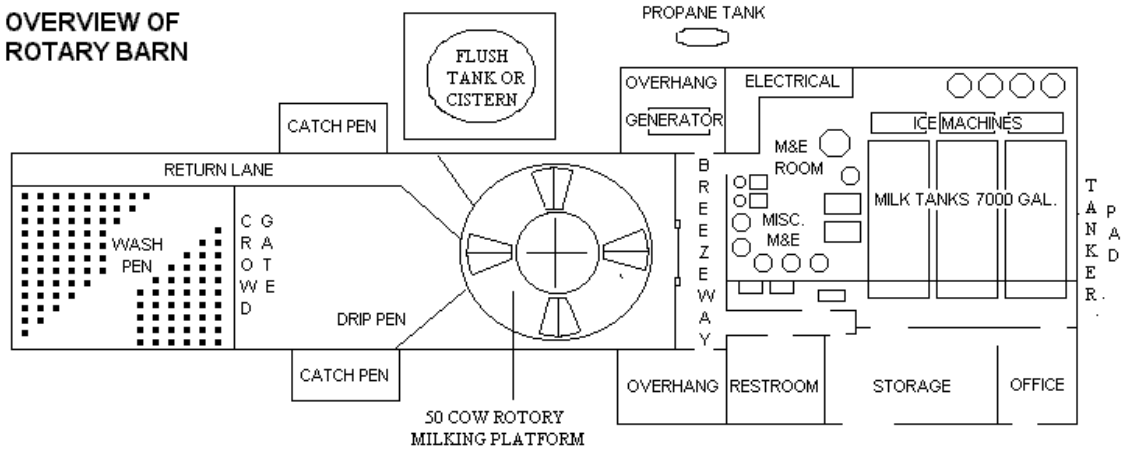
PARALLEL (DOUBLE 10)

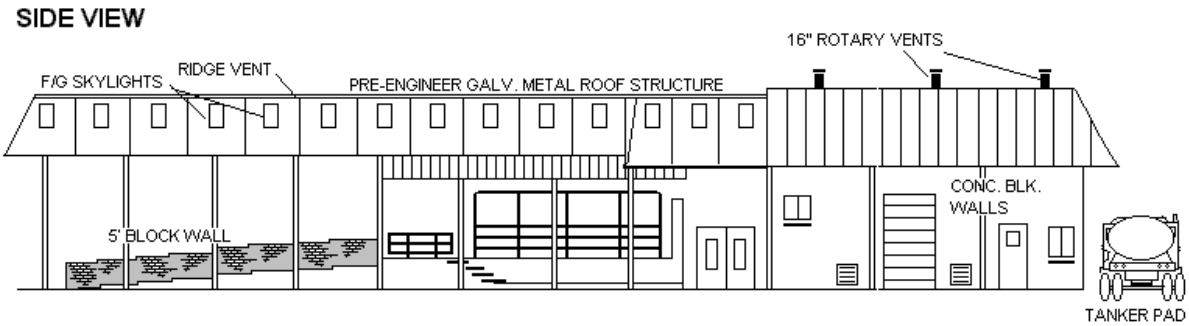


In this design, cows are milked from the rear, rather than the side. Thus, more cows can be milked in a given space than with other designs. Usually a rapid gang exit is present. Typical size is a double 20' to 30'.

DAIRY BARNS

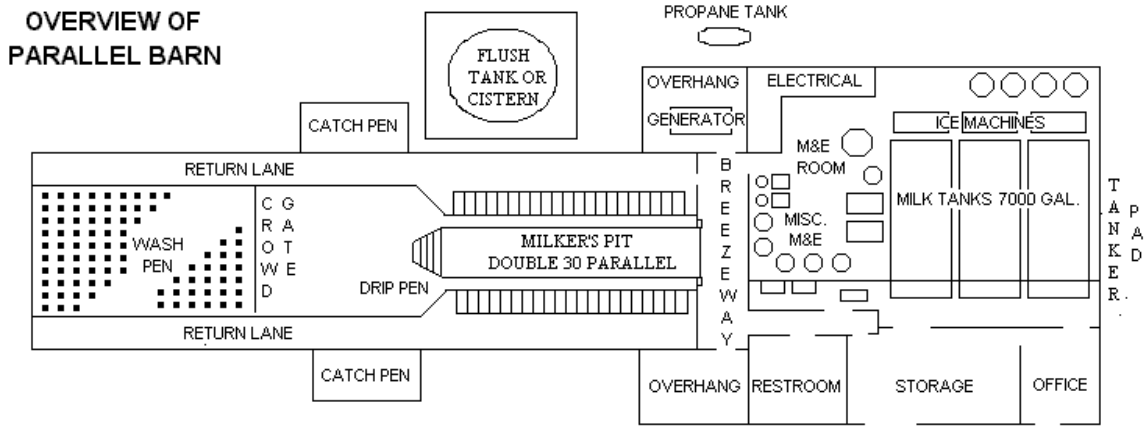
50-COW ROTARY BARN

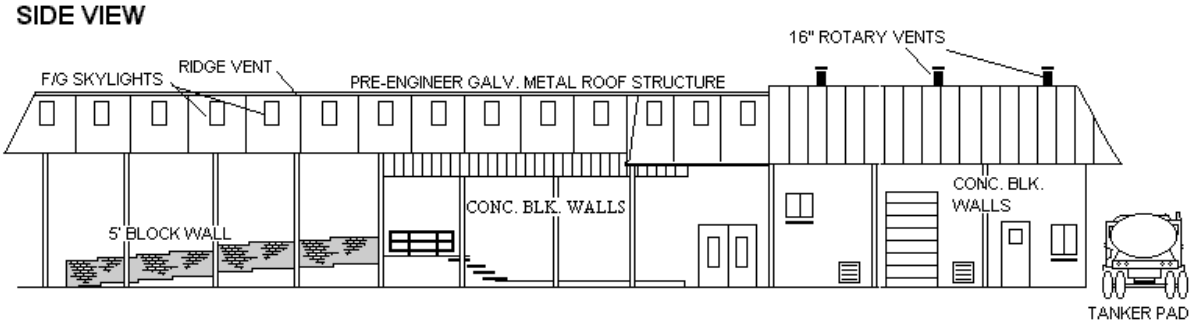




DAIRY BARNS

DOUBLE 30 PARALLEL BARN





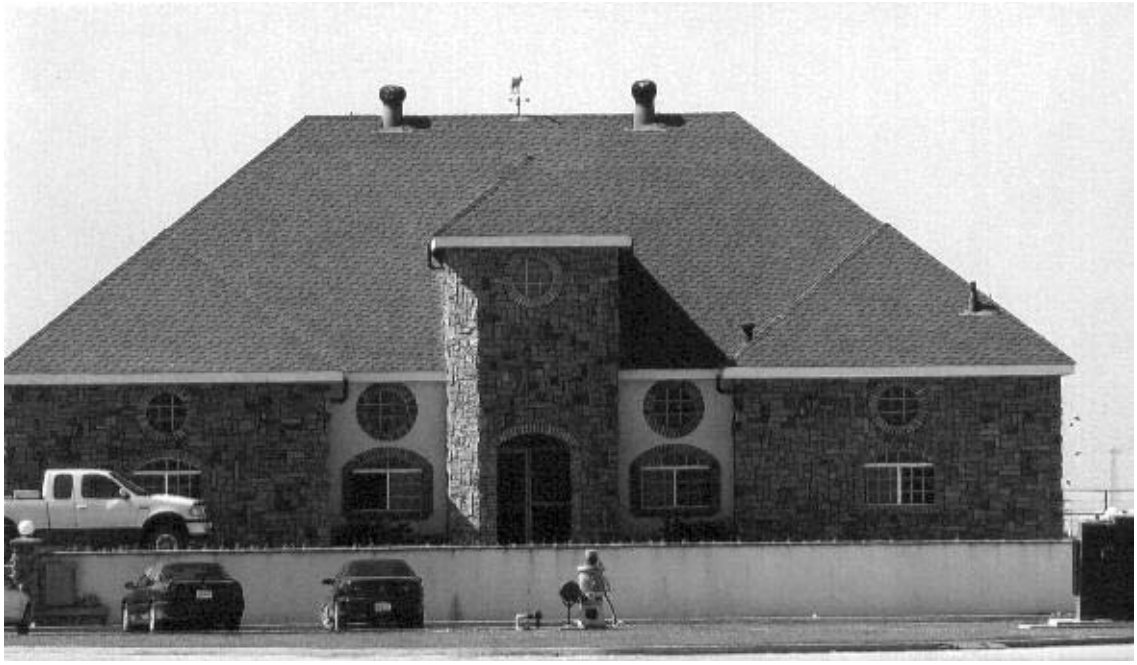
DAIRY BARNS

50-COW ROTARY MILKING PARLOR

DAIRY BARNS

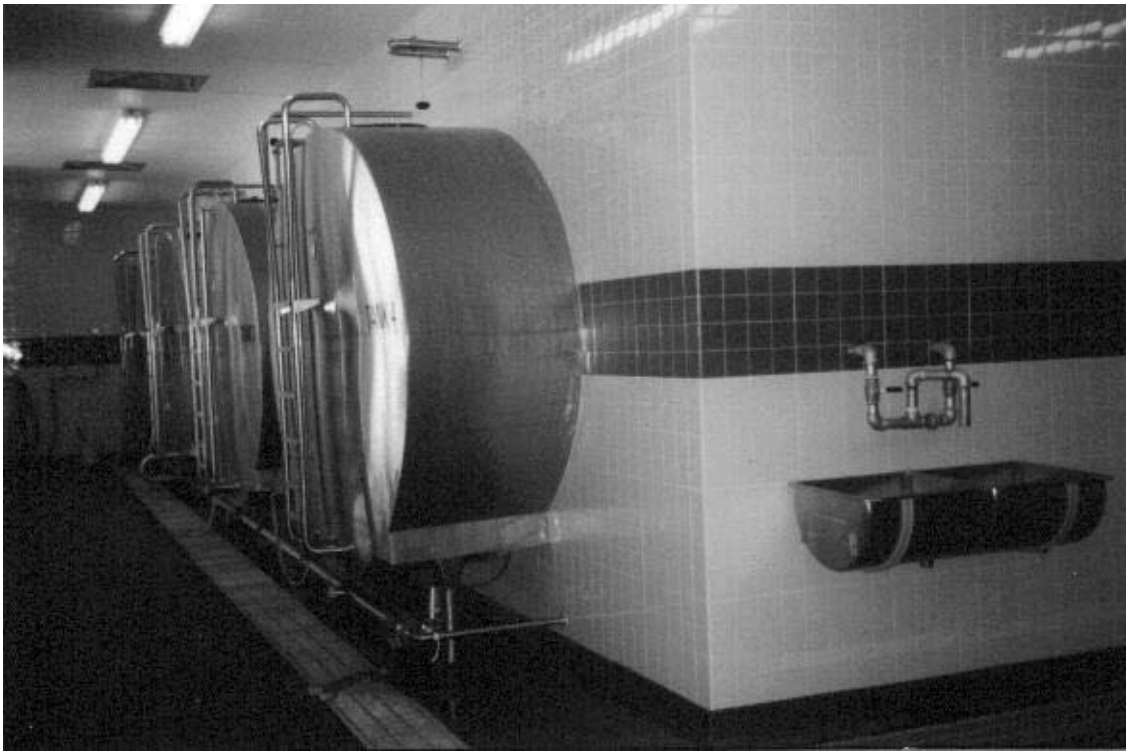
EXTERIOR MODERN HERRINGBONE, PARALLEL, OR ROTARY

Equipment, office, milk room



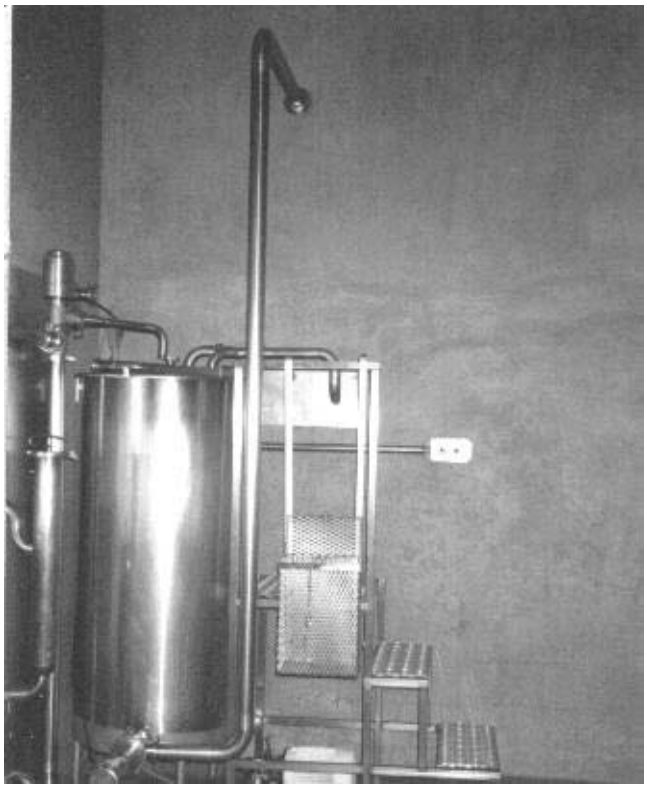
DAIRY BARNS

INTERIOR MODERN HERRINGBONE, PARALLEL, OR ROTARY



DAIRY BARNS

INTERIOR MODERN HERRINGBONE, PARALLEL, OR ROTARY



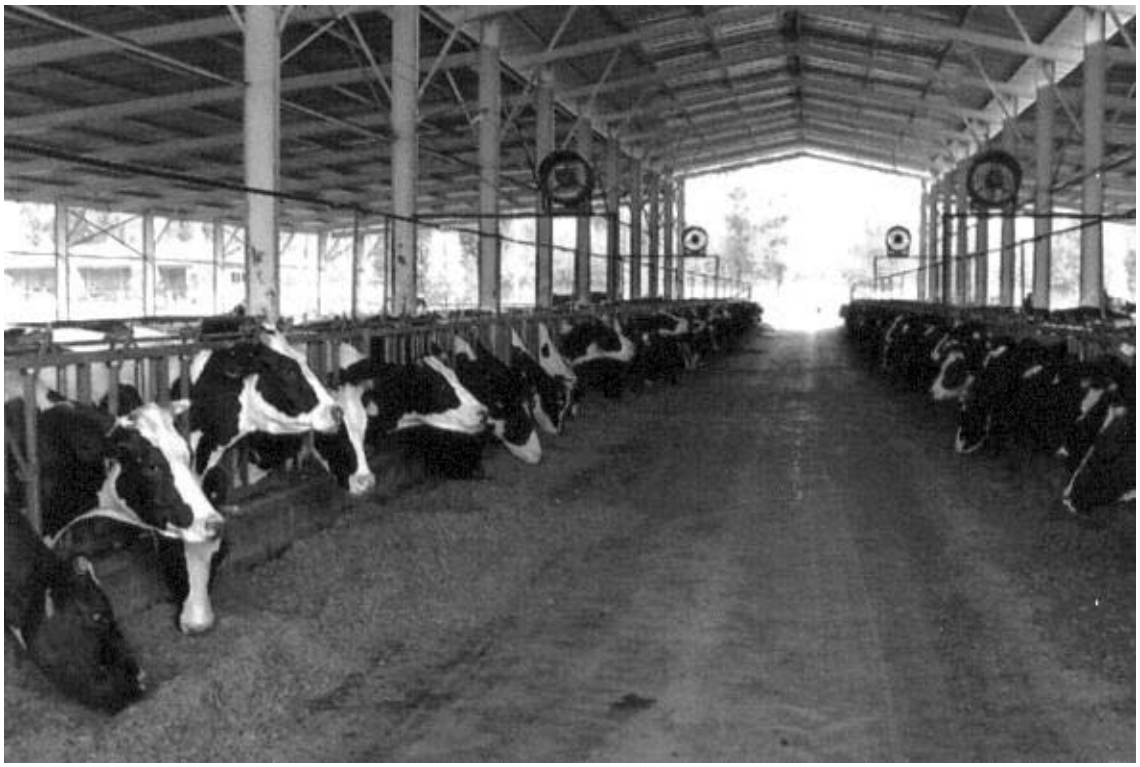
DAIRY BARNS

HOLDING, WASH, AND DRIP AREA EQUIPMENT

Wash Pen

DAIRY BARNS

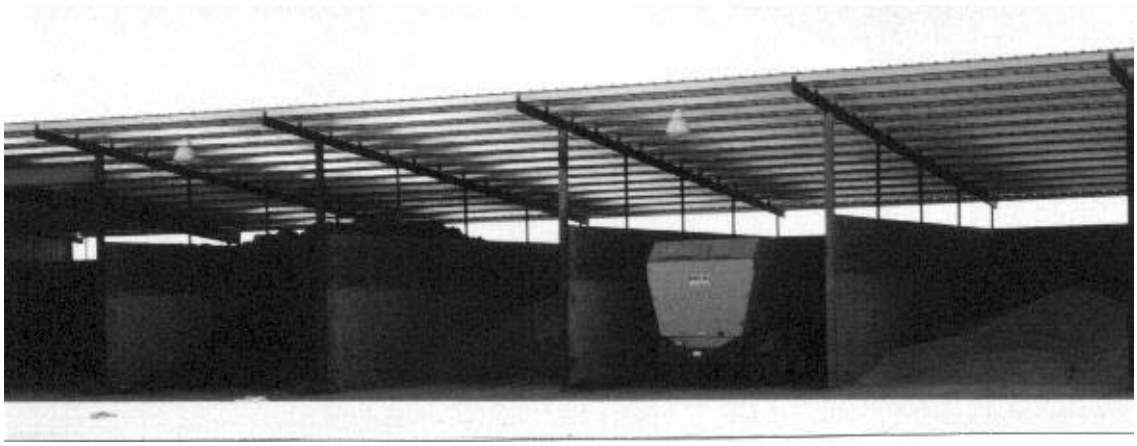
FREESTALL BARN



DAIRY BARNS

HOSPITAL BARN

Commodity Barn



DAIRY BARNS

HAY BARNS

DAIRY BARNS

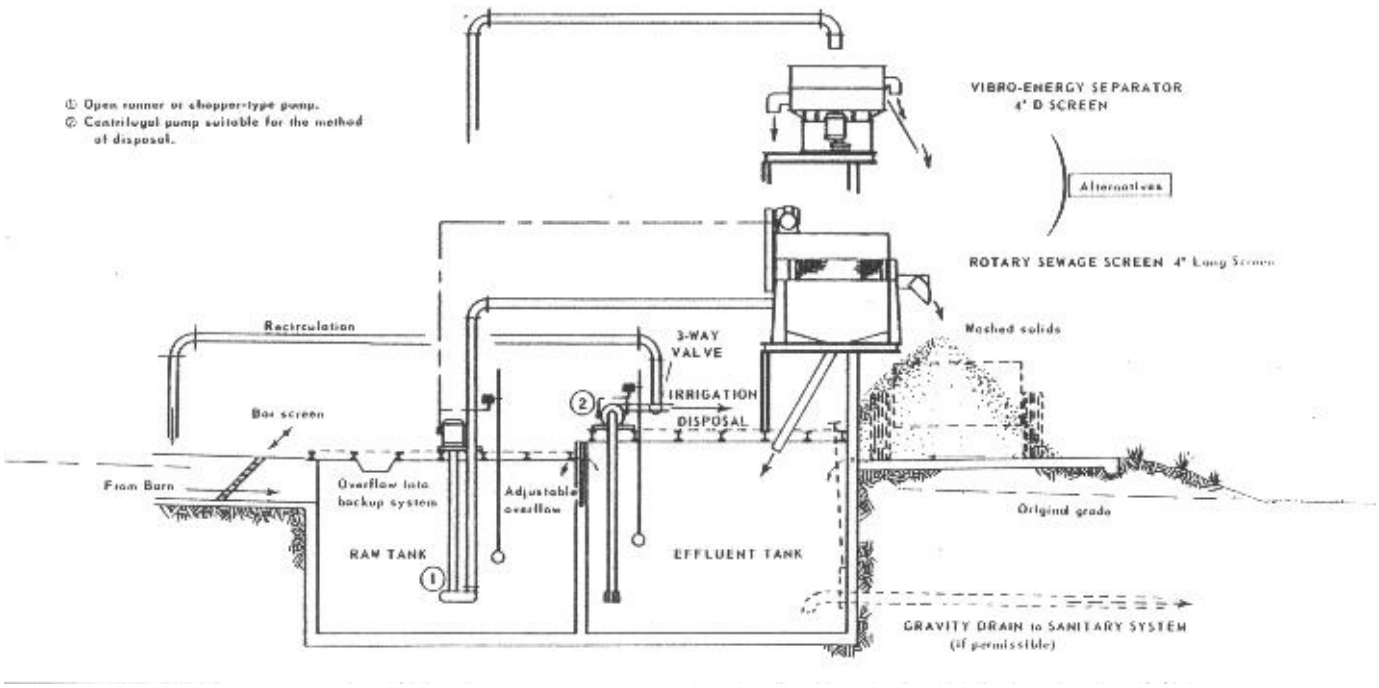
MISCELLANEOUS

Feedlane Stanchions

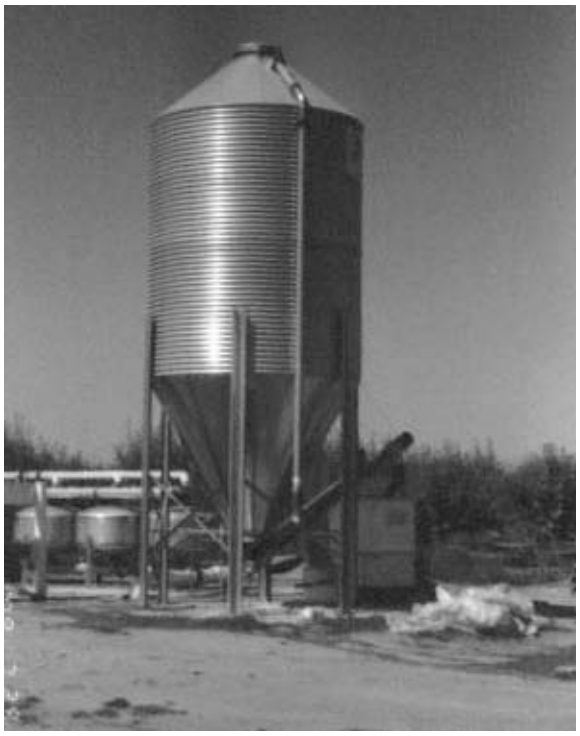
Silage Pits

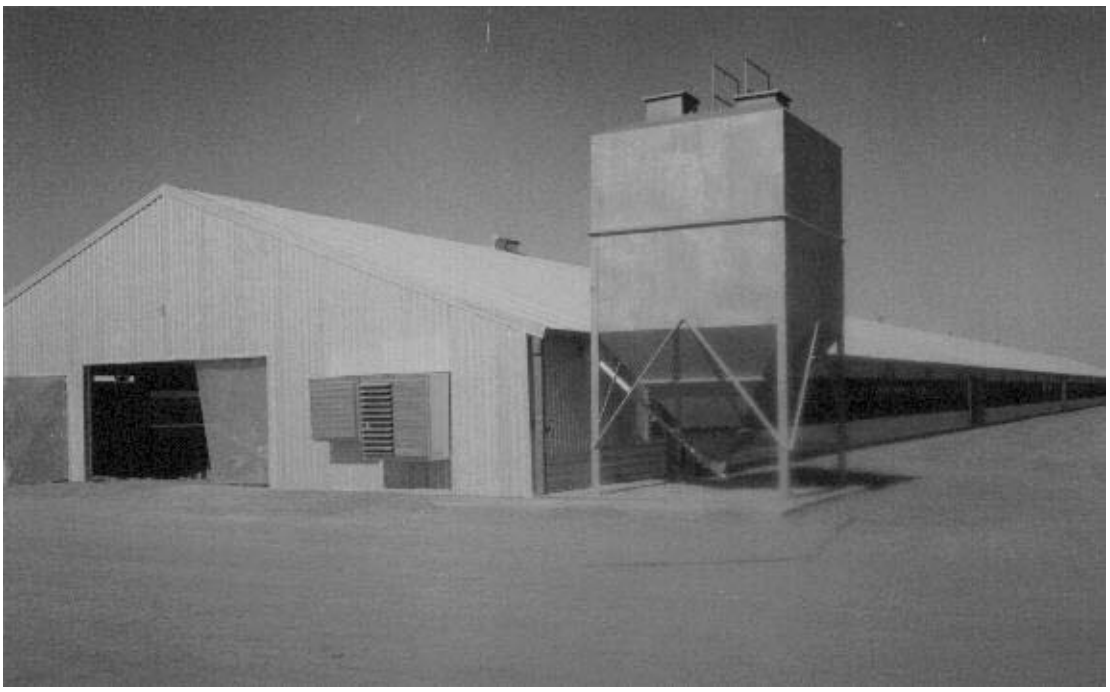
DAIRY BARNS

LIQUID MANURE SYSTEMS (MANURE SEPARATOR)



DAIRY BARNS

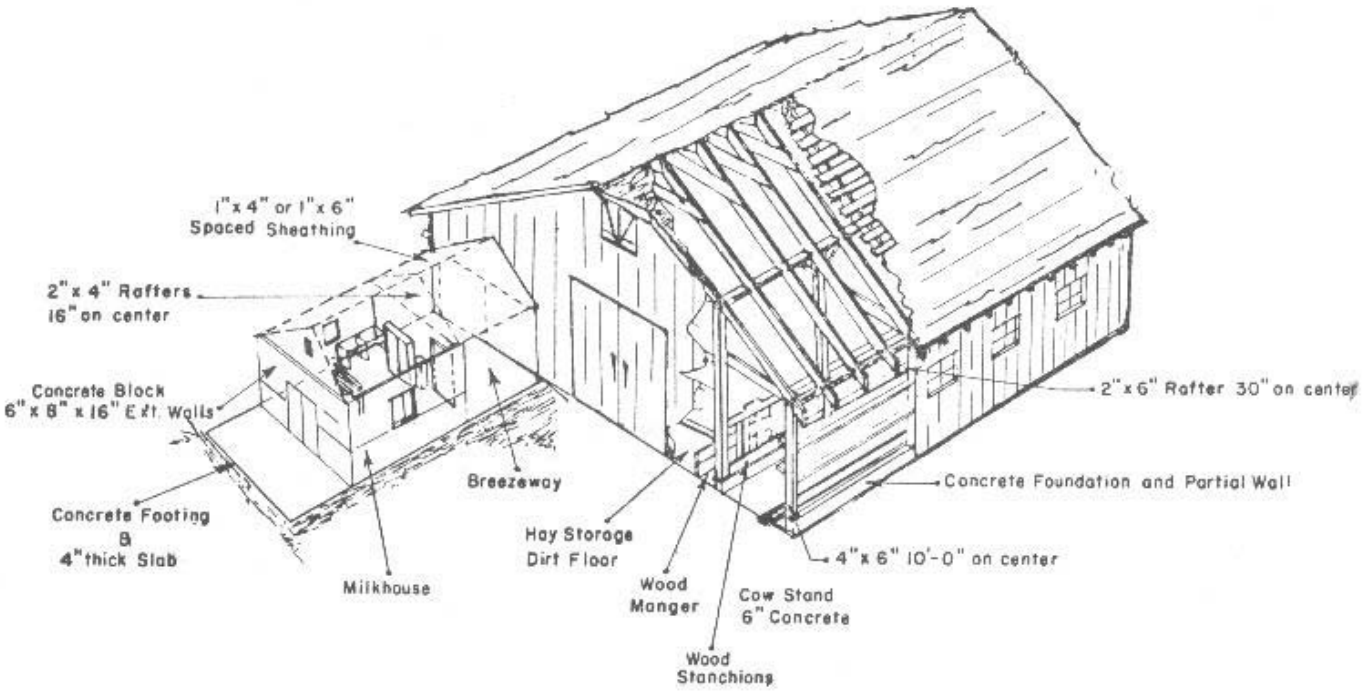




Steel Bulk Feed Tanks on Concrete Pad with Hopper Bottom

DAIRY BARNS

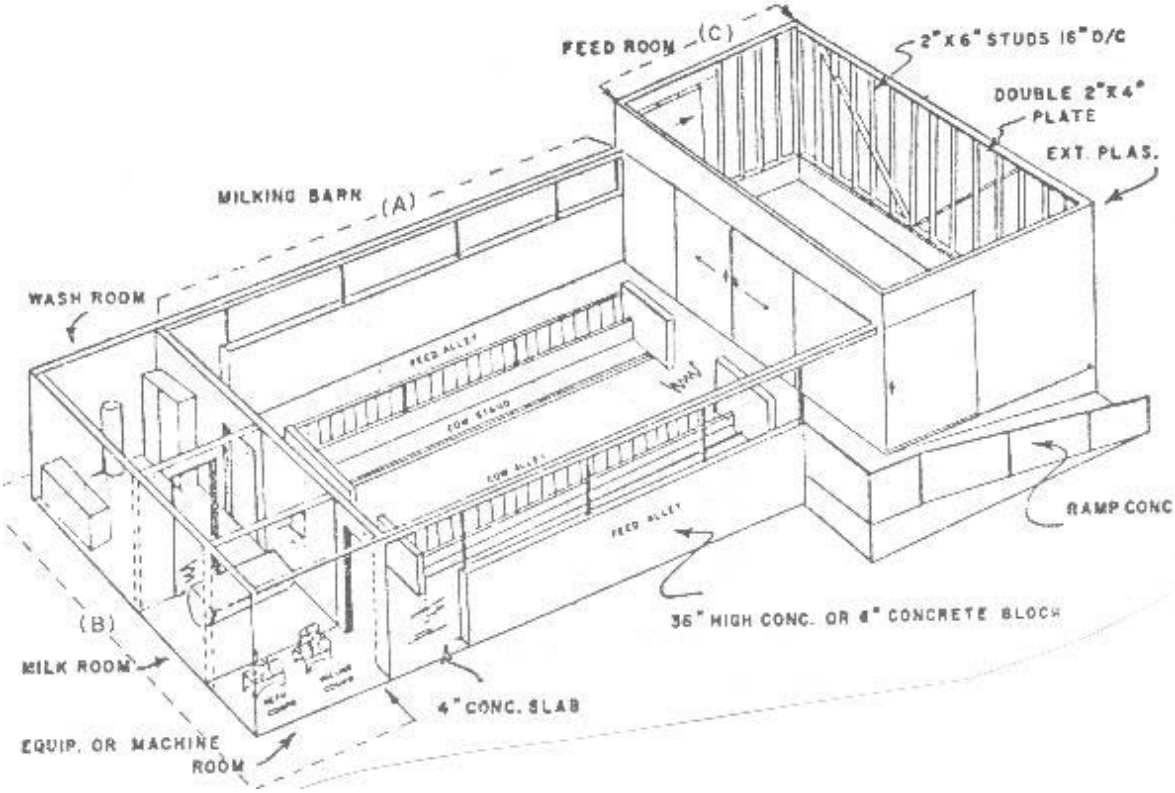
GRADE "B" BARNS



TYPICAL GRADE "B" DAIRY BARN

DAIRY BARNS

STANCHION BARNS



Component Parts of This Dairy

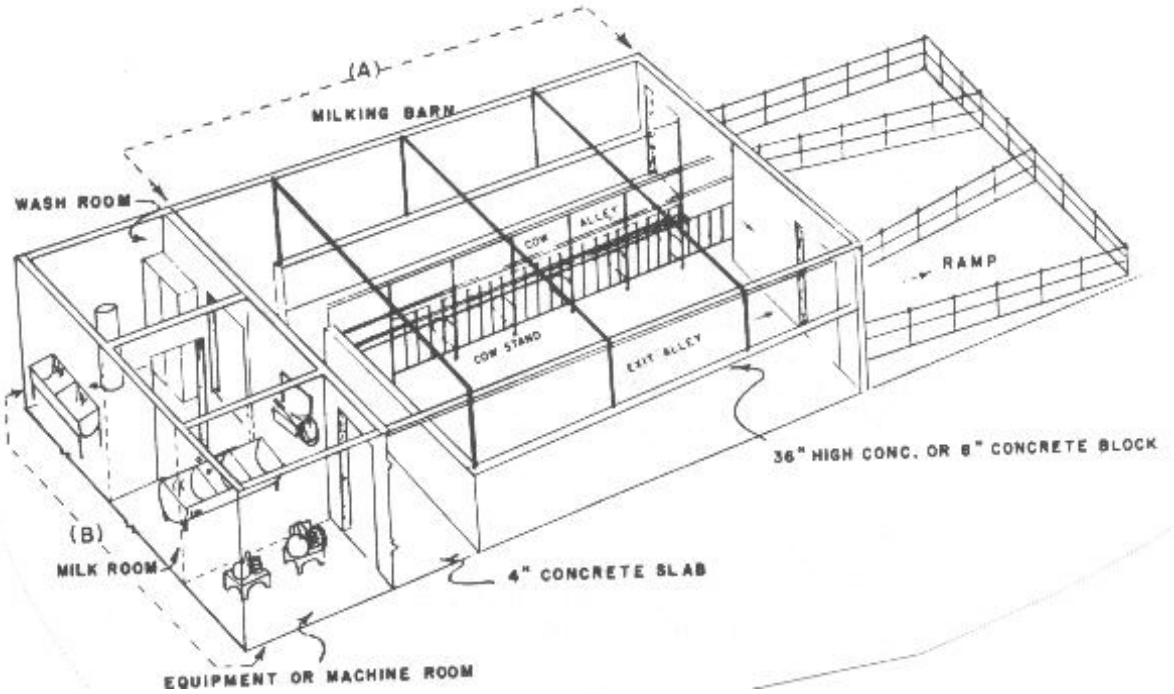
A. Milking Barn
B. Milk, Wash, and Equipment Rooms
C. Feed Room

TYPICAL STANCHION BARN

DAIRY BARNS

WALK-THROUGH TYPE

TYPICAL WALK-THROUGH BARN



Component Parts of This Dairy
- A. Milking Barn
- B. Milk, Wash, and Equipment Rooms

AH 534.30: POULTRY HOUSES

Poultry houses can be tailored to fulfill a variety of needs depending on the type of farming operation. The three most common types of poultry farming are for egg production, meat production, and "chick" production. Chickens which are farmed mainly for their eggs are called "egg laying hens," chickens farmed for meat are called "broilers," and chickens that lay fertilized eggs for the purpose of producing live "chicks" are called "breeders." The structures which house these three kinds of chickens are known respectively as "layer houses," "broiler houses," and "breeder houses."

This chapter contains specifications and costs for modern poultry structures and equipment used in both types of operations as well as breeder houses. The building and equipment costs listed below may be used as a baseline for costing other types of poultry houses not specifically mentioned here.

The basic building costs are for the structure only and include only those components specified. The cost of all items of equipment such as cages, drinking water systems, feeding systems, egg-gathering systems, ventilation systems, and heating and cooling systems must be added to the basic building cost to arrive at a total cost.

Drawings and photographs showing examples of the buildings and equipment discussed are located at the end of this chapter.

HOUSING - CONVENTIONAL LAYER HOUSES

Components	Average Quality	Good Quality
Foundation	Concrete slab	Concrete slab
Floor	Concrete with some partitions	Concrete with drains or plank floor with drains
Frame	Pole frame	Pole frame
Roof Cover	28-gauge galvanized steel	28-gauge galvanized steel
Exterior	Vinyl curtains or plywood	Plywood with metal siding, air inlets
Lighting	Average system, automatic controls	Good system, excellent wiring, automatic controls
Plumbing	Average system	Good system
Interior	Only roof insulated	Fully insulated, interior sheathing, finished walls
Basic Building Cost Per Square Foot	**$17.85 to $19.60 per square foot**	**$25.80 to $28.40 per square foot**

Typical Size 40' x 400'

(Photograph and drawing shown on AH 534.30, page 4)

POULTRY HOUSES

HOUSING - BROILER HOUSES

Components	Average Quality	Good Quality
Foundation	Concrete slab	Concrete slab
Floor	Dirt	Concrete or dirt
Frame	Pole frame	Pole frame
Roof Cover	28-gauge galvanized steel	28-gauge galvanized steel
Exterior	Vinyl curtains or plywood	Plywood with metal siding
Lighting	Average system, automatic controls	Average system, automatic controls
Plumbing	Average system	Average system
Interior	Only roof insulated, shutters or vents	Fully insulated and ventilated with interior sheathing
Basic Building Cost Per Square Foot	**$10.20 to $11.25 per square foot**	**$12.25 to $13.45 per square foot**

Typical Size 40' x 400'

(Photograph shown on AH 534.30, page 5)

HOUSING - BREEDER HOUSES

Components	Average Quality	Good Quality
Foundation	Concrete slab	Concrete slab
Floor	Dirt	Dirt with some concrete slab
Frame	Pole frame	Pole frame
Roof Cover	28-gauge galvanized steel	28-gauge galvanized steel
Exterior	Vinyl curtains or plywood	Plywood with metal siding
Lighting	Minimal	Average
Plumbing	Minimal	Average
Interior	Only roof insulated, natural ventilation only	Fully insulated and ventilated, interior sheathing
Basic Building Cost Per Square Foot	**$11.30 to $12.45 per square foot**	**$13.30 to $14.60 per square foot**

Typical Size 40' x 400'

(Photograph shown on AH 534.30, page 6)

POULTRY HOUSES

EQUIPMENT - CONVENTIONAL LAYER CAGE HOUSES

Components	A-Frame Cages	Battery Cages
Cages	3 to 5 tier	4 to 8 tier
Watering System	Automatic nipple system	Automatic nipple system
Feeding System	Automatic auger system	Automatic auger system
Egg-Gathering System	Automatic belt system	Automatic belt system
Manure Management System	Manual tray	Automatic belt
Cooling	Evaporative cooling pad and house fan system	Evaporative cooling pad and house fan system
Heating	None	None
Basic Building Cost Per Square Foot	**$9.00 to $9.90 per bird**	**$15.10 to $16.60 per bird**

Assuming 0.48 square feet per bird

(Photographs and drawings shown on AH 534.30, pages 7 and 8)

EQUIPMENT - MODERN BROILER HOUSES

Components	
Watering System	Automatic nipple system
Feeding System	Automatic auger system
Cooling	Pad and fan system
Heating	Gas brooders
Total Cost Per Bird Equipment	**$3.45 to $3.80 per bird**

Assuming 0.80 square feet per bird

(Photographs and drawing shown on AH 534.30, pages 9 - 11)

EQUIPMENT - MODERN BREEDER HOUSES

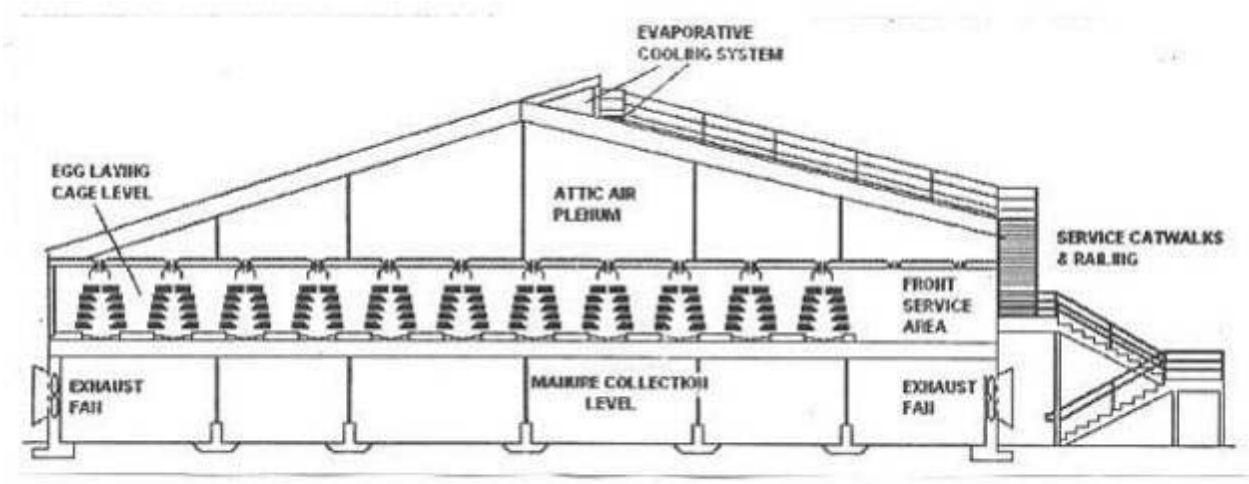
Components	
Watering System	Automatic nipple system
Feeding Systems	Female and male bin and fill system
Cooling	Pad and fan system
Egg-Gathering System	Nest and egg collection system
Total Cost Per Bird Equipment	**$9.15 to $10.10 per bird per bird**

Assuming 1.90 square feet per bird

(Photographs and drawing shown on AH 534.30, pages 9 - 11)

POULTRY HOUSES

CONVENTIONAL LAYER HOUSE



TYPICAL CROSS SECTION

POULTRY HOUSES

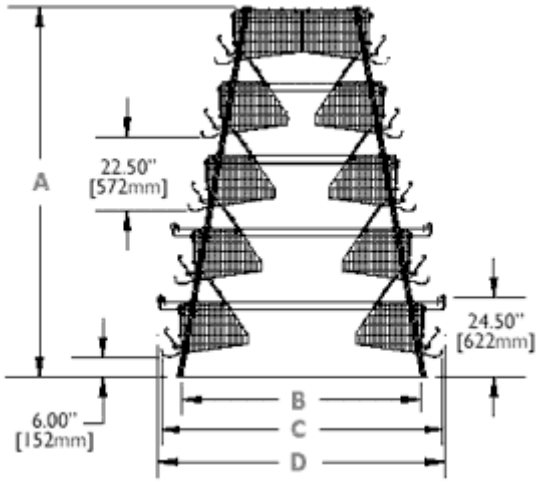
BROILER HOUSE

POULTRY HOUSES

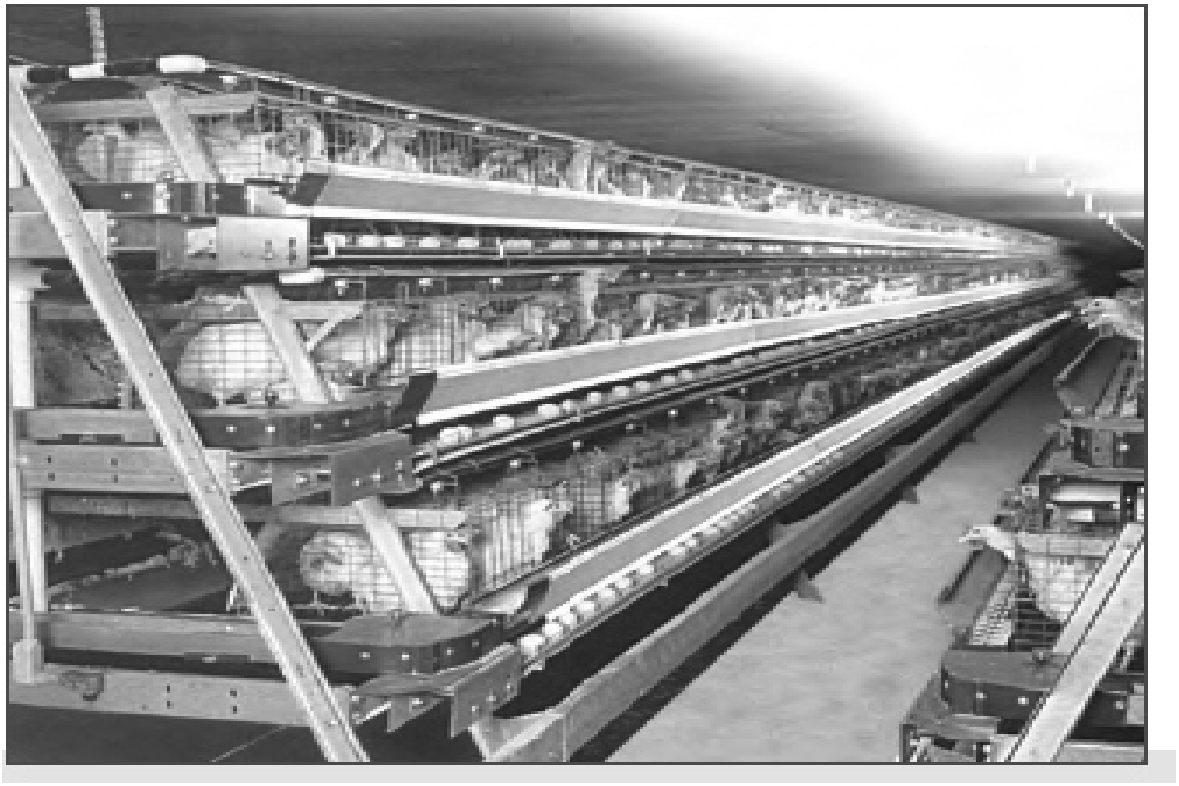
BREEDER HOUSE

POULTRY HOUSES

A-FRAME CAGE EQUIPMENT

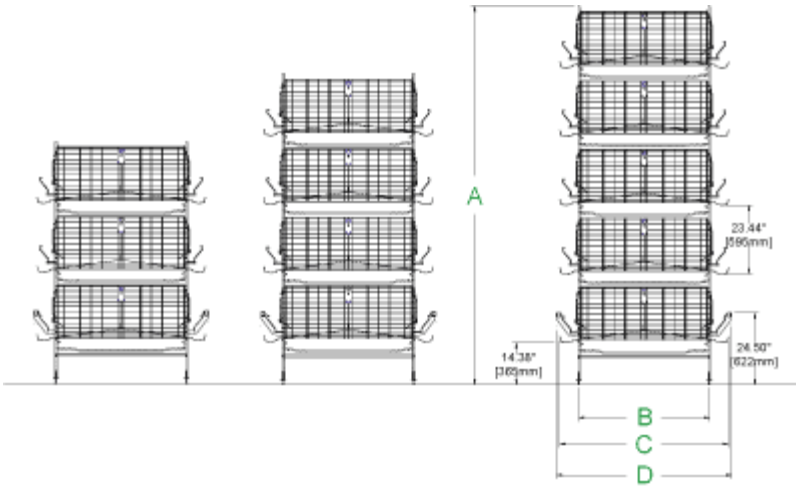


CONVENTIONAL A-FRAME CAGE LAYER HOUSE



POULTRY HOUSES

BATTERY CAGE EQUIPMENT

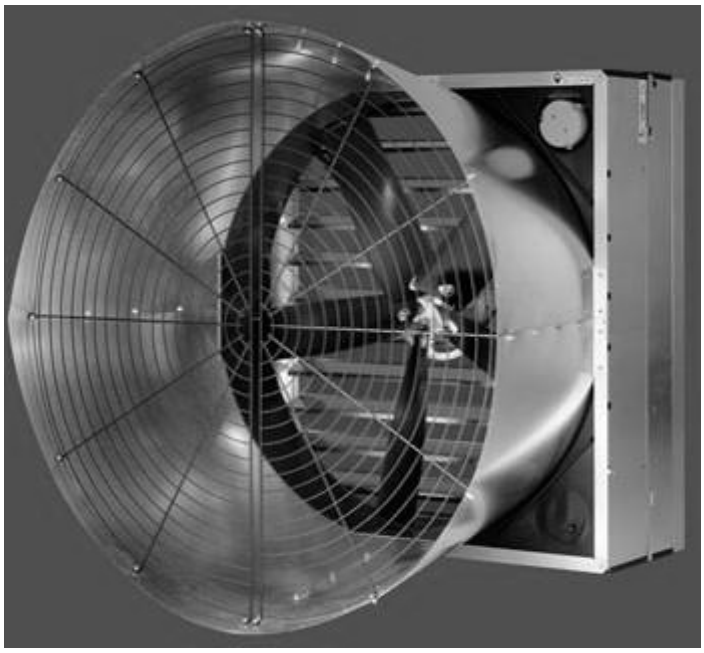


CONVENTIONAL BATTERY CAGE LAYER HOUSE

POULTRY HOUSES

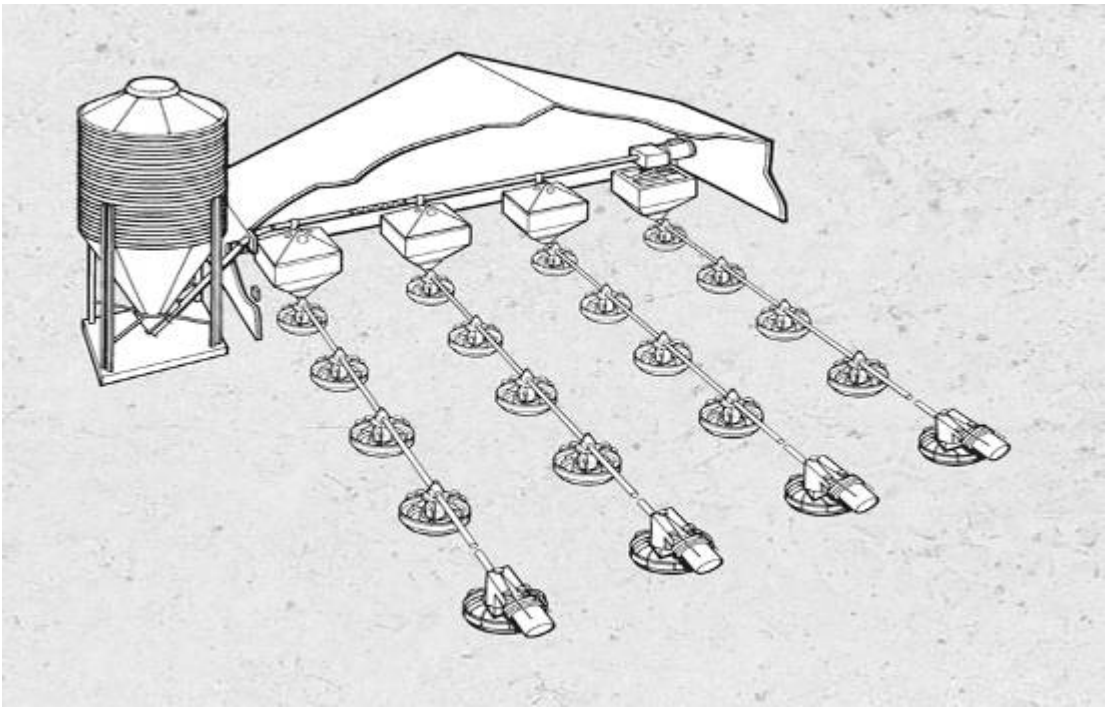
EVAPORATIVE COOLING PADS

HOUSE FAN



POULTRY HOUSES

AUGER FEEDING SYSTEM DIAGRAM



EGG COLLECTION SYSTEM

POULTRY HOUSES

GAS BROODER

AH:534.61: IRRIGATION SYSTEMS

This chapter contains specifications and costs for various irrigations systems, including:

- Concrete pipe
- PVC pipe
- Aluminum pipe
- Irrigation valves
- Permanent irrigation system
- Concrete ditch

Photographs showing examples of systems discussed are located at the end of this chapter.

The following costs for irrigation system components have been derived from information gathered, for the most part, in the San Joaquin and Sacramento Valleys. Costs have been collected for only the more widely used components. Many areas will have types of equipment not usually found in other locations. Costs for those items or systems should be checked locally.

CONCRETE PIPE - INSTALLED

Size in Inches	Cost Installed Per Linear Foot		Vertical Stand Pipe Including Base Installed Cost Per Foot of Height	
	Fresno Area	Sacramento North	Fresno Area	Sacramento North
8	$8.50	$8.90	$19.25	$20.20
10	8.80	9.20	23.50	24.70
12	9.80	10.30	24.60	25.80
14	10.80	11.30	26.75	28.10
16	12.00	12.60	40.40	42.40
18	12.80	13.40	45.60	47.90
20	15.55	16.30	46.65	49.00
24	24.00	25.20	82.80	86.95
30	60.00	63.00	144.65	151.90
36	77.90		160.60	168.60
42			227.50	238.90
48			321.20	337.25

The prices shown above are for installations over 700 feet in length. Adjust these prices for installations less than 700 feet by using an appropriate dollar figure from the next page. The use of PVC pipe has become more prevalent than concrete pipe in most areas. Concrete pipe is still used primarily in the southern San Joaquin Valley.

IRRIGATION SYSTEMS

CONCRETE PIPE - INSTALLED

Adjust the prices from the previous page for installations less than 700 feet by the following amount.

Length of Pipe	Add to All Sizes
Up to 100'	$7.50 per foot
100' to 200'	5.90 per foot
200' to 300'	4.90 per foot
300' to 400'	3.20 per foot
400' to 500'	2.70 per foot
500' to 600'	2.15 per foot
600' to 700'	1.60 per foot

PRESSURE BOXES (Reinforced concrete with capped top)

Size	Price Per Linear Foot of Height
24"	$370
30"	520
36"	645

STAND PIPE INCLUDING THE BASE

Size	6'	9'	12'	15'
24"	$530	$ 795	$1,060	$1,330
30"	930	1,390	1,855	2,320
36"	1,030	1,545	2,060	2,575
42"	2,100	2,185	2,915	3,645
48"	2,105	3,090	4,120	5,145

VENT PIPE—PLASTIC

Size	9' Height Limit
2"	$12 per foot
3"	13 per foot
4"	17 per foot

IRRIGATION SYSTEMS

CONCRETE PIPE - INSTALLED

VENT PIPE—STEEL

Size	9' Height Limit
2"	$14 per foot
4"	20 per foot
6"	24 per foot
8"	31 per foot
10"	39 per foot
12"	43 per foot

ADD HOOK-UP (When new concrete pipe is connected to old concrete pipe, add the following)

Size	Add
8", 10", and 12"	$262
14", 16", and 18"	315
20" and 24"	367

PVC PIPE

Cost includes components and installation, but not hook-up to pump. As pressure requirements rise, the pipe becomes more costly.

PVC PIPE—INSTALLED (PER LINEAR FOOT)

Size	Class 63 Low Head (Flood)	100 P S I (Sprinkler)
6"	$4.75	$5.70
8"	5.50	7.00
10"	8.25	9.70
12"	11.30	12.40
15"	12.10	17.15
18"	22.00	23.90

PVC hook-up to pump—includes relief valves, check valves, dresser couplings, elbows, and labor.

IRRIGATION SYSTEMS

PVC PIPE

ADD HOOK-UP

Size	Cost
6"	$ 848
8"	1,270
10"	1,695
12"	2,225

VALVE, SADDLE, AND RISER (FOR SURFACE LATERALS)

Size	Sprinkler	Flood
4"	$ 82	$114
8"	-	197
10"	-	244
12"	-	300
14"	-	400

ALUMINUM PIPE

Aluminum pipe costs include sales tax, but exclude installation costs due to their portable nature.

Main Lines Per Linear Foot	Diameter			
	6"	**8"**	**10"**	**12"**
Ring Lock Type				
40' joints without valve	$4.35	$6.00	$7.60	$8.20
40' joints with valve	4.80	7.20	9.00	9.75
Latch Type	**3"**	**4"**	**6"**	
30' joints without valve	$1.40	$2.35	$3.40	

SPRINKLER LINES

18" Risers—30' lengths 3"—**$1.85** per linear foot 4"—**$2.50** per linear foot

IRRIGATION SYSTEMS

GALVANIZED FITTINGS

Valve Openers		End Plugs		90° Elbows	
Size	**Cost**	**Size**	**Cost**	**Size**	**Cost**
4"	$160	6"	$45	6"	$115
6"	190	8"	60	8"	155
8"	245	10"	90	10"	200

IRRIGATION VALVES

Flood valves are set near the top or flush on top of a concrete pipe riser. Several types are in general use, i.e., Yakima and Alfalfa. They are made with either a solid arch or a removable arch. The removable arch type is more expensive, but it allows for replacement of the arch without complete valve removal when breakage occurs. The solid arch is usually found to be a Yakima and the removable arch is an Alfalfa.

FLOOD VALVES

Size in Inches	Solid Arch Yakima	Size in Inches	Alfalfa
3 x 8	$ 88		
4 x 8	91	8 x 8	$200
5 x 8	99	10 x 10	230
6 x 10	125	12 x 12	290
8 x 12	156	14 x 14	320
10 x 14	208		
12 x 16	255		
14 x 18	315		
16 x 20	490		
18 x 20	520		
20 x 20	630		

(Photographs shown on AH 534.61, page 12)

IRRIGATION SYSTEMS

IRRIGATION VALVES

OVERFLOW VALVES

Size in Inches	Cost Installed
3 x 8	$ 85
3 1/2 x 8	85
4 x 8	87
5 x 8	97
5 x 10	97
6 x 10	131
6 1/2 x 10	131
8 x 12	155
10 x 14	220
12 x 16	283
14 x 18	350
16 x 20	504
18 x 20	625
20 x 24	782

The orchard valve is a solid arch set down in a riser. Although it is generally used in orchards, it may also be found in row crops and pastures.

PVC ORCHARD VALVE

Valve Size	Riser Size	Cost
3 1/2"	8"	$ 82
4"	8"	103
5"	8"	103
6"	10"	132
6 1/2"	10"	132
8"	12"	157
10"	14"	220
12"	16"	278
14"	18"	327
16"	20"	488
18"	21"	598
20"	24"	730

IRRIGATION SYSTEMS

IRRIGATION VALVES

The vineyard valve is a modification of the orchard valve. The riser is pierced with two or more small galvanized tubes which have small sliding galvanized gates. This arrangement allows a choice of direction and volume of water flow. This valve is found mainly in the Central San Joaquin Valley.

VINEYARD VALVE

Valve Size	Riser Size	Number of Gates	Gate Size	Cost Installed
3 1/2"	8"	2	2"	$ 83
3 1/2"	8"	2	2 1/2"	86
3 1/2"	8"	2	3"	91
3 1/2"	8"	3	2"	93
3 1/2"	10"	2	2"	89
3 1/2"	10"	2	2 1/2"	90
3 1/2"	10"	2	3"	90
4"	8"	2	2"	91
4"	8"	2	2 1/2"	92
4"	8"	2	3"	96
4"	10"	2	2"	93
4"	10"	2	2 1/2"	95
4"	10"	2	3"	101
4"	10"	3	2"	99
4"	10"	4	2"	103
5"	10"	4	2"	125
5"	12"	2	3"	122
6"	10"	2	3"	109
6"	10"	4	3"	125
6"	12"	2	3"	130
6"	12"	2	4"	137

IRRIGATION SYSTEMS

IRRIGATION VALVES

Gate valves have different designs depending on the use. The canal gate is for general low-pressure uses as canal discharges, pressure pipelines, etc. The screw-pressure gate is a high-pressure gate valve used for reservoirs, etc. The hub-end gate is designed for use in pipelines.

GATE VALVES

Size in Inches	Screw Pressure	Canal Gate	Hub-End Gate	Clamp Gate	Baxter Gate	Galvanized Gate
6						$ 85
8	$ 710		$1,130	$470		115
10	820	$ 800	1,330	730		125
12	930	810	1,570	780	$1,250	145
14	1,200	950	1,890	1,040		175
16	1,920	1,050	2,450	1,250	1,560	205
18	2,630	1,160	3,100			225
20	2,970	1,520	3,750			250
24	3,400	1,700	8,200			250
36		3,120				
48		6,960				
60		12,400				

(Photographs shown on AH 534.61, page 12)

Capped riser irrigation systems are generally found in old orange groves. The galvanized gates are diamond shaped.

CAPPED RISERS

Size	Number of Gates	Size of Gates	Installed Cost
8"	2	2"	$44
8"	3	1"	45
8"	4	1"	51

AIR RELIEF VALVES

Size	Installed on PVC	Installed on Concrete Pipe
2"	$130	$150
3"	215	240
4"	275	350

IRRIGATION SYSTEMS

PERMANENT IRRIGATION SYSTEM

The larger set-ups are at lower end of range

SPRINKLERS— "SOLID SET"—UNDER TREES

Type	Cost Per Acre
Manual system	$ 900 to 1,300
Automatic system	1,150 to 1,600
Frost protection system	1,260 to 1,820
Automatic system with frost protection	1,560 to 2,210

PVC underground lines, 12" risers, impact sprinkler heads, screen filter

SPRINKLERS—"SOLID SET"—OVER VINES

Type	Cost Per Acre
Manual system	$1,050 to $1,350
Automatic system	$1,350 to $1,650
Frost protection system	$1,870 to $2,600
Automatic system with frost protection	$2,190 to $3,230

PVC underground lines, 12" risers, impact sprinkler heads, screen filter

DRIP SYSTEM—ORCHARD

Type	Cost Per Acre
New planting (1 to 4 emitters per tree)	$1,200 to $1,700
Mature orchard (4 emitters per tree)	$1,300 to $1,900

DRIP SYSTEM—VINEYARD

Type	Cost Per Acre	Total Cost
Ratio of cost—70 percent above ground, 30 percent below ground, add	$1,500 to $2,400	
Elaborate sand filters (for dirty water-aqueduct and river water), add	$210 to $350	
Fertilizer application equipment, add		$800 to $950
When proportion pumps are used, add		$1,450 to $2,330

Market research indicates that most new irrigation systems installed for orchard and vineyard crops utilize drip systems. Automatic systems can add $300 to $400 to the total cost while frost protection can add 40 percent to 60 percent to the total cost.

IRRIGATION SYSTEMS

PERMANENT IRRIGATION SYSTEM

HOSE PULL SYSTEM

Type	Cost Per Acre
Plus pump and filter	$550 to $700

LINEAR OVERHEAD SPRINKLER SYSTEM

Size	Cost Each
320 Acres	$152,000 to $180,000

The linear overhead sprinkler system is used on a level parcel usually a one-half section of land. A canal runs through the parcel as a water supply.

(Photographs shown on AH 534.61, page 13 and 14)

ELECTRIC CENTER PIVOT SPRINKLER—Including concrete base

Size	Cost Each
160 acres (130 acres net) – New	$52,000 to $60,000
160 acres (130 acres net) – Used 12-15 years	$22,000 to $30,000

(Photographs shown on AH 534.61, page 15)

Concrete Structures	**$400** per cubic yard
Control Gates	**$200**
Hook-up and Connections	Between no charge and **$240**

CRIBBINGS

Size in Inches	Cost Per Linear Foot
24	$153
30	204
36	224

The concrete riser above the valve is cut in half to direct the flow of water

IRRIGATION SYSTEMS

CONCRETE DITCHES

Costs are for one-half to one mile runs. Shorter runs are a little higher.

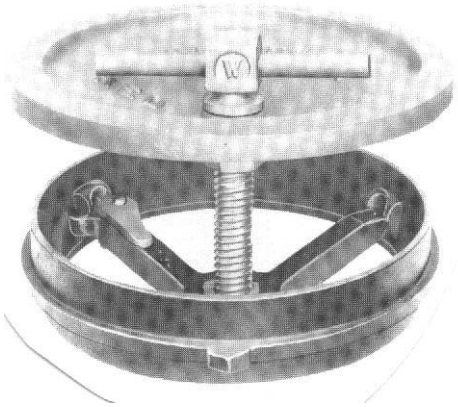
Bottom	Depth	Cost Per Foot
1'	16"	$12.00
1'	18"	12.30
1'	20"	12.90
1'	22"	13.70
1'	24"	14.10
1'	26"	14.90
1'	28"	15.30
1'	30"	16.20
2'	24"	20.60
2'	27"	21.30
2'	30"	24.00
2'	34"	25.80
2'	36"	26.70
2'	38"	27.60
2'	40"	28.50
2'	42"	29.40
2'	44"	31.50
2'	46"	32.60
2'	48"	35.40

The above costs do not include end gates and turn out gates. They range from **$125 to $155** each (three joints 12" x 14" in diameter). Check gates cost **$450**.

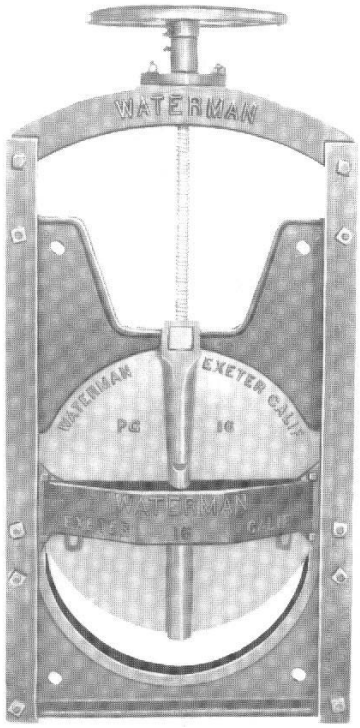
The above prices do include the land shaping.

IRRIGATION SYSTEMS

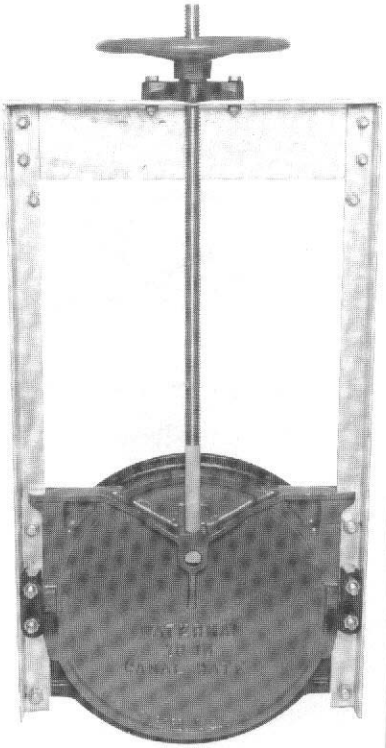
ALFALFA VALVE



YAKIMA VALVE



PRESSURE SLIDE GATE



CANAL GATE

HUB END GATE

IRRIGATION SYSTEMS

LINEAR OVERHEAD SPRINKLER

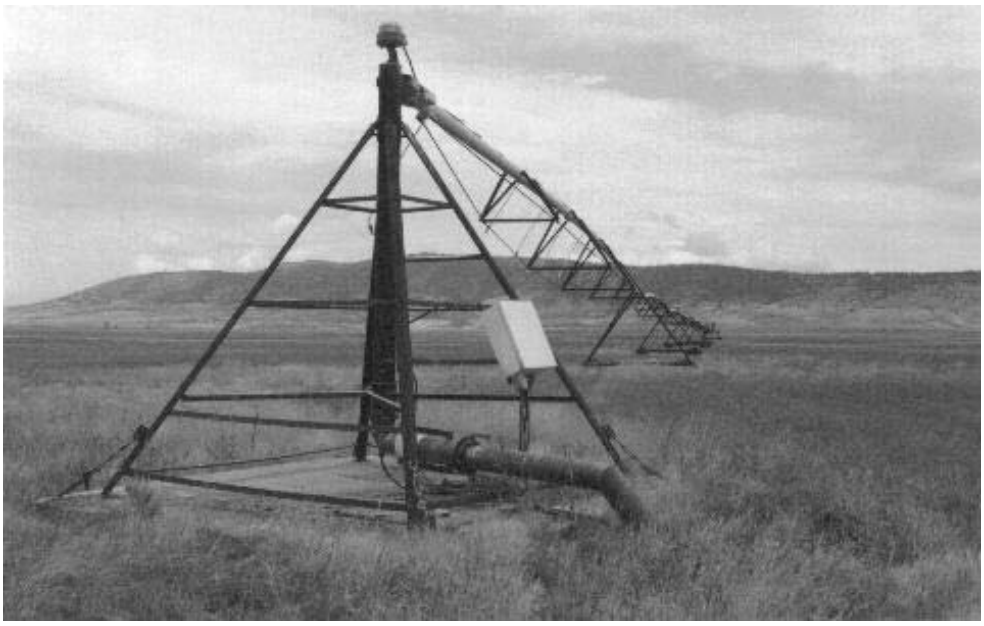
LINEAR OVERHEAD SPRINKLER

IRRIGATION SYSTEM

LINEAR OVERHEAD SPRINKLER

LINEAR OVERHEAD SPRINKLER

IRRIGATION SYSTEM



CENTER PIVOT SPRINKLER (PIVOT SIDE)

CENTER PIVOT SPRINKLER (OPPOSITE PIVOT)

AH 534.62: PUMPS

This chapter contains specifications and costs for various pumps used with irrigation systems, including:

- Turbine pumps
- Diesel powered pumps
- Submersible pumps
- Wells
- Windmills

Photographs showing examples of the pumps discussed are shown at the end of this chapter.

SAN JOAQUIN VALLEY BASE TURBINE PUMPS
3-PHASE FREE FLOW DISCHARGE

1,800 RPM, 5 to 350 HP installed, including pump complete in place with normal stages, power pole, pads, and control panel. Well and casing excluded.

	Depth of Setting											
HP	**40'**	**60'**	**80'**	**100'**	**120'**	**140'**	**160'**	**180'**	**200'**	**220'**	**260'**	**300'**
5	7,675	7,600	8,640	9,350	10,580							
8	7,750	7,750	9,000	9,580	11,480	12,340	13,670	14,640	15,810			
10	8,090	9,000	10,060	10,930	11,980	12,500	13,920	15,000	16,040	17,100	19,230	
15	9,440	10,350	11,460	12,380	13,330	13,330	14,980	16,180	17,570	18,680	21,260	23,300
20	11,980	12,750	13,000	14,320	14,980	15,710	16,430	17,200	18,550	20,030	22,430	24,540
25	12,750	13,130	14,300	15,850	16,430	16,990	18,360	19,710	21,070	22,210	22,790	25,110
30	14,310	15,070	15,630	16,630	17,400	18,360	19,340	20,290	21,260	22,430	24,170	26,090
40	15,830	16,220	16,630	17,580	19,700	20,870	22,040	23,200	24,360	25,110	27,980	29,960
50	16,430	18,360	20,290	21,250	22,210	23,210	24,170	25,110	28,010	28,990	32,850	34,780
60		21,250	22,210	24,170	25,110	26,100	27,070	28,010	29,950	32,850	36,720	38,650
75		24,180	25,110	28,010	29,120	29,970	30,930	32,850	34,780	36,720	42,540	44,450
100		25,120	28,010	29,970	32,850	34,790	36,730	38,640	39,620	41,550	44,440	46,390
125		29,970	32,850	34,780	36,720	38,650	41,550	43,480	46,680	50,240	54,630	55,980
150			34,780	36,320	38,670	41,550	44,450	46,380	48,320	53,140	57,990	59,900
200			36,720	37,540	42,540	48,320	50,250	54,120	56,050	59,920	65,720	67,580
250						61,450	63,490	65,590	69,640	73,730	75,780	81,930
300						71,700	73,740	77,860	81,930	83,980	88,080	90,120
350						86,420	88,000	90,120	94,220	96,250	98,320	102,320

Note: The appraiser must know the horsepower and depth of setting in order to estimate the replacement cost new from the chart.

Turbine pumps are more commonly used than submersibles, primarily due to accessibility of the pump for maintenance purposes. Submersibles tend to exceed the cost of turbines at high settings and tend to be less costly at lower settings.

Add 10 percent to the above replacement cost new factors for irrigated sprinkler systems.

(Photograph shown on AH 534.62, page 10)

PUMPS

DIESEL POWERED DEEP WELL IRRIGATION PUMPS

The complete costs installed are divided into three parts: engines, gear heads, and below ground assembly. Costs are based on data from Fresno to the Southern San Joaquin Valley.

DIESEL ENGINES NEW (Includes Tax and Delivery)

HP	Cost
75 – 100	$10,000 - $13,000
100 – 150	$12,500 - $17,500
150 – 200	$16,000 - $21,000
200 – 250	$21,000 - $25,000
250 – 300	$25,000 - $30,000
300 – 400	$30,000 - $38,500

Reconditioned engines, deduct 20 to 30 percent

(Photograph shown on AH 534.62, page 10)

GEAR HEADS

HP	DRIVE	SHAFT	FLANGES (2)	GUARD	LABOR	TOTAL
100	$2,400	$630	$350	$175	$1,640	$5,200
125	$2,600	$745	$460	$175	$1,640	$5,600
150	$3,190	$745	$460	$175	$1,640	$6,200
200	$3,890	$745	$460	$175	$1,640	$6,900
250	$6,470	$1,150	$570	$175	$1,640	$10,000
300	$7,140	$1,150	$570	$175	$1,640	$10,700
350	$8,360	$1,150	$570	$175	$1,640	$11,900
400	$10,340	$1,270	$570	$175	$1,640	$14,000

BELOW GROUND ASSEMBLY (Includes Column—Tube and Shaft and Bowls)

Gear Head HP	200' Lift	300' Lift	400' Lift	500' Lift	600' Lift	700' Lift
100	$19,900	$24,100				
125	$25,700	$30,100	$33,400			
150	$28,400	$33,400	$35,100			
200		$36,100	$38,100	$40,800		
250				$43,300	$46,000	
300				$45,100	$47,800	$50,500
400						$53,800

Add to engine and gear head figures.

RULE OF THUMB: The horsepower of the gear head will require an engine with bulk or gross horsepower of about 1-1/2 times the size of the gear head, i.e., 200 HP gear head x 1.5 = 300 HP engine. 300 bulk HP engine x 80 percent = continuous HP x 80 percent = 192 HP to gear head. NOTE: Costs do not include fuel tanks or fuel tank saddles.

PUMPS

DISCHARGE HEADS

Discharge Size	Price Includes Head, Solenoid, Oiler, Column, Nipple, and Flange
4 x 12	$1,420
6 x 12	1,700
8 x 12	1,760
8 x 16 1/2	2,200
10 x 20	2,570

COLUMN ASSEMBLY (In 20' lengths)

Column	Tube	Shaft	Price Per Foot
4"	1 1/2"	1"	$35
6"	2"	1 1/4"	48
8"	2 1/2"	1 1/2"	58
10"	2 1/2"	1 11/16"	70
10"	3"	1 15/16"	77
12"	3"	1 15/16"	85
12"	3 1/2"	2 1/4"	95

Column assembly in 10' lengths—add 10 percent

Reduce the above costs 10 percent for the San Joaquin Valley.

PUMPS

BOWLS

Stages	8"	10"	12"	14"	16"
1	$1,540	$1,870	$2,450	$3,610	$5,120
2	1,660	2,310	3,030	4,400	5,580
3	2,020	2,740	3,890	5,340	8,940
4	2,450	3,300	4,510	6,200	9,090
5	3,040	3,750	5,500	7,580	11,250
6	3,170	4,400	6,060	8,800	12,690
7	3,470	4,920	6,790	10,030	14,430
8	3,750	5,490	7,580	11,250	15,870
9	4,260	6,110	8,510	12,120	17,740
10	4,540	6,350	9,090	13,350	19,400
11	4,970	6,930	9,880		
12	5,480	7,580	10,600		
13	5,760	8,140			
14	6,060	8,660			
15	6,640	9,090			

Reduce the above costs 10 percent for the San Joaquin Valley

5 HP	to	7 1/2 HP	Use 8" bowls
10 HP	to	20 HP	Use 10" bowls
25 HP	to	60 HP	Use 12" bowls
75 HP	to	350 HP	Use 14" bowls up to 150' setting

8" bowls—25' per stage (100' = 4 stages)
10" bowls—35' per stage (100' = 3 stages)
12" bowls—50' per stage (100' = 2 stages)
14" bowls—60' per stage (100' = 2 stages)

CENTRIFUGAL BOOSTER PUMPS

Size	Cost
10 HP	$3,350 - $3,850
20 HP	$4,200 - $4,800
30 HP	$5,050 - $5,400
40 HP	$5,700 - $6,200
50 HP	$6,900- $7,400
60 HP	$8,150 - $8,700
80 HP	$9,150 - $9,600
100 HP	$9,850 - $10,300

PUMPS

TURBINE BOOSTER PUMPS

Size	Cost
40 HP	$8,100
50 HP	$8,900
60 HP	$10,400
75 HP	$11,500
100 HP	$12,400
125 HP	$15,800
150 HP	$17,600

SUBMERSIBLE PUMPS

Costs are based on 3-phase, 3,600 RPM pump in a 6" to 18" well. They include normal stages, check valve, power pole, control panel, and installation labor at 0' setting. Costs are relative to settings—low for shallow, high for deep—for installations typical to the horsepower. Add riser pipe and wire costs per linear foot to setting depth. Add well and casing.

HP	Motor, Pump, and Stages	Column Assembly	Recommended Well Size
5	3,000 to 3,900	$11.00 to $15.50	8"
7 ½	3,900 to 4,600	$11.00 to $15.50	8"
10	4,400 to 4,900	$11.00 to $15.50	8" to 10"
15	5,000 to 5,900	$13.00 to $17.50	10" to 12"
20	6,100 to 6,900	$13.00 to $20.00	12"
25	6,500 to 7,400	$16.50 to $22.00	12"
30	8,400 to 9,700	$16.50 to $22.00	12"

High capacity—1,760 RPM (little used) for deep wells. Cost includes pump end and one stage, control panel, power pole, tax, and installation labor.

HP	Motor and Pump	Stages	Riser Pipe and Wire Per Foot	Recommended Well Size
40	$11,500 +	$340 per stage	$19.50	12"
50	12,600 +	410 per stage	24.40	14"
60	13,600 +	450 per stage	24.40	14"
75	14,500 +	460 per stage	24.40	14"
100	15,600 +	480 per stage	24.40	14"

PUMPS

SUBMERSIBLE PUMPS

TAIL WATER PUMPS

HP	Cost	HP	Cost
2	$3,700	20	$7,300
3	3,900	25	7,800
5	4,300	30	8,100
7 ½	4,700	40	9,000
10	5,000	50	9,900
15	6,500		

WELLS

REVERSE ROTARY DRILLING

(Includes Casing, Gravel Pack, Cement Seal, Development of Well) Cost per foot of depth.

Size	To 700'	Over 700'	Over 1,000'
6" 12 ga.	$32	$43	
6" 10 ga.	37		
8" 12 ga.	43		
8" 10 ga.	47		
8" 3/16 in.	52	50	
10" 10 ga.	55		
10" 3/16 in.	59		
10" 1/4 in.	67	74	
12" 10 ga.	68		
12" 3/16 in.	73		
12" 1/4 in.	81	89	$88
14" 3/16 in.	84		
14" 1/4 in.	92	120	122
14" 5/16 in.	99	132	132
16" 3/16 in.	91		
16" 1/4 in.	104		
16" 5/16 in.	113	154	154
18" 3/16 in.	107		
18" 1/4 in.	127		
18" 5/16 in.	148	176	176
20" 3/16 in.	120		
20" 1/4 in.	145		
20" 5/16 in.	170	200	200

PUMPS

WELLS

Cable Tool Drilling	Cost Per Foot of Depth
6"	$23 - $28
8"	$27 - $28
10"	$31 - $36
12"	$46 - $60
14"	$51 - $65
16"	$61 - $73
18"	$71 - $93

State law requires 20' seal in all well shafts.

6"	$ 500
8"	800
10"	1,000
12"	1,000
14"	1,250
16"	1,250
18"	1,250

WINDMILLS

COST INSTALLED

Wheel or Fan Diameter	Weight (Pounds)	Cost	Installation	Total
6'	200	$2,900	$1,300	$4,200
8'	370	3,000	1,350	4,350
10'	660	4,350	1,520	5,570
12'	1,100	6,500	1,840	8,340
14'	1,700	9,900	2,100	12,000
16'	2,500	13,200	2,520	15,720

TOWER REQUIREMENTS FOR FAN SIZE IN DIAMETER

	Windmill Size				
Tower Height	6' - 8' Fan	10' Fan	12' Fan	14' Fan	16' Fan
21'	$2,200	$2,500			
27'	2,850	3,300	$3,900	$4,000	
33'	3,100	3,500	4,100	4,700	$6,250
40'	3,750	4,200	4,900	5,100	7,100
47'	4,725	4,900	5,700	7,200	8,700

PUMPS

WINDMILLS

Windmill installation costs are estimated by considering the following:

- Tower height
- Fan diameter
- Force pump: size and diameter
- Cylinder: size and type
- Pipe: size and length
- Rod: material, size and length.

Force pump, cylinder pipe, rod, and miscellaneous costs range from **$920 to $2,800**.

Example	
10' Fan	$5,570
33' Tower	3,500
Force Pump, Cylinder Pipe, Rod and Miscellaneous Costs	1,900
	$10,970

Refurbished windmill: deduct 35 to 40 percent from above prices.

PUMPS

WINDMILLS

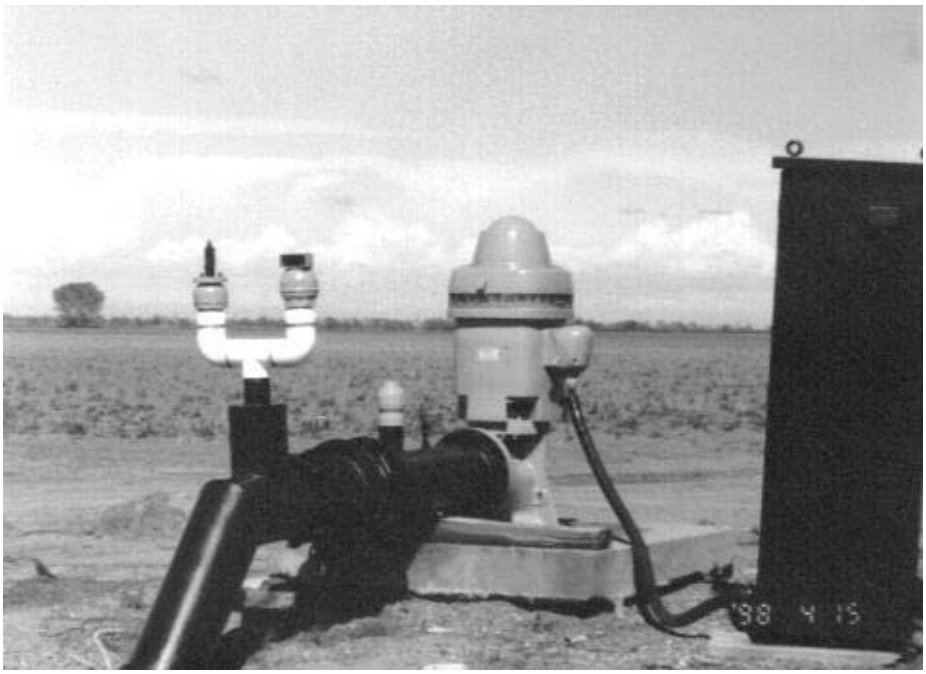
WATER STORAGE TANKS

GALVANIZED COVERED STORAGE TANKS

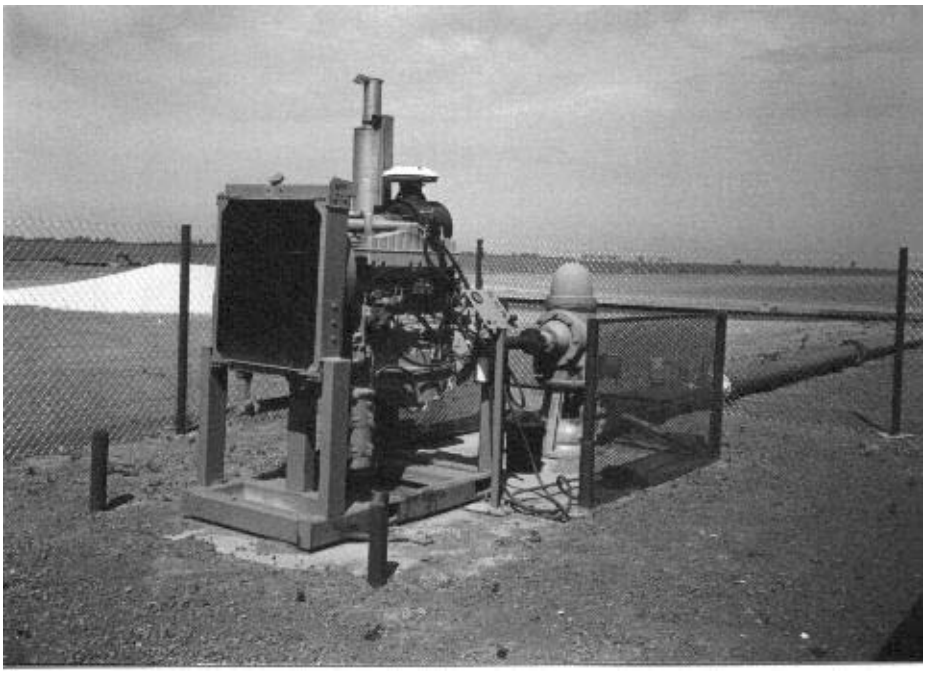
Gallons	Diameter	Height	Gauge	Weight (Pounds)	Price
1,044	6' 8"	48"	12	670	$ 1,430
1,504	8' 10"	48"	12	912	1,775
1,900	6' 4"	96"	12	1,014	1,850
2,500	7' 4"	96"	12	1,321	2,300
2,880	7' 10"	96"	12	1,329	2,460
3,200	8' 3"	96"	12	1,423	2,630
3,500	8' 8"	96"	12	1,520	2,825
4,200	9' 5 1/2"	96"	12	1,724	3,490
5,000	10' 4"	96"	12	1,924	3,720
5,500	10' 10"	96"	12	2,080	4,120
6,000	11' 4"	96"	12	2,163	4,290
6,500	11' 10"	96"	12	2,210	4,575
7,500	10' 4"	12'	12	2,553	4,975
8,600	9' 7"	16'	12	2,856	5,490
10,000	9' 9"	18'	12	3,169	6,360
12,000	10' 2"	20'	12	3,667	7,210
15,000	11' 11"	18'	10	5,376	9,495
17,500	11' 2"	24'	10	5,995	10,580
20,000	11' 11"	24'	10	6,480	12,300
25,000	18' 10"	12'	10	7,320	14,870
30,000	20' 9"	12'	10	8,500	16,875

Tanks should be set on a level foundation of ¾" crushed rock that is 4" to 6" deep

PUMPS



TURBINE PUMP



DIESEL ENGINE
WITH GEAR HEAD DRIVE

AH 534.71: CORRALS AND FENCES

This chapter contains various costs associated with corrals and fences. Specifications and costs are included for:

- Steel fencing
- Barbed wire fencing
- Wood fencing
- Wood gates
- Metal gates
- Metal panels
- Vinyl/PVC fencing
- Cattle squeeze

Photographs showing examples of equipment discussed are located at the end of the chapter.

STEEL FENCING

Height and Type	Fence Cost Per Linear Foot	Additions
11 Gauge		
3' chain link	$8.05	Top Rail: $1.65 per linear foot
4' chain link	9.00	
5' chain link	11.65	Barbed wire, 3 strands:
6' chain link	13.05	$2.50 per linear foot
8' chain link	16.50	
10' chain link	20.25	Barbed coils: $8.80 per
12' chain link	24.85	linear foot
9 Gauge		
3' chain link	$9.10	Barbed wire, 3 strands:
4' chain link	9.75	$2.65 per linear foot on
5' chain link	11.65	10' and 12' fence
6' chain link	14.25	
8' chain link	18.20	
10' chain link	23.20	
12' chain link	27.15	

Fences over 1,000 feet, deduct 10 percent.

CORRALS AND FENCES

BARBED WIRE FENCING

Size and Type	Per Linear Foot/1 Mile or More
Barbed wire, 3 strand	$2.25 to $2.75
Barbed wire, 4 strand	$2.45 to $2.95
Barbed wire, 5 strand	$2.70 to $3.20
2 strands barbed, 32" woven wire, steel posts	$3.90 to $4.30

Fence costs are complete—fencing and posts. Gates are to be added. When gates are added, continue using the total linear distance of the fence for costing and do not deduct for the linear distance of the fence replaced by the gate. Posts are set in concrete on 10' centers.

WOOD FENCING

COST PER LINEAR FOOT

Rail Size	Post Size	Number of Rails			
		1	2	3	6
2" x 8"	6" x 6"	$6.85	$7.90	$10.15	$12.85
2" x 6"	6" x 4"	5.28	5.75	6.20	7.60
2" x 4"	6" x 4"	5.10	5.40	5.70	6.85
1" x 8"	6" x 4"	4.90	5.55	5.90	7.10
1" x 6"	6" x 4"	4.60	5.00	5.65	6.80
1 ¼" x 6"	6" x 4"	4.75	4.80	5.95	7.15
2" x 6"	4" x 4"	4.80	5.20	5.70	6.85

All posts figured at 8' on center.

WOOD GATES

COST PER GATE

Height/ Description	Width						
	4'	6'	8'	10'	12'	16'	20'
4' 5 Rails	$54	$68	$87	$167	$173	$190	$203
5' 6 Rails	67	80	129	181	195	210	224
6' 7 Rails	79	93	186	198	216	228	246

CORRALS AND FENCES

METAL GATES

(INCLUDING POSTS)—COST PER GATE

Height/ Description	Width					
	3'	4'	10'	12'	14'	16'
4' 1 3/8" Galvanized Tube Galvanized Fabric Including Hardware	$78	$86	$180	$194	$219	$251
5' 1 5/8" Standard Pipe Fabric Including Hardware	138	158	280	323	351	377
6' 1 5/8" Standard Pipe Fabric Including Hardware	150	169	305	365	408	449

5-BAR ADJUSTABLE GATES—5' IN HEIGHT

Size	Cost Per Gate
3' to 4'	$ 88.00
4' to 6'	98.00
6' to 8'	125.00
8' to 10'	141.00
10' to 12'	153.00
12' to 14'	183.00
14' to 16'	217.00
16' to 20'	275.00

6-BAR ADJUSTABLE GATES—5' IN HEIGHT

Size	Cost Per Gate
3' to 4'	$ 96.00
4' to 6'	112.00
6' to 8'	142.00
8' to 10'	161.00
10' to 12'	172.00
12' to 14'	207.00
14' to 16'	218.00
16' to 20'	270.00

CORRALS AND FENCES

METAL PANELS

5-BAR ADJUSTABLE PANEL USED FOR STALLS OR PENS

Size	Cost Per Gate
8' to 10'	$119.00
10' to 12'	138.00
12' to 14'	148.00
14' to 16'	172.00
16' to 18'	193.00
18' to 20'	208.00
20' to 22'	223.00
22' to 24'	228.90
24' to 26'	244.00

Add for the hinge and latch posts - **$35 to $40**

6-BAR ADJUSTABLE PANEL USED FOR STALLS OR PENS

Size	Cost Per Gate
8' to 10'	$142.00
10' to 12'	158.00
12' to 14'	174.00
14' to 16'	201.00
16' to 18'	217.00
18' to 20'	247.00
20' to 22'	259.00
22' to 24'	278.00
24' to 26'	289.00

3-BAR FENCE PANEL

Size	Cost Per Gate
10'	$ 77.00
12'	91.00
16'	105.00
18'	112.00
20'	125.00
24'	140.00

PORTABLE LOADING CHUTE

Size	Cost Per Gate
30" x 5' High	$1,575

CORRALS AND FENCES

METAL PANELS

5-BAR SOLID PANEL

Size	Cost Per Gate
10'	$113.00
12'	125.00
16'	166.00
18'	178.00
20'	193.00
24'	216.00

6-BAR SOLID PANEL

Size	Cost Per Gate
10'	$124.00
12'	140.00
16'	185.00
18'	193.00
20'	214.00
24'	245.00

VINYL/PVC FENCING

White

Post Size	Rail Size	Number of Rails	Cost Per Linear Foot Installed
5" x 5"	1-1/2" x 5-1/2" x 16'	3	$14.68
5" x 5"	1-1/2" x 5-1/2" x 16'	4	$15.44

Prices based on 1,000' +

Height: 60 inches

Posts: Set in concrete—10" diameter, 30" deep, 8' on center

Gates: 12' Metal gates (preferred)—$**695** installed, plus paint

12' PVC gates (have tendency to sag)—$**1,075** installed

Color: Add 10 percent

(Photograph shown on AH 534.71, page 7)

CORRALS AND FENCES

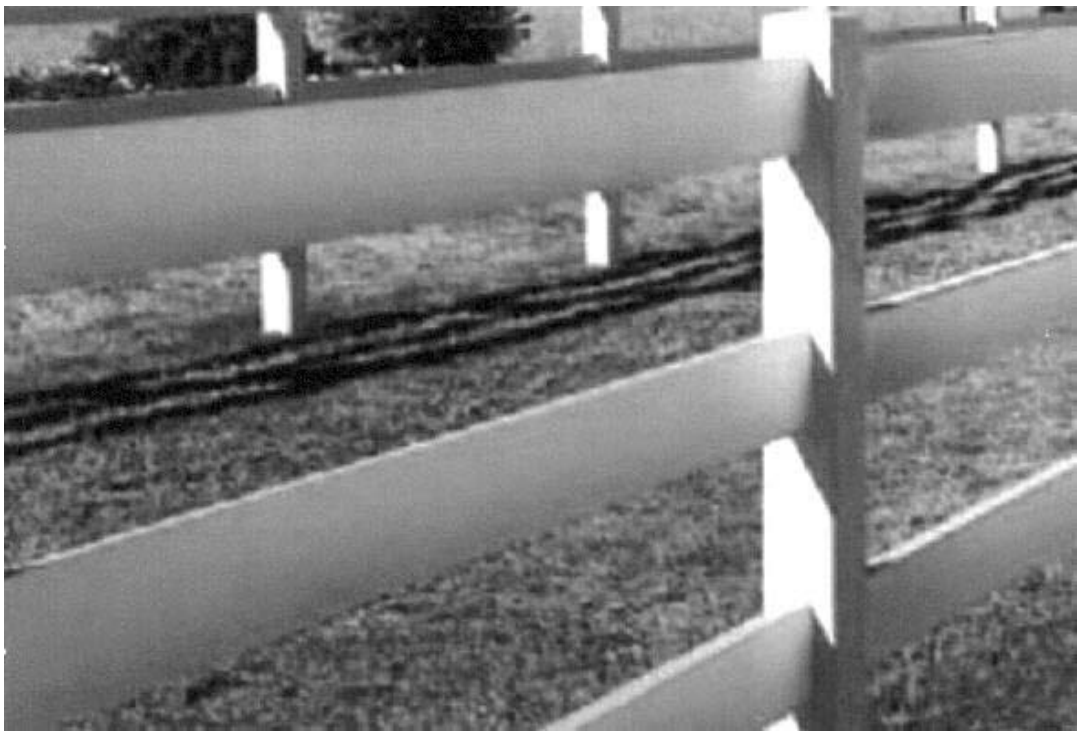
CATTLE SQUEEZE

Examples vary in cost significantly depending on manufacturer, model, and features. These listed costs are representative of models that range from economy to midrange level. High end models produced by the highest quality manufacturers can be sold for amounts that exceed the listed costs by more than fifty percent.

Hydraulic Metal	$5,700 to $6,760
Upright Metal	$1,870 to $2,080
Upright Metal Extended	$2,080 to $2,600
Calf Chute or Table	$930 to $1,040

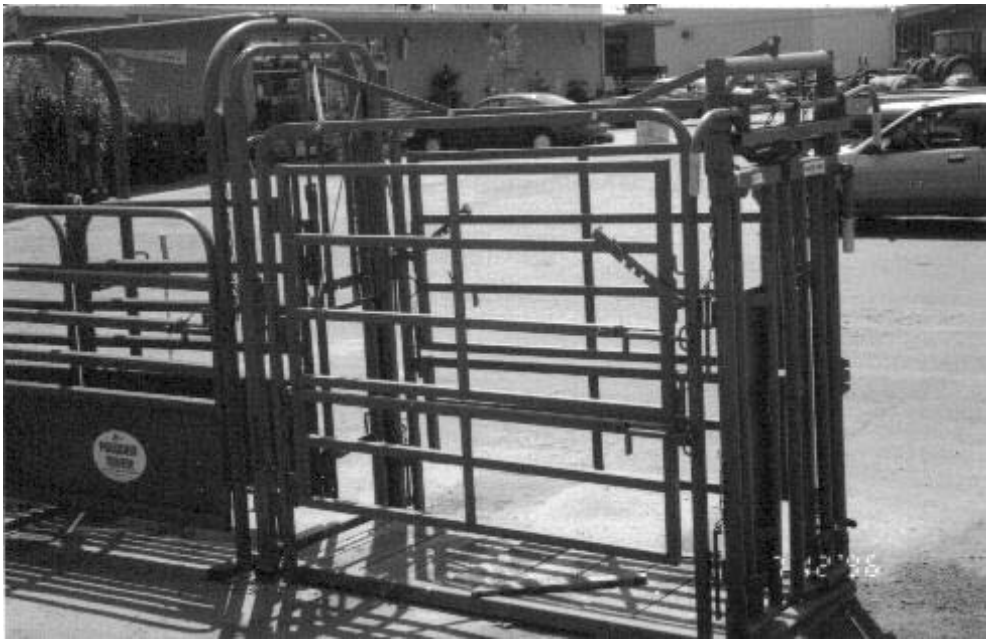
(Photograph shown on AH 534.71, page 8)

CORRALS AND FENCES



VINYL FENCING

CORRALS AND FENCES



CATTLE SQUEEZE

AH 534.75: GREENHOUSES

All greenhouses are designed to provide a controlled and ideal environment in which to cultivate plants. While all greenhouses share the same objective, there are many different types of greenhouses made from various construction materials. This allows growers a great deal of freedom in choosing an appropriate configuration consistent with the needs of the plants being grown. Appropriate ventilation is important to prevent mold growth and to maintain an even temperature throughout the greenhouse. Some houses require misting systems to keep the relative humidity elevated for certain species of plants.

Commercial greenhouses are constructed with steel or wooden posts and trusses on a typical 10' center. The span of a truss is generally 20 to 40 feet. Typical commercial greenhouses use either glass or polycarbonate covers. Fiberglass or polyethylene plastic covers are cheaper alternative materials but generally need more frequent replacement. Sometimes a combination of materials can be used such as glass for the exterior and polyethylene in the interior to separate plants with different environmental requirements. High quality polyethylene is also available with infrared retention and anti-condensate properties. The energy savings for this type of polyethylene can reduce heating requirements significantly. Although requiring more frequent replacement than either glass or polycarbonate, the energy savings can make this an economic choice. Additionally, the anti-condensate properties reduce incidence of plant diseases, yet another benefit of using this product.

Basic building costs shown here are for the structure only and include only those components specified. The cost of other items or equipment such as a ventilation system or a watering system must be added to the basic building cost to arrive at a total cost.

Photographs showing examples of greenhouse types discussed are located at the end of this chapter.

- Wall heights vary from 7 feet to 10 feet on the straight wall construction.

BUILDING SPECIFICATIONS

Components	Low Quality	Average Quality	High Quality
Wall and Roof	Light pipe, 4' wall, single light polyethylene cover, fiberglass ends	Galvanized steel frame, 8' wall, double polycarbonate or fiberglass cover	Heavy steel frame, 8' wall, glass or multi-wall polycarbonate cover
Floor	Dirt—some gravel	Gravel—some concrete walks	Adequate concrete walks, concrete foundation
Interior	No lighting, minimum water	Average lighting, water, and roof vents	Ample lighting, water, roof vents, and exhaust fans

(Photographs shown on AH 534.75, page 3)

GREENHOUSES

SQUARE-FOOT COSTS

	Square-Foot Area					
Quality	**3,000-5,000**	**10,000**	**20,000**	**30,000**	**40,000**	**50,000**
Low	4.00	3.60	3.50	3.30	2.90	2.70
Average	15.25	14.25	12.00	11.50	11.00	10.50
High	23.50	21.75	18.70	17.80	16.70	15.80

ADDITIVES

Additional concrete walk	**$3.30 to $3.75** per square foot
Benching	**$3.10 to $4.90** per square foot – average quality
Gravel floor	**$0.35 to $0.45** per square foot

SHADE CLOTH HOUSES

In anticipation of the threat of citrus greening disease (huanglongbing) many commercial citrus nursery stock growers have installed shade cloth houses to protect the mother plants that are used as a source for budwood in production of nursery stock. The Asian citrus psyllid, now found to be present in California, spreads the disease by feeding on new growth. The purpose of the shade cloth is to physically prevent the psyllid from entering the growing area to prevent transmitting the disease to the mother plants. For this type of installation the shade cloth will be installed on top and sides of the support structure to entirely screen out the psyllid. There is no treatment currently for the disease (caused by bacteria), so screening out the insect is the only preventive measure that can be taken by growers at this time. Once infected the fruit produced becomes unmarketable and leads to the premature death of the tree.

FAIR TO LOW COST

BUILDING SPECIFICATIONS

Components	Low Quality
Wall and Roof	Wood or steel post construction, no walls, overhead cable support with wire, covered by a flat shade fabric. Normally 7 feet to 9 feet high.
Floor	Dirt
Interior	No lighting, no water

(Photographs shown on AH 534.75, page 4)

SQUARE-FOOT COSTS

Square-Foot Area	Cost Per Square Foot
Under 10,000	$1.70 to $1.85
10,000 – 20,000	$1.30 to $1.45
20,000 – 40,000	$1.20 to $1.35
40,000 Up	$1.10 to $1.30

ADDITIVE

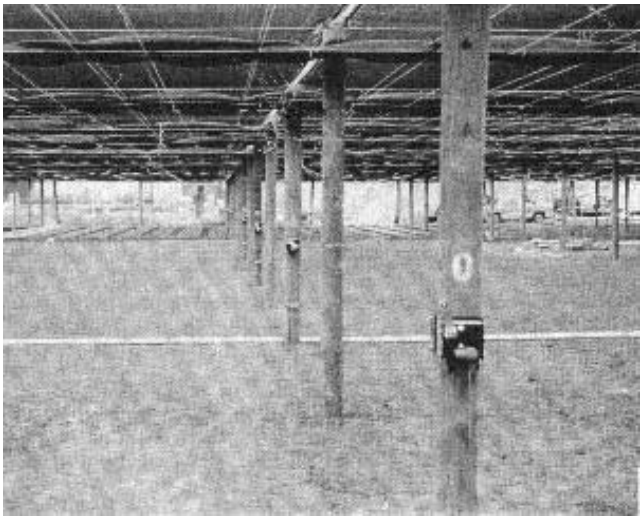
Gravel Floor	**$0.30 to $0.45** per square foot

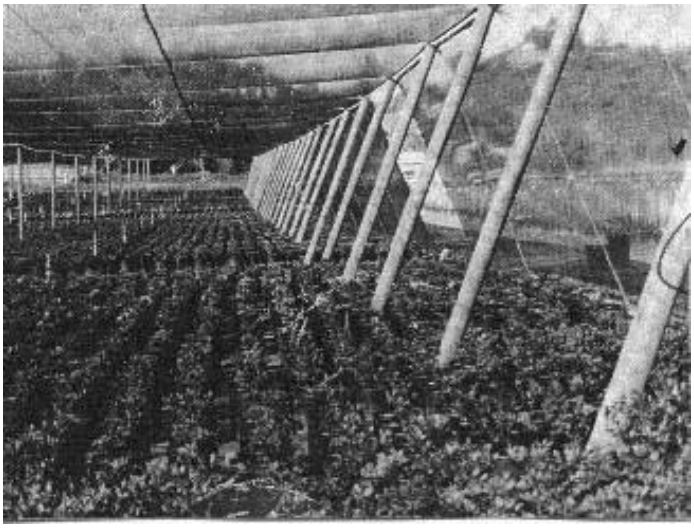
GREENHOUSES

CLIMATE CONTROL

GREENHOUSES

SHADE CLOTH HOUSES





AH 534.76: LAND DEVELOPMENT AND DRAINAGE TILE

This chapter presents some of the costs incurred in the process of converting raw land to that which is suitable for its intended agricultural purpose. The land development portion provides costs for leveling of land, moving soil, and ripping of the land. The drainage portion provides drainage pipe costs to allow control of water on the land.

LAND DEVELOPMENT

LEVELING COST

Item	Per Acre
Native Land	$385 to $750
Ripping and Relieving	$440 to $700
Touch-Up Leveling—Laser	$120 to $150
Rescaping	$77 to $100

The cost of precision grading varies widely depending on the amount of soil moved, the distance the soil is moved, how far the earthmoving equipment must travel, and the costs of diesel fuel for the earthmoving equipment. Contractors charge $100 to $150 per hour for leveling land where the amount of soil to be moved is undetermined.

EARTH MOVING

Size	Cost
Per cubic yard	$.95 to $1.25

RIPPING

Item	Cost
Clay 5' deep	$440 to $520
Clay 6' deep	$440 to $650
Loamy or sandy soil	$275 to $440
Hard pan 4' - 6' deep	$460 to $750

NOTE:

1. Ripping costs are based on four-foot centers.
2. Ripping cost with a slip plow attached to shank (superior mixing and breaking of soils) is typically done on six-foot centers, and the cost is equal to standard ripping on four-foot centers.
3. It typically takes ten hours to rip seven acres on four-foot centers.

LAND DEVELOPMENT AND DRAINAGE TILE

DRAINAGE

Modern drainage tile installations use corrugated plastic tubing. The spacing varies from 100 feet to 400 feet on centers. The older type installation includes perforated tile with wide trenches. A 5-inch corrugated plastic drain tubing is installed in a 12-inch trench versus a 24-inch to 27-inch trench for the older type installation. The cost for gravel fill is much less because of the narrower trench.

The installed cost of 5-inch corrugated plastic tubing on 400-foot centers, 7 1/2-feet deep including sump and pump, and trench width of 12 inches with gravel fill over the pipe is as follows.

DRAINAGE PIPE

Loamy soils	$473 to $682 per acre
Rocky soils	$682 to $1,050 per acre

Reduce the above cost 25 percent if system lacks a pump or sump.

Increase the above cost 25 percent if the system has 100-foot centers, with 4-inch lines

AH 534.77: VINEYARD STAKES AND TRELLIS SYSTEMS

Vine training systems are used primarily to assist in good canopy management which is important due to its positive effect on yield, quality, vigor, and disease prevention of grapes resulting in potential profitability for a vineyard operation.

The selection of an appropriate grape variety with a compatible trellis system is of utmost importance in the growing of grapevines. Pruning and training the grapevine on a trellis system helps a grower develop the ideal balance of vegetative growth and fruit which can lead to higher production and better fruit quality while reducing the incidence of disease.

By managing the amount of sunlight reaching the fruit and fruiting buds, a grower can assure full ripening of the grapes during a growing season and increase chances that there will be more fruit production from fruiting buds the following year. Controlling sunlight levels in the canopy also limits sun damage to the fruit.

The ultimate selection of a grapevine trellis system depends on various factors such as the variety of grape and whether it is a table, raisin or wine grape. The vigor of a particular variety, soil fertility, and local climate conditions will also affect the selection. The popularity of any system may be influenced by recent research and studies or even by word of mouth among growers.

This chapter contains costs for various stake and trellis systems used in the production of table, raisin, and wine grapes. Miscellaneous vineyard component costs are also provided for the following:

- Wire price per acre
- Metal stakes and cross-arms
- Wood stakes and cross-arms
- Deer fence

Vineyard stakes and trellis costs can vary significantly due to differences in the following:

- Nature and quality of material
- Spacing between the rows of vines
- Type of vineyard
- Cost of labor (farm labor or commercial contractor)

The Useful Information page at the end of the chapter contains a conversion chart for wire sizes, along with a chart for the spacing of plants and an estimate of the amount of wire required.

Photographs showing examples of the improvements discussed are located at the end of this chapter.

VINEYARD STAKES AND TRELLIS SYSTEMS

TABLE GRAPES

SINGLE CROSS-ARM

10 FOOT ROWS

	Spacing—6' x 10' or 7 ' x 10' or 8' x 10'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$6.05		
Every 15 feet	$6.05	290	$1,755
Every 18 feet	$6.05	242	$1,464
Every 21 feet	$6.05	207	$1,252
Every 24 feet	$6.05	182	$1,101
Four wires			$427
End post with anchor (installed)	$35.00	14	$490
End post without anchor (installed)	$27.00	14	$378

11 FOOT ROWS

	Spacing—6' x 11' or 7 ' x 11' or 8' x 11'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$6.05		
Every 15 feet	$6.05	264	$1,597
Every 18 feet	$6.05	220	$1,331
Every 21 feet	$6.05	188	$1,137
Every 24 feet	$6.05	165	$998
Four wires			$395
End post with anchor (installed)	$35.00	13	$455
End post without anchor (installed)	$27.00	13	$351

12 FOOT ROWS

	Spacing—6' x 12' or 7 ' x 12' or 8' x 12'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$6.05		
Every 15 feet	$6.05	242	$1,464
Every 18 feet	$6.05	201	$1,216
Every 21 feet	$6.05	172	$1,041
Every 24 feet	$6.05	151	$914
Four wires			$348
End post with anchor (installed)	$35.00	12	$420
End post without anchor (installed)	$27.00	12	$324

Based on 600 foot rows

(Photographs shown on AH 534.77, page 17)

VINEYARD STAKES AND TRELLIS SYSTEMS

TABLE GRAPES

DOUBLE CROSS-ARM

10 FOOT ROWS

	Spacing—6' x 10' or 7 ' x 10' or 8' x 10'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$7.25		
Every 15 feet	$7.25	290	$2,103
Every 18 feet	$7.25	242	$1,755
Every 21 feet	$7.25	207	$1,501
Every 24 feet	$7.25	182	$1,320
Six wires			$640
End post with anchor (installed)	$35.00	14	$490
End post without anchor (installed)	$27.00	14	$378

11 FOOT ROWS

	Spacing—6' x 11' or 7 ' x 11' or 8' x 11'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$7.25		
Every 15 feet	$7.25	264	$1,914
Every 18 feet	$7.25	220	$1,595
Every 21 feet	$7.25	188	$1,363
Every 24 feet	$7.25	165	$1,196
Six wires			$580
End post with anchor (installed)	$35.00	13	$455
End post without anchor (installed)	$27.00	13	$351

12 FOOT ROWS

	Spacing—6' x 12' or 7 ' x 12' or 8' x 12'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$7.25		
Every 15 feet	$7.25	242	$1,755
Every 18 feet	$7.25	201	$1,457
Every 21 feet	$7.25	172	$1,247
Every 24 feet	$7.25	151	$1,095
Six wires			$534
End post with anchor (installed)	$35.00	12	$420
End post without anchor (installed)	$27.00	12	$324

Based on 600 foot rows

(Photographs shown on AH 534.77, page 18)

VINEYARD STAKES AND TRELLIS SYSTEMS

TABLE GRAPES/RAISINS

OPEN GABLE TRELLIS

10 FOOT ROWS

	Spacing—6' x 10' or 7 ' x 10' or 8' x 10'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$13.00		
Every 18 feet	$13.00	242	$3,146
Every 21 feet	$13.00	207	$2,691
Every 24 feet	$13.00	182	$2,366
Six wires			$640
Eight wires			$853
End post with anchor (installed)	$35.00	14	$490

11 FOOT ROWS

	Spacing—6' x 11' or 7 ' x 11' or 8' x 11'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$13.00		
Every 18 feet	$13.00	220	$2,860
Every 21 feet	$13.00	188	$2,444
Every 24 feet	$13.00	165	$2,145
Six wires			$582
Eight wires			$774
End post with anchor (installed)	$35.00	13	$455

12 FOOT ROWS

	Spacing—6' x 12' or 7 ' x 12' or 8' x 12'		
	Cost Per Unit	**Posts Per Acre**	**Cost Per Acre**
Post and cross-arm assembly	$13.00		
Every 18 feet	$13.00	201	$2,613
Every 21 feet	$13.00	172	$2,236
Every 24 feet	$13.00	151	$1,963
Six wires			$534
Eight wires			$711
End post with anchor (installed)	$35.00	12	$420

Based on 600 foot rows

(Photographs shown on AH 534.77, page 19)

VINEYARD STAKES AND TRELLIS SYSTEMS

RAISIN GRAPES

TRELLIS

10 FOOT ROWS

	Cost Per Unit	Posts Per Acre	Cost Per Acre		
			5' x 10'	6' x 10'	7' x 10'
Light 7' stake and 24" cross-arm	$5.45				
Every 5 feet	$5.45	871	$4,747		
Every 6 feet	$5.45	726		$3,957	
Every 7 feet	$5.45	622			$3,390
Two wires			$217	$217	$217
End post	$27.00	14	$378	$378	$378
Light 7' stake with no cross-arm	$3.75		$3,092	$2,577	$2,208
One wire			$108	$108	$108

11 FOOT ROWS

	Cost Per Unit	Posts Per Acre	Cost Per Acre		
			5' x 11'	6' x 11'	7' x 11'
Light 7' stake and 24" cross-arm	$5.45				
Every 5 feet	$5.45	792	$4,316		
Every 6 feet	$5.45	660		$3,597	
Every 7 feet	$5.45	566			$3,085
Two wires			$197	$197	$197
End post	$27.00	13	$351	$351	$351
Light 7' stake with no cross-arm	$3.75		$2,970	$2,475	$2,122
One wire			$98	$98	$98

12 FOOT ROWS

	Cost Per Unit	Posts Per Acre	Cost Per Acre		
			5' x 12'	6' x 12'	7' x 12'
Light 7' stake and 24" cross-arm	$5.45				
Every 5 feet	$5.45	726	$3,957		
Every 6 feet	$5.45	605		$3,297	
Every 7 feet	$5.45	518			$2,823
Two wires			$165	$165	$165
End post	$27.00	12	$324	$324	$324
Light 7' stake with no cross-arm	$3.75		$2,504	$2,087	$1,787
One wire			$82	$82	$82

(Drawing and photograph shown on AH 534.77, page 20)

VINEYARD STAKES AND TRELLIS SYSTEMS

RAISIN GRAPES

OVERHEAD DRY ON VINE TRELLIS

Commonly used in 12' row with 6' between vines; occasionally used on 10' and 11' rows; a few 8' and 9' rows.

Materials: Wood post 12' on ends, 9' on sides, 10' wood post every third vine with 36" cross-arm, 8 wires per row, and cable support.

Trellising Cost Per Acre:
$4,900 to $5,300 on 6' x 12' spacing
$5,300 to $5,900 on 10' and 11' rows
$5,800 to $6,900 on 8' and 9' rows

(Drawing and photograph shown on AH 534.77, page 21)

T-POST DRY ON VINE TRELLIS

T-Posts:
V8' T-post every 28' with two 10' cross-arms and 5 wires. In between T-posts are 2 bent 7' to 8' T-posts with 2 wires. Each vine will have a training stake. Each end has a heavy steel post with anchors.
Cost: **$2,600 to $3,200** for 7' x 12' spacing.

(Photographs shown on AH 534.77, page 22)

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

TRELLIS

6 FOOT ROWS

	Cost Per Unit	Vines Per Acre		
		1,815	1,452	1,210
		Cost Per Acre		
		4' x 6'	5' x 6'	6' x 6'
22 end posts per acre with anchor	$35	$770	$770	$770
22 end posts per acre without anchor	$27	$594	$594	$594
7' Light T-post (Add 30% for heavy T-post)				
Every vine	$3.50	$6,353	$5,082	$4,235
Every other vine	$1.75	$3,176	$2,541	$2,118
Every third vine	$1.17	$2,124	$1,699	$1,416
Every fourth vine	$.88	$1,597	$1,278	$1,065
8' Vertical line post (13 ga.)				
Every vine	$7.50	$13,613	$10,890	$9,075
Every other vine	$3.75	$6,806	$5,445	$4,538
Every third vine	$2.50	$4,538	$3,630	$3,025
Every fourth vine	$1.88	$3,412	$2,730	$2,275
4' Rebar or pencil rod at each vine (between T-post or vertical line)	$.67			
One rebar between posts	$.34	$617	$494	$411
Two rebars between posts	$.45	$817	$653	$545
Three rebars between posts	$.50	$908	$726	$605
24" cross-arm (Add 25% for 30" cross-arm)				
Every vine	$1.70	$3,086	$2,468	$2,057
Every other vine	$.85	$1,543	$1,234	$1,029
Every third vine	$.57	$1,035	$825	$690
Every fourth vine	$.43	$781	$624	$520
Two wires		$340	$340	$340
Three wires		$511	$511	$511
Four wires		$680	$680	$680
Five wires		$851	$851	$851
Six wires		$1,022	$1,022	$1,022
Seven wires		$1,192	$1,192	$1,192
Eight wires		$1,362	$1,362	$1,362

(Photographs shown on AH 534.77, pages 23-28)

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

TRELLIS

7 FOOT ROWS

	Cost Per Unit	Vines Per Acre			
		1,555	1,245	1,037	889
		Cost Per Acre			
		4' x 7'	5' x 7'	6' x 7'	7' x 7'
20 end posts per acre with anchor	$35	$700	$700	$700	$700
20 end posts per acre without anchor	$27	$540	$540	$540	$540
7' Light T-post (Add 30% for heavy T-post)					
Every vine	$3.50	$5,443	$4,358	$3,630	$3,112
Every other vine	$1.75	$2,721	$2,179	$1,815	$1,556
Every third vine	$1.17	$1,819	$1,457	$1,213	$1,040
Every fourth vine	$.88	$1,368	$1,096	$913	$782
8' Vertical line post (13 ga.)					
Every vine	$7.50	$11,663	$9,338	$7,778	$6,668
Every other vine	$3.75	$5,831	$4,669	$3,889	$3,334
Every third vine	$2.50	$3,888	$3,113	$2,593	$2,223
Every fourth vine	$1.88	$2,923	$2,341	$1,950	$1,671
4' Rebar or pencil rod at each vine (between T-post or vertical line)	$.67				
One rebar between posts	$.34	$529	$423	$353	$302
Two rebars between posts	$.45	$700	$560	$467	$400
Three rebars between posts	$.50	$778	$623	$519	$445
24" cross-arm (Add 25% for 30" cross-arm)					
Every vine	$1.70	$2,644	$2,117	$1,763	$1,511
Every other vine	$.85	$1,322	$1058	$882	$756
Every third vine	$.57	$886	$710	$591	$507
Every fourth vine	$.43	$669	$535	$446	$382
Two wires		$289	$289	$289	$289
Three wires		$438	$438	$438	$438
Four wires		$584	$584	$584	$584
Five wires		$730	$730	$730	$730
Six wires		$875	$875	$875	$875
Seven wires		$1,021	$1,021	$1,021	$1,021
Eight wires		$1,156	$1,156	$1,156	$1,156

(Photographs shown on AH 534.77, pages 23-28)

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

TRELLIS

8 FOOT ROWS

	Cost Per Unit	Vines Per Acre			
		1,089	907	778	681
		Cost Per Acre			
		5' x 8'	6' x 8'	7' x 8'	8' x 8'
18 end posts per acre with anchor	$35	$630	$630	$630	$630
18 end posts per acre without anchor	$27	$486	$486	$486	$486
7' Light T-post (Add 30% for heavy T-post)					
Every vine	$3.50	$3,812	$3,175	$2,723	$2,384
Every other vine	$1.75	$1,906	$1,587	$1,362	$1,192
Every third vine	$1.17	$1,274	$1,061	$910	$797
Every fourth vine	$.88	$958	$798	$685	$599
8' Vertical line post (13 ga.)					
Every vine	$7.50	$8,168	$6,803	$5,835	$5,108
Every other vine	$3.75	$4,084	$3,401	$2,918	$2,554
Every third vine	$2.50	$2,723	$2,268	$1,945	$1,703
Every fourth vine	$1.88	$2,047	$1,705	$1,463	$1,280
4' Rebar or pencil rod at each vine (between T-post or vertical line)	$.67				
One rebar between posts	$.34	$370	$308	$265	$232
Two rebars between posts	$.45	$490	$408	$350	$307
Three rebars between posts	$.50	$545	$454	$389	$341
24" cross-arm (Add 25% for 30" cross-arm)					
Every vine	$1.70	$1,851	$1,542	$1,323	$1,158
Every other vine	$.85	$926	$771	$661	$579
Every third vine	$.57	$621	$517	$444	$388
Every fourth vine	$.43	$468	$390	$335	$293
Two wires		$257	$257	$257	$257
Three wires		$385	$385	$385	$385
Four wires		$511	$511	$511	$511
Five wires		$639	$639	$639	$639
Six wires		$769	$769	$769	$769
Seven wires		$897	$897	$897	$897
Eight wires		$1,023	$1,023	$1,023	$1,023

(Photographs shown on AH 534.77, pages 23-28)

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

TRELLIS

9 FOOT ROWS

	Cost Per Unit	Vines Per Acre			
		968	807	691	605
		Cost Per Acre			
		5' x 9'	6' x 9'	7' x 9'	8' x 9'
16 end posts per acre with anchor	$35	$560	$560	$560	$560
16 end posts per acre without anchor	$27	$432	$432	$432	$432
7' Light T-post (Add 30% for heavy T-post)					
Every vine	$3.50	$3,388	$2,825	$2,419	$2,118
Every other vine	$1.75	$1,694	$1,412	$1,209	$1,059
Every third vine	$1.17	$1,133	$944	$808	$708
Every fourth vine	$.88	$852	$710	$608	$532
8' Vertical line post (13 ga.)					
Every vine	$7.50	$7,260	$6,053	$5,183	$4,538
Every other vine	$3.75	$3,630	$3,026	$2,591	$2,269
Every third vine	$2.50	$2,420	$2,018	$1,728	$1,513
Every fourth vine	$1.88	$1,820	$1,517	$1,299	$1,137
4' Rebar or pencil rod at each vine (between T-post or vertical line)	$.67				
One rebar between posts	$.34	$329	$274	$235	$206
Two rebars between posts	$.45	$436	$363	$311	$272
Three rebars between posts	$.50	$484	$404	$346	$303
24" cross-arm (Add 25% for 30" cross-arm)					
Every vine	$1.70	$1,646	$1,372	$1,175	$1,029
Every other vine	$.85	$823	$686	$587	$514
Every third vine	$.57	$552	$460	$394	$345
Every fourth vine	$.43	$416	$347	$297	$260
Two wires		$242	$242	$242	$242
Three wires		$362	$362	$362	$362
Four wires		$484	$484	$484	$484
Five wires		$605	$605	$605	$605
Six wires		$726	$726	$726	$726
Seven wires		$848	$848	$848	$848
Eight wires		$1,032	$1,032	$1,032	$1,032

(Photographs shown on AH 534.77, pages 23-28)

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

TRELLIS

10 FOOT ROWS

	Cost Per Unit	Vines Per Acre			
		871	726	622	544
		Cost Per Acre			
		5' x 10'	6' x 10'	7' x 10'	8' x 10'
14 end posts per acre with anchor	$35	$490	$490	$490	$490
14 end posts per acre without anchor	$27	$378	$378	$378	$378
7' Light T-post (Add 30% for heavy T-post)					
Every vine	$3.50	$3,049	$2,541	$2,177	$1,904
Every other vine	$1.75	$1,524	$1,271	$1,089	$952
Every third vine	$1.17	$1,019	$849	$728	$636
Every fourth vine	$.88	$766	$639	$547	$479
8' Vertical line post (13 ga.)					
Every vine	$7.50	$6,533	$5,445	$4,665	$4,080
Every other vine	$3.75	$3,266	$2,723	$2,333	$2,040
Every third vine	$2.50	$2,178	$1,815	$1,555	$1,360
Every fourth vine	$1.88	$1,638	$1,365	$1,169	$1,023
4' Rebar or pencil rod at each vine (between T-post or vertical line)	$.67				
One rebar between posts	$.34	$296	$247	$212	$185
Two rebars between posts	$.45	$392	$327	$280	$245
Three rebars between posts	$.50	$436	$363	$311	$272
24" cross-arm (Add 25% for 30" cross-arm)					
Every vine	$1.70	$1,481	$1,234	$1,057	$925
Every other vine	$.85	$740	$617	$529	$462
Every third vine	$.57	$497	$414	$355	$310
Every fourth vine	$.43	$375	$312	$268	$234
Two wires		$217	$217	$217	$217
Three wires		$326	$326	$326	$326
Four wires		$436	$436	$436	$411
Five wires		$521	$521	$521	$521
Six wires		$653	$653	$653	$653
Seven wires		$762	$762	$762	$762
Eight wires		$870	$870	$870	$870

(Photographs shown on AH 534.77, pages 23-28)

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

TRELLIS

11 FOOT ROWS

	Cost Per Unit	Vines Per Acre			
		792	660	566	495
		Cost Per Acre			
		5' x 11'	6' x 11'	7' x 11'	8' x 11'
13 end posts per acre with anchor	$35	$455	$455	$455	$455
13 end posts per acre without anchor	$27	$351	$351	$351	$351
7' Light T-post (Add 30% for heavy T-post)					
Every vine	$3.50	$2,772	$2,310	$1,981	$1,733
Every other vine	$1.75	$1,386	$1,155	$991	$866
Every third vine	$1.17	$927	$772	$662	$579
Every fourth vine	$.88	$697	$581	$498	$436
8' Vertical line post (13 ga.)					
Every vine	$7.50	$5,940	$4,950	$4,245	$3,713
Every other vine	$3.75	$2,970	$2,475	$2,123	$1,856
Every third vine	$2.50	$1,980	$1,650	$1,415	$1,238
Every fourth vine	$1.88	$1,489	$1,241	$1,064	$931
4' Rebar or pencil rod at each vine (between T-post or vertical line)	$.67				
One rebar between posts	$.34	$269	$224	$192	$168
Two rebars between posts	$.45	$356	$297	$255	$223
Three rebars between posts	$.50	$396	$330	$283	$248
24" cross-arm (Add 25% for 30" cross-arm)					
Every vine	$1.70	$1,346	$1122	$962	$842
Every other vine	$.85	$673	$561	$481	$421
Every third vine	$.57	$451	$376	$323	$282
Every fourth vine	$.43	$341	$284	$243	$213
Two wires		$197	$197	$197	$197
Three wires		$297	$297	$297	$297
Four wires		$394	$394	$394	$394
Five wires		$492	$492	$492	$492
Six wires		$594	$594	$594	$594
Seven wires		$692	$692	$692	$692
Eight wires		$790	$790	$790	$790

(Photographs shown on AH 534.77, page 23-28)

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

LYRE SYSTEM

11 FOOT ROWS

	Cost Per Unit	Vines Per Acre			
		792	660	566	495
		Cost Per Acre			
		5' x 11'	6' x 11'	7' x 11'	8' x 11'
13 end posts per acre with anchor	$35	$455	$455	$455	$455
13 end posts per acre without anchor	$27	$351	$351	$351	$351
Heavy steel stake with open lyre cross-arm					
Every vine	$14.50				
Every other vine	$7.25	$5,742	$4,785	$4,104	$3,589
Every third vine	$4.83	$3,825	$3,188	$2,734	$2,391
Every fourth vine	$3.63	$2,875	$2,396	$2,055	$1,797
4' Rebar or pencil rod at each vine (between lyre cross-arm)	$.67				
One rebar between lyres	$.34	$269	$224	$192	$168
Two rebars between lyres	$.45	$356	$297	$255	$223
Three rebars between lyres	$.50	$396	$330	$283	$248
Six wires		$594	$594	$594	$594
Seven wires		$692	$692	$692	$692
Eight wires		$790	$790	$790	$790
Nine wires		$887	$887	$887	$887
Ten wires		$986	$986	$986	$986

(Drawing and photograph shown on AH 534.77, page 25)

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

LYRE SYSTEM

12 FOOT ROWS

	Cost Per Unit	Vines Per Acre			
		726	605	518	454
		Cost Per Acre			
		5' x 12'	6' x 12'	7' x 12'	8' x 12'
12 end posts per acre with anchor	$35	$420	$420	$420	$420
12 end posts per acre without anchor	$27	$324	$324	$324	$324
Heavy steel stake with open lyre cross-arm					
Every vine	$14.50				
Every other vine	$7.25	$5,264	$4,386	$3,756	$3,292
Every third vine	$4.83	$3,507	$2,922	$2,502	$2,193
Every fourth vine	$3.63	$2,635	$2,196	$1,880	$1,648
4' Rebar or pencil rod at each vine (between lyre cross-arm)	$.67				
One rebar between lyres	$.34	$247	$206	$176	$154
Two rebars between lyres	$.45	$327	$272	$233	$204
Three rebars between lyres	$.50	$363	$303	$259	$227
Six wires		$543	$543	$543	$543
Seven wires		$636	$636	$636	$636
Eight wires		$726	$726	$726	$726
Nine wires		$816	$816	$816	$816
Ten wires		$901	$901	$901	$901

(Drawing and photograph shown on AH 534.77, page 25)

VINEYARD STAKES AND TRELLIS SYSTEMS

MISCELLANEOUS

COMPONENT COSTS TO CALCULATE COSTS PER ACRE

WIRE PRICE PER ACRE

Based on 10' spacing between rows of vines and 13 gauge wire	
2 wire	$213
3 wire	$320
4 wire	$427
5 wire	$534
6 wire	$640

METAL STAKES AND CROSS-ARMS

T-Post Stakes and Training Stakes			Metal Cross-arms With U Bolts (Medium Grade)	
7'	.95 lbs/ft	$3.43	6"	$.83
7'	1.25 lbs/ft	$4.26	12"	$.94
6'	.95 lbs/ft	$2.93	18"	$1.30
6'	1.25 lbs/ft	$3.64	24"	$1.66
5'	.95 lbs/ft	$2.44	30" to 34"	$2.36
4'	Rebar Training Stake	$.65	36"	$2.48
4'	¼" Steel Training Stake	$.55	48"	$3.31

Heavy duty elaborate galvanized cross-arms can run 40 to 50 percent more.

WOOD STAKES AND CROSS-ARMS

Stakes			Cross-arms With Clips		Cross-arms With U-Bolts	
5'	1 ¾" sq	$1.45	12"	$.50	12"	$.50 - $.60
6'	1 ¾" sq	$1.75	24"	$.65	24"	$.80 - $1.00
7'	1 ¾" sq	$2.10	30"	$.75	30"	$.95 - $.1.05
8'	3" to 4"	$3.85 – $4.95	36"	$.95	36"	$1.05 - $1.15

Price varies with quality

4' Pencil rod and rebar **$.63 to $.71** each

T-post with J.R. wire clips
7' heavy T-post: **$4.55** installed
7' light T-post: **$3.50** installed

Vertical line post with wire slots
8' Vertical line post (13 ga): **$7.50** installed
J.R. clips: **$.30** each

Steel end post with spade
$25.00 to **$26.00** each
$3.50 install

Screw-in earth anchor
6" x 48" : **$7.00** 6" x 36" : **$6.25**
$4.50 install

(Photographs shown on AH 534.77, page 26, 27, and 28)

7' Deer fence made with 9' T-post and 9' wood stakes
6 ½' woven wire with 2 barbed wires on top and steel gates at drives
Cost: **$4.55** to **$5.90** per linear foot

(Photographs shown on AH 534.77, page 29)

VINEYARD STAKES AND TRELLIS SYSTEMS

USEFUL INFORMATION

WIRE

10 Gauge	2,060 ft. Per 100 lbs. roll
11 Gauge	2,580 ft. Per 100 lbs. roll
12 Gauge	3,370 ft. Per 100 lbs. roll
13 Gauge	4,470 ft. Per 100 lbs. roll
14 Gauge	5,860 ft. Per 100 lbs. roll

PLANTING SPACING AND WIRE CHART

Planting Pattern Between Plants—Between Rows	One-Wire System No. of Wire Feet Required Per Acre	No. of Plants Required Per Acre
3' x 6'	7,260'	2,420
4' x 6'	7,260'	1,815
5' x 6'	7,260'	1,452
6' x 6'	7,260'	1,210
3' x 7'	6,222'	2,074
4' x 7'	6,222'	1,555
5' x 7'	6,222'	1,245
6' x 7'	6,222'	1,037
7' x 7'	6,222'	889
3' x 8'	5,445'	1,815
4' x 8'	5,445'	1,361
5' x 8'	5,445'	1,089
6' x 8'	5,445'	907
7' x 8'	5,445'	778
8' x 8'	5,445'	681
3' x 9'	4,850'	1,613
4' x 9'	4,850'	1,210
5' x 9'	4,850'	968
6' x 9'	4,850'	807
7' x 9'	4,850'	691
8' x 9'	4,850'	605
5' x 10'	4,355'	871
6' x 10'	4,356'	726
7' x 10'	4,354'	622
8' x 10'	4,352'	544
5' x 11'	3,960'	792
6' x 11'	3,960'	660
7' x 11'	3,962'	566
8' x 11'	3,960'	495
5' x 12'	3,630'	726
5½' x 12'	3,630'	660
6' x 12'	3,630'	605
7' x 12'	3,626'	518
8' x 12'	3,632'	454

VINEYARD STAKES AND TRELLIS SYSTEMS

TABLE GRAPES

SINGLE CROSS-ARM

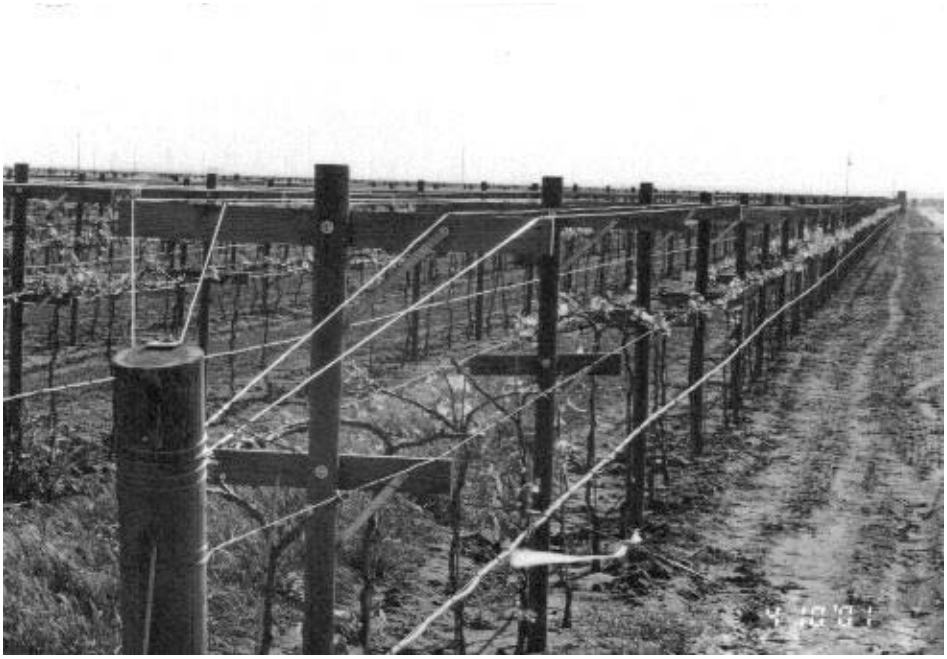
Seven-foot stake and 36" to 42" cross-arm with four wires (13-gauge)

VINEYARD STAKES AND TRELLIS SYSTEMS

TABLE GRAPES

DOUBLE CROSS-ARM

Seven-foot stake, 42" top cross-arm, 24" to 30" lower cross-arm, with six wires (13-gauge)



VINEYARD STAKES AND TRELLIS SYSTEMS

TABLE GRAPES/RAISINS

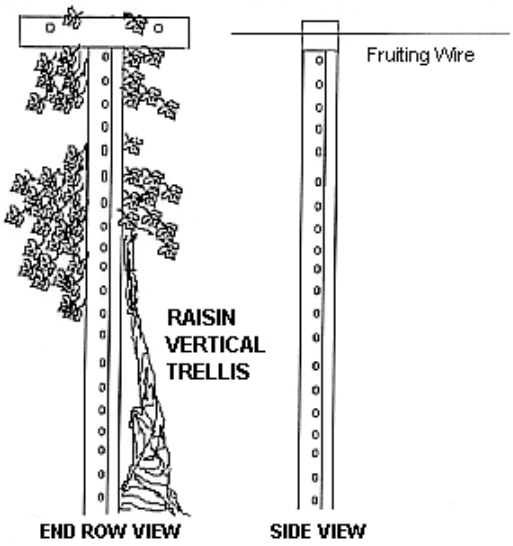
OPEN GABLE TRELLISES

Eight-foot steel post, 4' angle iron on each side of post forming V with the tops approximately 6' to 7' apart, with 3 to 4 wires (13-gauge) on each side

VINEYARD STAKES AND TRELLIS SYSTEMS

RAISIN GRAPES

VERTICAL TRELLIS



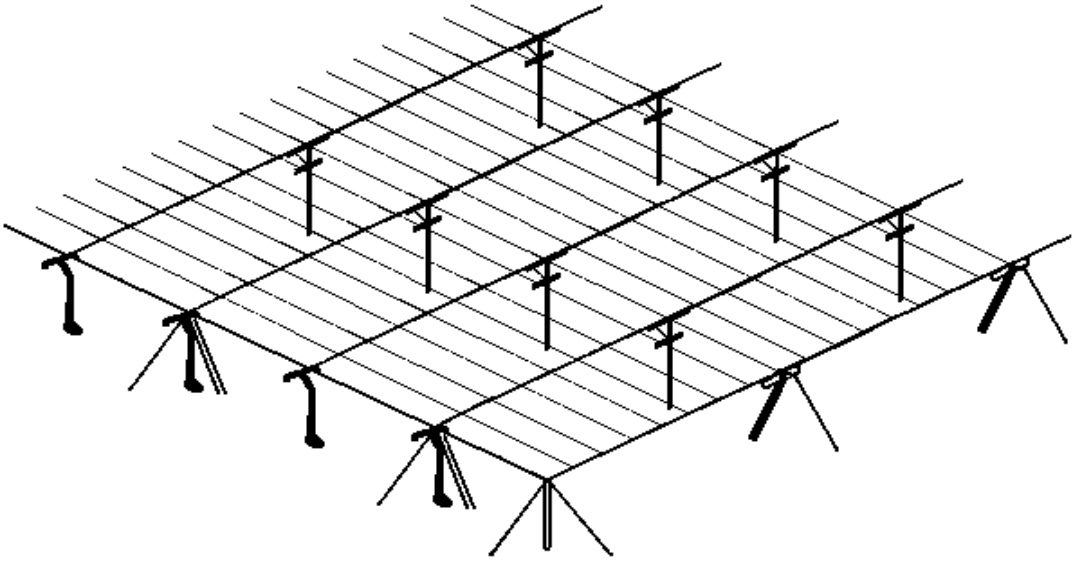
Commonly used for raisins with 12' spacing.

Materials: 8' wooden end posts with 7' medium T stakes at each vine. A single 24" metal cross-arm with two 13-gauge wires.

VINEYARD STAKES AND TRELLIS SYSTEMS

RAISIN GRAPES

OVERHEAD DRY ON VINE TRELLIS



Commonly used in 12' row with 6' between vines; occasionally used on 10' and 11' rows; a few 8' and 9' rows.

Materials: Wood post 12' on ends, 9' on sides, 10' wood post every third vine with 36" cross-arm, 8 wires per row, and cable support.

VINEYARD STAKES AND TRELLIS SYSTEMS

RAISIN GRAPES

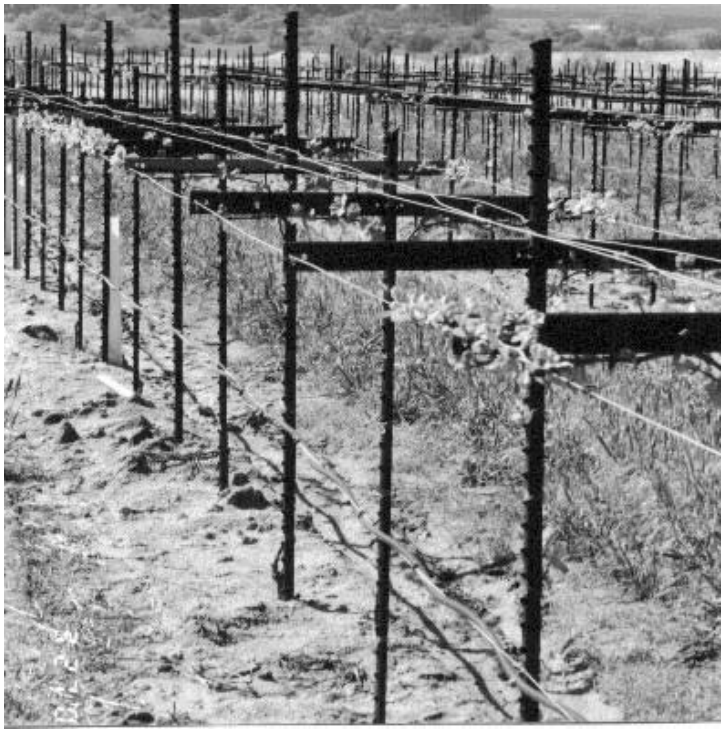
SUN MAID SOUTHSIDE DRY ON VINE TRELLIS

8' T-post every 28' with two 10' cross-arms and 5 wires. In between T-posts are 2 bent 7' to 8' T-posts with 2 wires. Each vine will have a training stake. Each end has a heavy steel post with anchors.

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

TRELLIS



T-post with cross-arm every vine

T-post and V cross-arm

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

TRELLIS

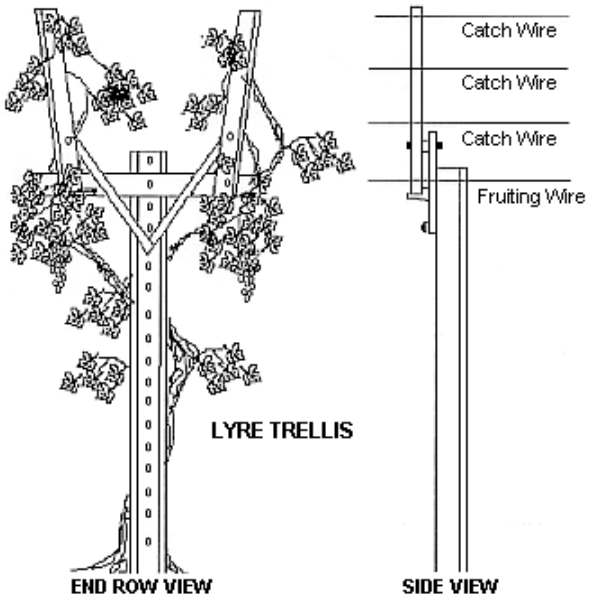
8' vertical line post with 4' T-posts in between

8' vertical line post with light grape stakes in between

VINEYARD STAKES AND TRELLIS SYSTEMS

WINE GRAPES

LYRE TRELLIS

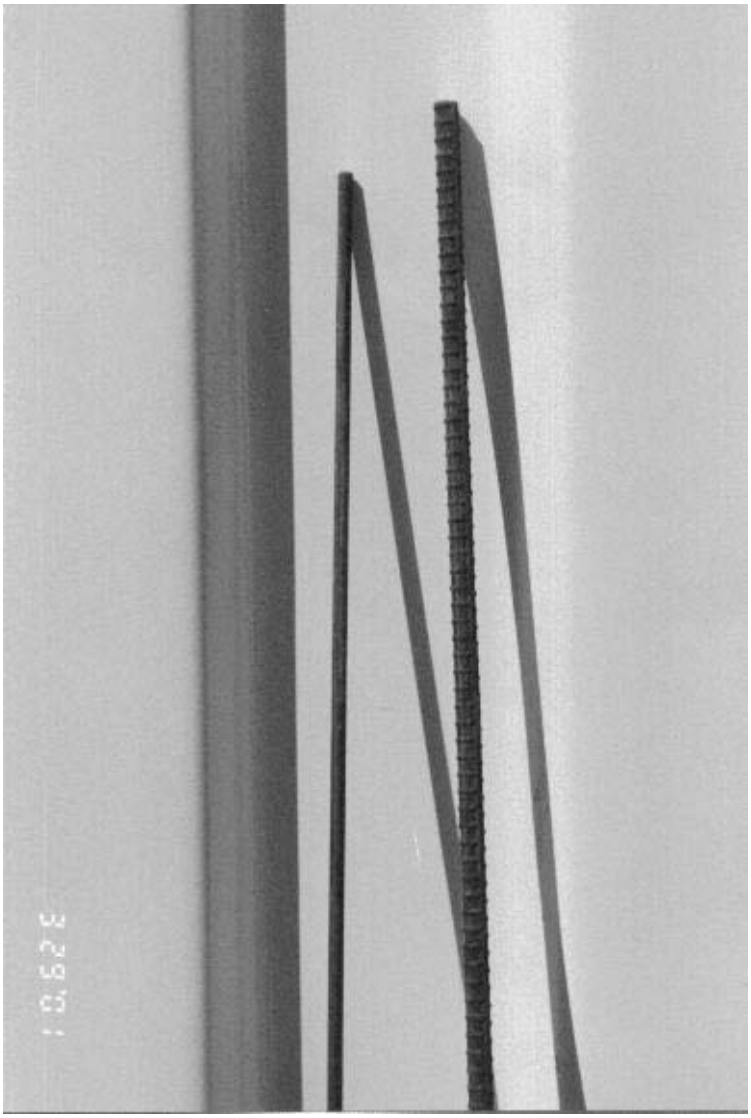


Commonly used in wide row of 11' to 12'.

Materials: Heavy steel or wood end posts; heavy and medium T stakes with anchor plates; 8' to 12' gauge wires on metal open Lyre cross-arms with a typical width of 42" at the top; 6 to 10 wires.

VINEYARD STAKES AND TRELLIS SYSTEMS

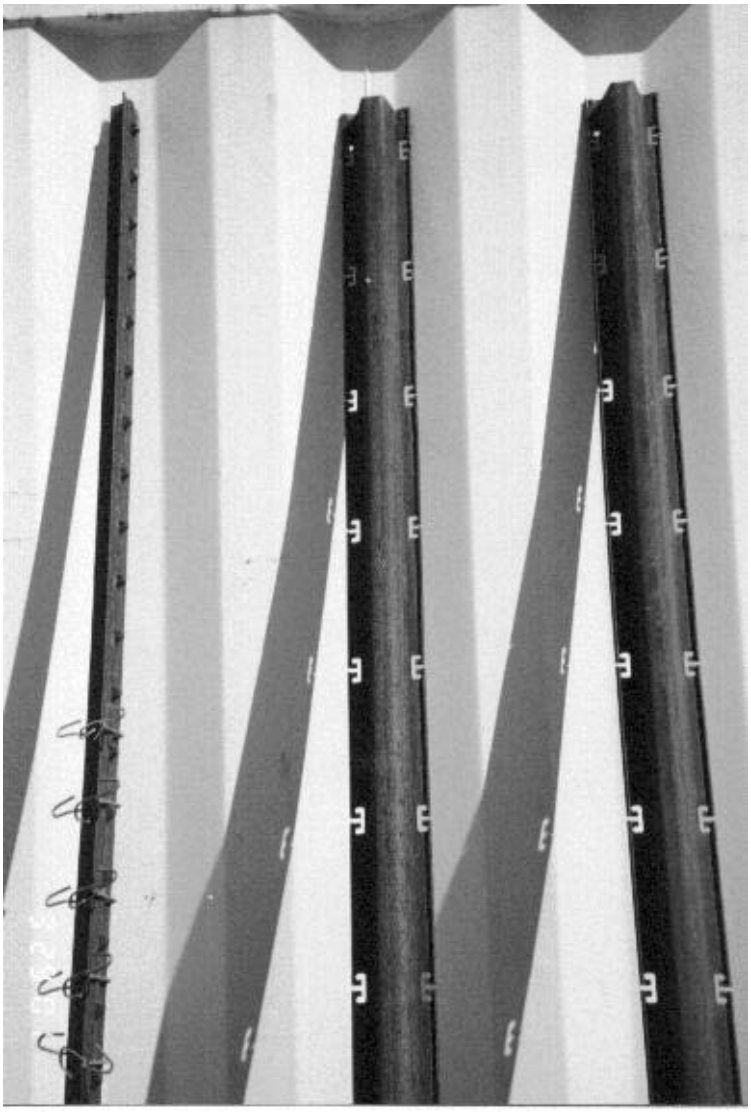
MISCELLANEOUS



4' Pencil rod and rebar

VINEYARD STAKES AND TRELLIS SYSTEMS

MISCELLANEOUS



↑ T-post with J.R. wire clips

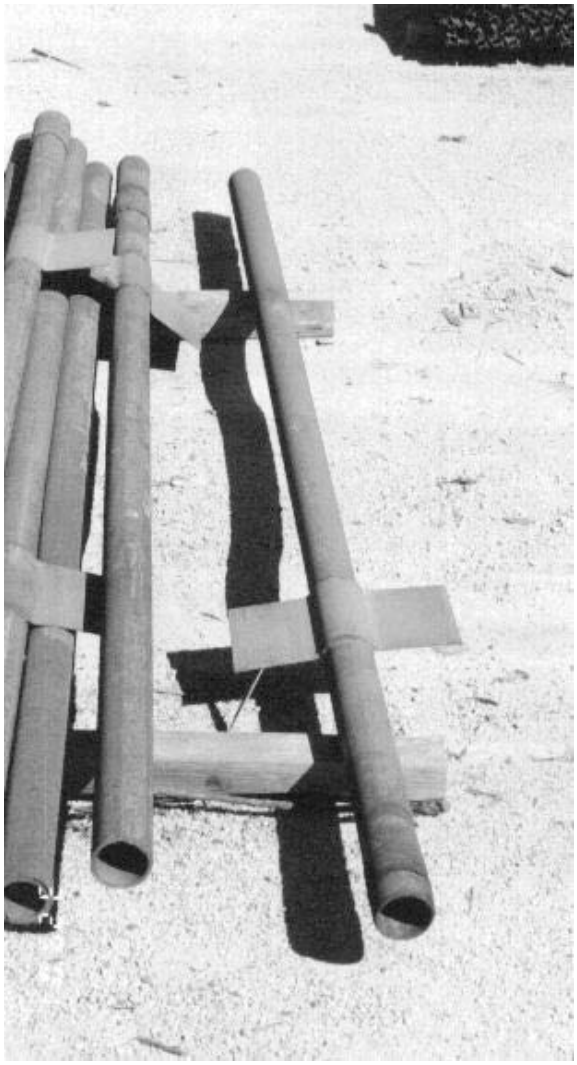
7' heavy T-post
7' light T-post
J.R. clips

↑ Vertical line post with wire slots

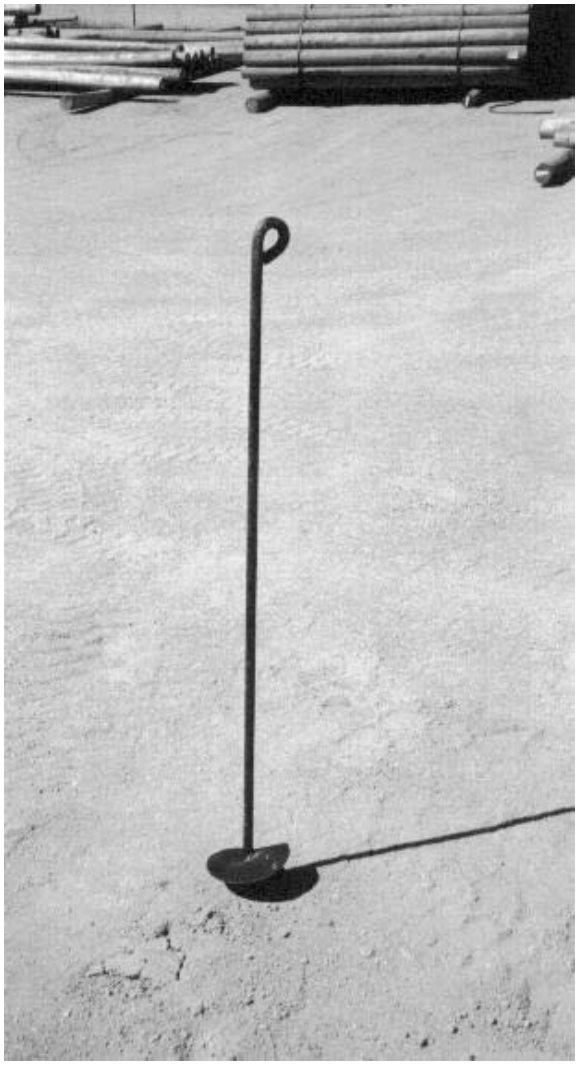
8' Vertical line post (13 ga)

VINEYARD STAKES AND TRELLIS SYSTEMS

MISCELLANEOUS



Steel end post with spade



Screw-in earth anchor

VINEYARD STAKES AND TRELLIS SYSTEMS

MISCELLANEOUS

DEER FENCE

7' Deer fence made with 9' T-post and 9' wood stakes
6 ½' woven wire with 2 barbed wires on top and steel gates at drives

AH 534.78: STEEL BUILDINGS

The *all steel* building performs a variety of functions for a farmer or rancher. The most common use is storage space for farm equipment and machinery. They are also used for storage of feed and grain and other agricultural products. Steel buildings commonly house livestock for protection and security.

Steel buildings have numerous advantages over wood construction including cost-effectiveness since steel is the least expensive method of constructing farm buildings. They have low maintenance costs to keep the structure in good working order and are not susceptible to pests such as termites. Steel structures also withstand the elements better and are less vulnerable to fire. Additions can be added at a lower cost, and they are much easier to improve with items such as windows or air conditioning.

The basic square foot building costs for a typical steel building may need to be adjusted where different specifications involving wall height, partitions, and extra electrical circuits within the structure are present. Specifications and costs for Quonset-style buildings are covered on AH 534.78, page 3. The specifications for a typical steel building are described below.

BASIC BUILDING COST

Square-foot costs of basic steel buildings include the following:

SPECIFICATIONS

Foundation	As required for normal soil conditions
Floor	Concrete slab, 4 inches to 6 inches thick with wire mesh
Frame or bents	Steel, 20, 25, or 30 feet on center
Roof purlins	Steel, 4 1/2 to 5 1/2 feet on center
Wall girts	Steel, 6 to 7 feet on center
Walls and roof	The exterior is made of 26 gauge steel
Window area	Equal to 2 percent of floor area
Lighting	Minimal light fixtures—including wiring
Ventilation	One rotary vent per bay
Doors	Two walk-in, two overhead or sliding
Eave height	14 feet

Basic steel buildings are of two types: the low profile roof pitch (1" in 12") and the more conventional barn-like roof pitch (4" in 12"). The cost differential between the two is considered immaterial for appraisal purposes.

(Photographs shown on AH 534.78, page 6)

ADDITIVE COSTS

Additive costs are the in-place cost components that are not included in the basic square-foot cost but are for many items costs found in steel buildings. Additive costs, where appropriate, are added to the basic building cost which results in a total building cost.

STEEL BUILDINGS

COST PER SQUARE FOOT

	Width											
Length	**20'**	**25'**	**30'**	**35'**	**40'**	**45'**	**50'**	**55'**	**60'**	**65'**	**70'**	**80'**
20'	29.90											
25'	29.00	28.46										
30'	27.95	27.73	27.20									
35'	26.94	26.56	25.95	25.38								
40'	25.92	25.28	24.69	24.26	23.23							
50'	24.94	24.26	23.86	23.44	22.44	22.33	22.00					
60'	24.30	23.47	22.79	22.49	22.04	21.77	21.48	21.36				
75'	24.04	23.13	22.65	22.10	21.70	21.36	21.08	20.77				
80'	23.56	22.73	22.15	21.66	21.36	20.92	20.63	20.22	19.75	19.21	18.67	18.41
90'	22.98	22.01	21.48	21.17	20.79	20.43	20.04	19.75	19.31	18.82	18.23	17.84
100'	22.01	21.59	21.12	20.53	20.29	20.04	19.59	19.21	18.82	18.08	17.59	17.25
135'		21.22	20.43	19.70	19.36	19.13	18.82	18.65	18.25	17.69	17.15	16.91
150'				19.11	18.63	18.33	18.04	17.93	17.69	17.44	16.95	16.69
175'				18.60	18.31	18.08	17.84	17.66	17.44	17.05	16.71	16.42
200'					18.08	17.86	17.67	17.44	17.10	16.70	16.42	16.23
225'						17.66	17.44	17.10	16.66	16.46	16.27	16.07
250'							17.10	16.71	16.46	16.22	16.12	15.93

ALTERNATE COSTS

Wall Height: Add or subtract 3 percent per square foot from basic cost for each foot of variation above or below the basic 14-foot eave height.

Missing Wall Cover: Deduct **$1.90** for each square foot of missing wall area.

Electrical Power: Deduct **$1.60 - $2.10** per square foot for lack of power.

The above costs are for 26 gauge steel cover.

STEEL BUILDINGS

QUONSET-STYLE BUILDINGS

Quonset-style buildings are pre-engineered structures assembled with a steel frame and galvanized steel panels on the exterior. The buildings have an arch shape with no distinction between the roof and sides. The costs provided are for a typical Quonset-style building constructed with a steel frame and exterior panels in the dimensions shown below.

Square-foot costs of basic Quonset-style steel buildings include the following:

SPECIFICATIONS

Footings	As required for normal soil conditions
Floor	Dirt
Frame	Arched steel-the width of the building at the base of the arch is generally 30 feet to 70 feet
Walls and roof	The exterior panels are made of 26 gauge galvanized steel
Window area	None
Lighting	None
Ventilation/heat	Natural-building ends are open
Doors	None

(Photograph shown on AH 534.78, page 7)

COST PER SQUARE FOOT OF BUILDING

	Width of Building at the Base			
Length	**30'**	**40'**	**60'**	**70'**
30'	25.65			
36'	24.48			
48'	22.81	20.89		
60'	21.63	19.66	18.73	
72'	20.71	18.79	17.99	17.25
84'	19.97	18.17	17.18	16.69
96'	19.22	17.55	16.69	16.07
108'	18.67	17.06	16.13	15.64
120'	18.17	16.63	15.70	15.14
160'	17.00	15.45	14.59	14.09
200'		14.59	13.78	13.41
240'		13.91	13.23	12.92

ALTERNATE COSTS

Electrical Power: Add **$1.60 - $2.10** per square foot for electrical power.

STEEL BUILDINGS

ADDITIVE COSTS

The cost of additives, such as doors and windows, that replace a portion of the exterior skin of the building, reflect the net added cost of the component in-place. The cost of the skin that is replaced has been deducted from the total cost of the additive components. No further deduction is necessary.

OVERHEAD DOORS WITH CHAIN HOIST OPENERS

	Height				
Width	**8'**	**10'**	**12'**	**14'**	**16'**
8'	$910	$965	$1,050	$1,165	
10'	935	1,015	1,125	1,315	$1,510
12'	1,025	1,120	1,265	1,450	1,640
14'	1,255	1,300	1,510	1,640	2,005
16'	1,380	1,515	1,730	2,025	2,250
18'	1,670	1,805	2,025	2,250	

WALK-IN DOORS

Flush 3' x 7'	$450 to $550
Half Glass	$500 to $600

ROTARY VENTS

20"	$250

RIDGE VENTS

9" x 10'	$425
12" x 10'	$450

GUTTERS AND DOWNSPOUTS

Per linear foot	$4.50 to $6.50

SKYLIGHTS

3' x 10'	$82 to $102

WINDOWS

3' x 3'	$148
3' x 6'	174
4' x 6'	235
4' x 8'	286

STEEL BUILDINGS

ADDITIVE COSTS

HEATING

Overhead Suspended Unit	Cost Per Unit
75,000 BTU	$1,365
100,000 BTU	1,627
200,000 BTU	2,205
300,000 BTU	2,625

RESTROOMS

	Total Cost
Cost includes 2 fixtures, electrical service, and all partitions. Add for septic tank.	$6,600 - $8,175

OFFICE AREAS

	Square Foot
Cost includes partitioning, interior finish, trim, and doors	$56 - $73

PARTITIONS

	Per Square Foot of Wall Area
Drywall on wood frame	$3.57
Plaster on wood frame	$5.10
Paneling (average quality)	$4.05 - $5.10

INSULATION

	Square Foot
R-13	$.60 - $.70

STEEL BUILDINGS

TYPICAL STEEL BUILDINGS

STEEL BUILDINGS

QUONSET-STYLE BUILDING

AH 534.79: MISCELLANEOUS COSTS

PIT TYPE MOTOR TRUCK SCALES WITH CONCRETE DECK

Scales			Scale Pit		
Tons Capacity	**Platform Size**	**Total Cost**	**Size**	**Standard Cost**	**Add for: 12' Width**
20	25' x 10'	$21,250	25' x 10'	$17,900	990
30	25' x 10'	23,500	40' x 10'	20,600	1,100
50	40' x 10'	26,150	50' x 10'	22,900	1,210
50	50' x 10'	27,900	60' x 10'	25,500	1,430
60	60' x 10'	30,950	70' x 10'	26,400	1,650
60	70' x 10'	36,700	80' x 10'	28,550	2,310
60	80' x 10'	39,750	90' x 10'	21,100	
80	80' x 10'	42,100	90' x 10'	33,750	
100	90' x 10'	45,150	100' x 10'	36,800	

Pitless above-ground scales, deduct 25 percent from above prices

Used scales, deduct 25 to 40 percent

ADD FOR WEIGHT RECORDING EQUIPMENT

Electronic indicator	$2,100
Ticket printer	$6,300

EXAMPLE OF MOTOR TRUCK SCALE COST

Scales:	80 ton capacity, 80' x 10' platform	$42,100
Scale Pit:	90' x 10' size, standard	33,750
Electric weight recording equipment and printer		8,400
	Total	$84,250

(Photograph shown on AH534.79, page 10)

ELEVATED HOPPER TANK – Steel Support Legs, Stiffened Side Walls, Ladder, Roof Access Door, includes Concrete Base

Size	Cost
80 Tons	$14,900
100 Tons	16,850
130 Tons	19,800
160 Tons	23,050
200 Tons	28,750
235 Tons	32,300
300 Tons	40,750
350 Tons	37,700
400 Tons	54,050

MISCELLANEOUS COSTS

CONCRETE HORIZONTAL OR FLAT STORAGE

Cwt	Cost per Cwt
28,000	$4.36
42,000	4.19
56,000	4.02
85,000	3.83
110,000	3.68
140,000	3.55
200,000	3.44
400,000	3.00
600,000	2.87

ABOVE-GROUND FUEL TANKS & CONTAINMENT SYSTEMS

PREFABRICATED CONCRETE FUEL CONTAINMENT TUBS

400 gallon capacity containment	$843
500 gallon capacity containment	$1,092
1,000 gallon capacity containment	$1,588

CONTAINMENT WITH TANK AND ELECTRIC PUMPS

500 gallon – diesel	$4,851
1,000 gallon – diesel	$6,609
500 gallon – gasoline	$5,821
1,000 gallon – gasoline	$7,641

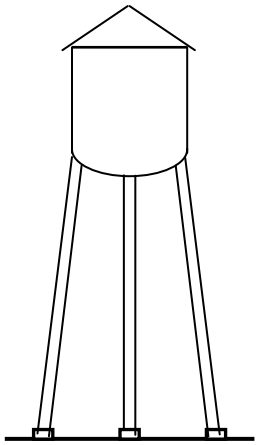
ABOVE-GROUND FUEL TANKS (Steel Tanks with Thick Outer Shell of Concrete)

Gallons	Cost
500, with electric pump	$ 8,766 to $ 9,968
1,000, with electric pump	$12,012 to $13,814
2,000, with electric pump	$17,828 to $20,060
Double unit—(1) 1,000 gallon, (1) 500 gallon with 2 electric pumps	$13,213 to $14,830

(Photographs shown on AH 534.79, page 10)

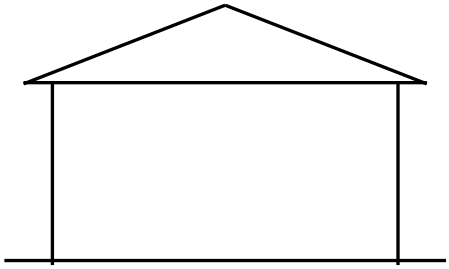
MISCELLANEOUS COSTS

ELEVATED STEEL WATER STORAGE TANKS



Gallon Capacity	Total Cost of 75' Tower and Tank	Total Cost of 100' Tower and Tank
25,000	$299,800	$345,350
30,000	321,310	368,100
40,000	337,750	378,230
50,000	349,140	397,200
60,000	364,320	414,400
75,000	388,100	437,700
100,000	448,620	473,100
150,000	569,650	607,800
200,000	705,160	745,950
300,000	877,500	945,910
500,000	1,178,800	1,260,350
1,000,000	1,956,300	2,160,215

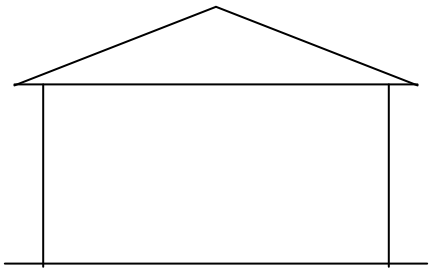
WELDED STEEL WATER STORAGE TANKS ON GROUND WITH FOUNDATION



Gallon Capacity	Total Cost of Tank on Ground
25,000	$66,500
30,000	75,100
40,000	85,800
50,000	102,900
60,000	116,000
75,000	138,300
100,000	157,400
150,000	197,900
200,000	224,550
300,000	281,000
500,000	297,800
1,000,000	617,200

MISCELLANEOUS COSTS

BOLTED STEEL WATER TANKS



Gallon Capacity	Total Cost of Tank on Ground
10,000	$23,150
20,000	33,650
30,000	41,850
50,000	53,800
75,000	64,350
100,000	73,850
125,000	87,100
150,000	106,000
200,000	125,600

Price varies due to gauge, height, diameter, and delivery costs.
Price typically includes crushed rock base or concrete on longer tanks.

POLYETHYLENE OR FIBERGLASS TANKS (Used for Ag Chemicals or Liquid Fertilizers)

Capacity (Gallons)	Cost
1,000	$1,225
2,000	2,250
3,000	3,450
4,000	4,375
5,000	5,625
6,000	6,475
8,000	8,425
10,000	10,075

Add **$4.10** per square foot for concrete base

Polyethylene water only tanks, deduct 20 percent from above prices.

MISCELLANEOUS COSTS

STEEL GRAIN BINS

Sacramento and Northern California

Steel grain bins are used for storage and drying of small grains. The typical storage bin has metal walls and roof, a concrete floor and foundation. The drying bin is of similar construction with a dryer floor, unloading auger, and leveler. Dryer fan, heater unit, and motor are also considered part of the drying bin.

GRAIN DRYING BINS

	Eave Heights					
Diameter	**16'**	**18'**	**21'**	**24'**	**32'**	**40'**
18'	15,822	16,650	17,460	20,246	24,613	28,429
21'	18,045	18,720	19,575	23,425	28,868	32,173
24'	20,610	21,375	22,500	27,070	33,242	36,839
27'	24,840	25,650	27,090	32,659	40,484	43,011
30'	27,675	28,845	30,465	35,915	44,226	49,086
36'	36,630	38,340	40,050	47,239	56,182	63,763
42'	45,225	46,710	48,285	61,236	70,373	82,134
48'	58,005	61,515	65,160	75,622	86,071	89,861

Includes cost of foundation, perforated floor, unloading auger, aeration unit, fan, dryer, and stirring devices.

GRAIN STORAGE BINS

	Eave Heights								
Diameter	**16'**	**18'**	**21'**	**24'**	**32'**	**40'**	**48'**	**58'**	**64'**
18'	9,315	9,450	10,485	12,420	16,200	20,368	23,516		
21'	10,575	10,980	12,060	14,490	18,900	23,278	27,380		
24'	12,825	13,410	13,995	17,190	21,555	27,141	31,673	37,778	41,976
27'	14,625	15,840	17,775	21,015	27,405	32,293	39,162	47,128	51,993
30'	16,470	17,640	20,205	22,770	29,745	36,157	42,930	53,758	60,436
36'	22,050	23,310	25,830	29,610	37,800	46,746	56,191	69,499	77,083
42'	27,630	28,800	30,105	39,600	47,655	61,247	71,836	86,528	95,972
48'	38,250	41,400	45,090	51,183	59,085	75,337	83,952	102,030	112,286

Includes cost of bin foundation, door, ladder, and unloading auger.

ADD FOR: Roof Augers **$800 to $1,500** (depends on length—13' to 24')
Fan **$1,700** (5 H.P.) to **$3,100** (25 H.P.)

(Photographs shown on AH 534.79, page 11)

PERFORATED FLOORS

18'	21'	24'	27'	30'	36'	42'	48'
$2,550	$2,754	$3,468	$4,182	$5,202	$7,242	$9,282	$11,322

MISCELLANEOUS COSTS

2-INCH REDWOOD WATER STORAGE TANKS

Gallons	Diameter	Height	Cost
500	5'	4'	$3,900
1,000	6'	6'	4,800
1,500	7'	6'	4,950
2,000	8'	6'	7,325
3,000	10'	6'	9,475
4,000	10'	8'	11,300
5,000	11'	8'	12,950
6,000	12'	8'	15,100
7,000	11'	10'	16,700
8,000	12'	10'	17,500
9,000	13'	10'	18,700
10,000	14'	10'	20,775
12,000	15'	10'	23,000
15,000	14'	14'	25,100

Above costs include chime joists, covers, foundation, and all labor, set up, and transportation charges.

ADD FOR:	Ladders	**$40** per linear foot
	Water level registers	**$15** per linear foot of tank height
	Cone covers	**$1,000 to $3,000** per tank

MISCELLANEOUS COSTS

3-INCH REDWOOD WATER STORAGE TANKS

Gallons	Diameter	Height	Cost
10,000	14'	10'	$23,100
12,000	14'	12'	26,550
15,000	16'	12'	28,450
20,000	18'	12'	36,650
25,000	17'	16'	39,700
30,000	20'	14'	46,200
40,000	23'	14'	58,175
50,000	24'	16'	65,300
60,000	26'	16'	73,300
70,000	28'	16'	77,900
75,000	29'	16'	88,400
80,000	30'	16'	95,350
90,000	30'	18'	100,275
100,000	32'	18'	105,850
150,000	37'	20'	141,750
200,000	43'	20'	168,000

Above costs include typical foundation, chime joists, tank cover, and all labor, set up, and transportation charges.

CYLINDRICAL 3-INCH REDWOOD WINE TANKS

Gallons Capacity	Base Price
1,000	$5,100
1,500	6,500
2,000	7,600
2,500	9,000
3,000	10,700
4,000	11,500
5,000	14,000
7,500	17,300
10,000	19,100
15,000	26,600
20,000	35,000
25,000	38,000
30,000	45,000

Base price includes 4" x 6" chime joists, 1/2' galvanized hoops, recessed head cover, side door with galvanized T-bolt.

MISCELLANEOUS COSTS

STAINLESS STEEL WINE TANKS

Gallons Capacity	Cost
1,000	$ 9,373
2,000	13,339
3,000	15,141
4,000	16,892
5,000	17,098
10,000	24,910
20,000	39,655
50,000	62,109
100,000	93,305
200,000	170,988

Cost includes all valves, temperature controls, vents, and cooling jackets for tanks with a capacity of 20,000 gallons or less. The cost on tanks of 50,000 gallons or more excludes cooling jackets.

CYLINDRICAL 2 INCH OAK TANKS

Gallons Capacity	Base Price
500	$2,257
750	3,307
1,000	4,305
1,250	5,250
1,500	6,090
2,000	8,610
2,500	9,922
3,000	11,340
4,000	15,225
5,000	18,270
6,000	22,050

Base price includes 4" x 6" chime joists, galvanized hoops, head supports with stainless steel head bolts, side door with stainless T-bolt, installation in Sonoma County. Foundations not included.

MISCELLANEOUS COSTS

PREFABRICATED METAL SHADES

SPECIFICATIONS

Foundation	Metal base plate with tie downs
Floor	Dirt
Wall/Roof Frame	2 3/8" galvanized structural tubing (4' on center) 7' to 9' eaves
Roofing	29-gauge steel with baked on enamel (extends 6" to 12" below eaves)
Exterior Wall Covering	None

(Photograph shown on AH534.79, page 12)

COMMON SIZES

12' x 21'	$1,150	20' x 21'	$1,950
12' x 26'	1,400	20' x 26'	2,350
12' x 31'	1,800	20' x 31'	2,900
12' x 36'	2,050	20' x 36'	3,400
12' x 41'	2,350	20' x 41'	3,800

RV SHADES

14' x 30' x 12'	$3,550
14' x 40' x 12'	4,700

ADDITIVES

- Add 6 percent to above prices for 26-gauge steel roofing
- 29-gauge metal wall covering—**$1.25** per square foot of wall (standard roofing extends 6" to 12" below eaves)
- Back enclosure kit:
  - 12-foot wide — **$468**
  - 20-foot wide — **$624**
  - 24-foot wide — **$832**
- Front enclosure kit with opening for roll-up door:
  - 12-foot wide — **$364**
  - 20-foot wide — **$416**
- Light duty roll-up doors
  - 8' x 6' — **$312**
  - 9' x 7' — **$364**
  - 10' x 8' — **$416**
  - 10' x 10' — **$468**
- Walk-thru door 32" x 72" —**$208 to $260**
- Add 3 percent for each additional foot of wall height above 8 feet
- Concrete floor—**$4.16 to $5.20** per square foot
- Windows 30" x 30" — **$130**

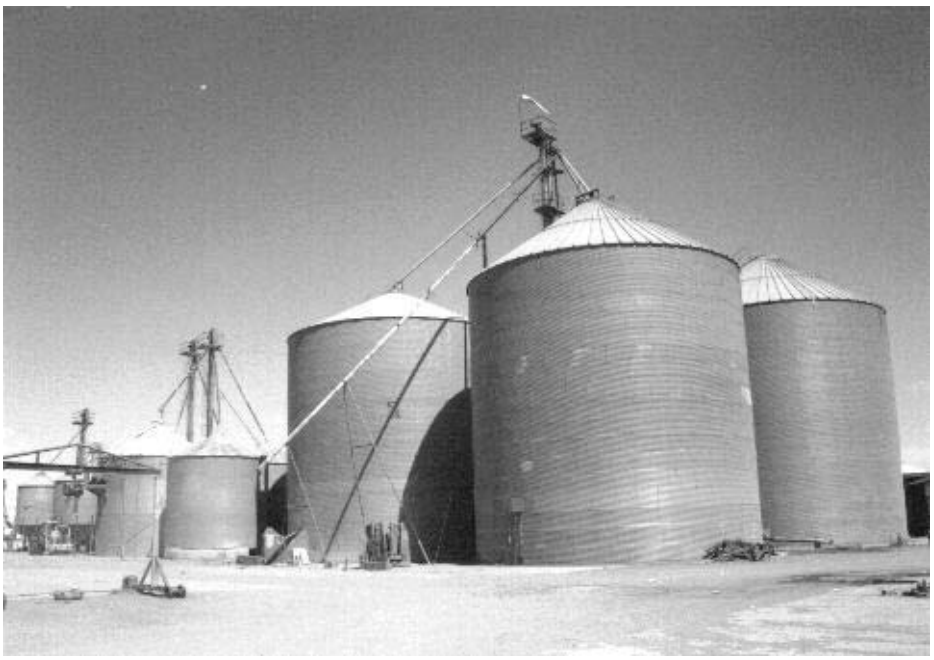
MISCELLANEOUS COSTS

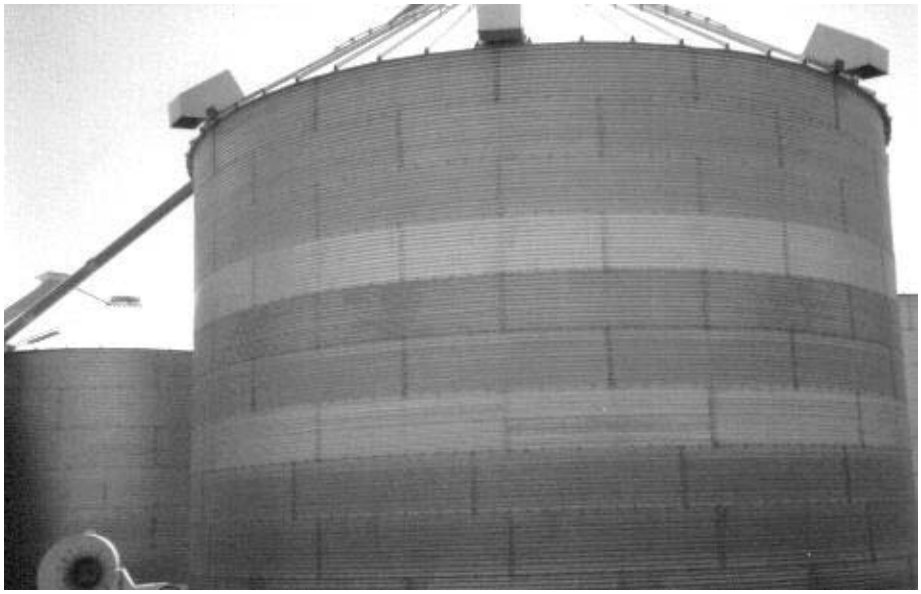
PIT TYPE MOTOR TRUCK WITH CONCRETE DECK

ABOVE-GROUND FUEL TANK (Steel Tank with Thick Outer Shell of Concrete)

MISCELLANEOUS COSTS

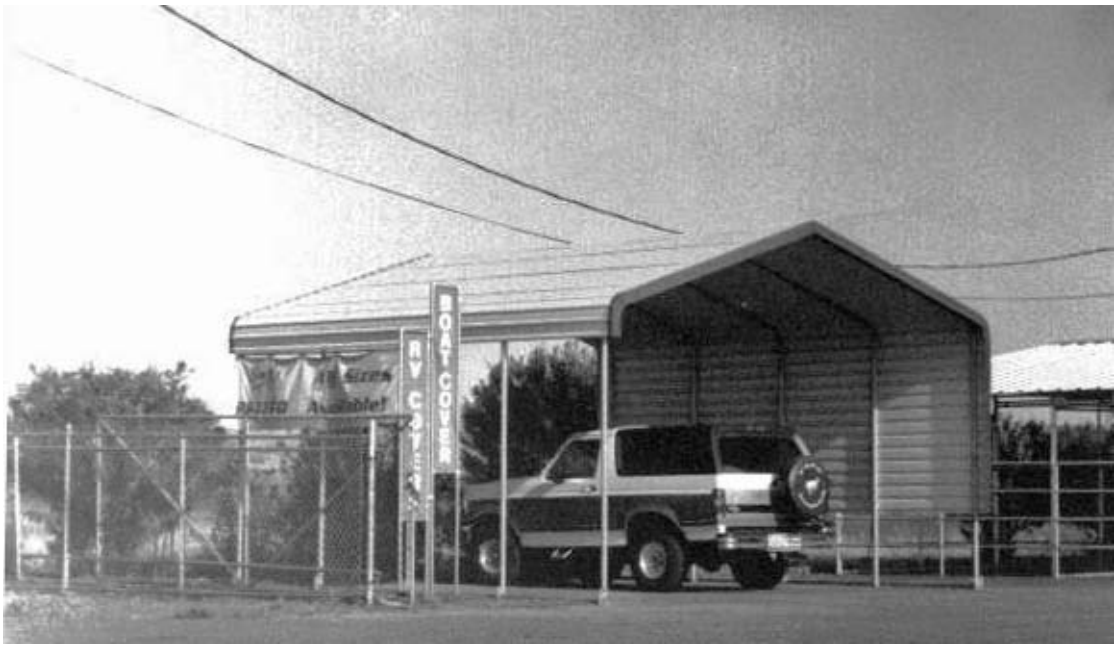
STEEL GRAIN BINS





MISCELLANEOUS COSTS

PREFABRICATED METAL SHADES



AH 534.80: WIND MACHINES

Conventional wind machines have a large fan on top of a tower. These wind machines work with temperature inversions to mix warm air with lower-lying cold air. Tower wind machines are best suited for flat, evenly shaped growing areas.

A newer design called a cold air drain has also been introduced to the market. In this design, rather than being mounted on a tower, the unit is placed at ground level. It operates by drawing in air from the sides of the unit, directing it upwards, displacing lower-lying cold air with warmer surrounding air. These machines are used where conventional tower wind machines are less effective, such as gentle slopes, rolling hills, swales, pockets, canyons, and valleys. These new design units are often used in addition to a conventional wind machine.

Photographs of these wind machines are located at the end of this chapter.

NEW

New machines have an average physical life of about 30 years. The amount of time that these machines are used varies depending on the climate but typically averages around 100 to 150 hours per year. Each conventional wind machine will service approximately 10 acres.

CONVENTIONAL WIND MACHINES

Model	Cost
G.P. 359 Cummins Diesel	$29,600
130 HP Ford V-10 L.P.G.	$28,250
130 HP F460 L.P.G.	$23,750
115 HP John Deere 6068 Diesel	$28,250
100 HP John Deere 4T	$27,350
Portable Low Crop 115 HP John Deere Diesel	$29,650
Portable Low Crop 115 HP F460 L.P.G.	$26,800
Portable Low Crop 100 HP John Deere Diesel	$28,750
Portable Low Crop 92 HP F300-6 L.P.G.	$24,500

Tower height for the above machines is 36 feet.
The prices above include the foundation and installation.

OPTIONS

Item	Cost
41 Foot Tower	$2,000
Auto Thermostat Control	$2,500
Variable Speed Rotation	$1,200
Contour Assembly	$3,000
Replacement fan	$1,200

WIND MACHINES

USED

The cost of used wind machines can vary widely depending upon the age and condition of the equipment.

Used Electric Machines

The cost to run an electrical line for a new installation of a wind machine by local utility companies has increased very significantly over the last several years with installation fees nearly equaling those of a new conventional wind machine. Dealers report no demand for these machines currently, and therefore we will be discontinuing the section on used electric wind machines.

USED PROPANE

HP	Model	Cost
292-V-8	Propane 86 HP	$2,500
332-V-8	Propane 86 HP	$2,500
300-6	Propane 92 HP	$4,000
391-V-8	Propane 100 HP	$4,000
391-V-8	Propane 125 HP	$4,500
460-V-8	Propane 125 HP	$4,500

DIESEL MACHINES (REBUILT ENGINES)

330 Ford *	6 Cylinder	Diesel - 81 HP	$5,100
363 Ford *	6 Cylinder	Diesel - 100 HP	$6,200
378 Cummins *	V-6	Diesel - 125 HP	$6,200

The above prices include a 550 gallon above-ground fuel tank. Larger tanks are available on request at additional cost.

The cost of used wind machines can vary widely depending upon the age and condition of the equipment.

* No longer manufactured

WIND MACHINES

RECONDITIONED

RECONDITIONED GROUND POWERED TROPIC BREEZE

Model		Cost
F300-6	Ford, Propane 92HP	$12,500
F391	Ford, Propane 115 HP 1	$14,500
F460	Ford, Propane 130 HP	$17,500
In Line 6	John Deere, Diesel	$18,500
In Line 6	Cummins, Diesel	$18,500
V-6	Cummins, Diesel	$18,500

115HP and 130HP machines have new fiberglass fans

RECONDITIONED EOT

Model		Cost
391	Ford, Propane	$12,500
460	Ford, Propane	$15,500

NOTE: All used costs listed above include the foundation and installation.

RECONDITIONED GROUND POWERED TROPIC BREEZE

Model		Cost
F300-6	Ford, Propane 92HP	$12,500
F391	Ford, Propane 115 HP	$14,500
F460	Ford, Propane 130 HP	$17,500
In Line 6	John Deere, Diesel	$18,500
In Line 6	Cummins, Diesel	$18,500
V-6	Cummins, Diesel	$18,500

115HP and 130HP machines have new fiberglass fans

RECONDITIONED EOT

Model		Cost
391	Ford, Propane	$12,500
460	Ford, Propane	$15,500

NOTE: All used costs listed above include the foundation and installation.

WIND MACHINES

COLD AIR DRAIN

Much newer to the marketplace than conventional wind machines, cold air drain units are becoming more commonly used. The unique design is particularly effective on gentle slopes, rolling hills, swales, pockets, canyons, and valleys where conventional tower wind machines are less effective. These units are often used to supplement conventional wind machines.

Model	Cost
# 925 Shur Farms Cold Air Drain PTO-Requires min. 10HP at 540	$7,995
EM1 Electric Motor, 1ph, 230V	$3,195
EM1/AS Electric Motor, 1ph, 230V with Temperature Controlled Auto-Start	$5,190
H9 Honda Gasoline Power Unit, 9HP Electric Start	$2,995
H15/AS/2.5 Honda Gasoline Power Unit w/ Temperature Controlled Auto -Start	$6,395
#3510 Shur Farms Cold Air Drain (10acres) PTO- Requires min. 35HP @ 540 RPM	$15,800
Power options	
V35-Vanguard Gasoline Power Unit	$5,490
#1550 Shur Farms Cold Air Drain PTO-Requires min. 15HP @ 540 RPM	$9,890
Other Power Options For Shur Farms	
EM3-Electric Motor, 3ph, 230/460V	$2,795
EM3/AS Electric Motor, 3ph, 230/460V Temperature Controlled Auto-Start	$5,490
EM1-10 Electric Motor , 1ph, 230V, 10HP	$3,795
EM1-10/AS Electric Motor , 1ph, 230V, 10HP w/ Temp Controlled Auto-Start	$5,995
H15 Honda Gasoline Power Unit, 15HP w/ Temperature Controlled Auto-Start	$6,395
HVT20 Honda V-Twin Gasoline Power Unit	$3,495

WIND MACHINES

Glossary of Abbreviations

GP	Ground Power
RT	Rotating Tower
TT	Tall Tower
ST-ROT	Standard Rotation
SP-ROT	Special Rotation
LC	Low Crop
S	Single
D	Dual
EOT	Engine on Tower
SC	Special Contour

WIND MACHINES

Conventional Design

WIND MACHINES

Cold Air Drain

AH 534.90: DEPRECIATION

DEFINITIONS

An essential part of the cost approach is the estimation of depreciation, and the usefulness of this approach depends greatly upon the appraiser's ability to make this estimate. This discussion is confined to the application of normal percent good factors to replacement cost new to arrive at replacement cost less normal depreciation. A more detailed discussion of depreciation may be found in Assessors' Handbook Section 501, *Basic Appraisal*.

PERCENT GOOD TABLES

Accrued depreciation is considered to be the difference between replacement cost new and current value.

Percent good is the complement of accrued depreciation. If accrued depreciation is 20 percent, percent good is 80 percent. The percent good concept is used because it saves one arithmetic operation in calculating replacement cost new less normal depreciation.

In a mass appraisal program, speed and uniformity in depreciation estimates are accomplished by the use of normal percent good tables. Percent good factors reflect the average loss in value that improvements suffer over time from normal or usual causes. They include normal physical deterioration and normal functional obsolescence, but they do not include value losses caused by unusual physical deterioration, unusual functional obsolescence, or economic obsolescence.

There are two types of normal percent good tables for structures. They are designated as "R" and "OR" tables. "R" tables are generally applicable to residential-type buildings, and "OR" tables are applicable to "other-than-residential" buildings. For each of the two types there are a number of different tables for buildings with various life expectancies.

Individual tables are designated as type "R" or "OR," with a total life expectancy in years. For example, the proper table for an average-quality dairy barn with a 20-year total life expectancy is designated as "R-20."

AVERAGE LIFE TABLES

Average life tables direct the appraiser to the proper normal percent good table. This selection is based upon the following three factors:

- Use type
- Construction type
- Quality

Use type refers to the use that is currently being made of the improvement. It may or may not be the same as the original design type that the building cost is based upon.

Construction type and quality classification are based upon the same standards as those set forth in the standard classification system for these two building characteristics.

REMAINING LIFE EXPECTANCY TABLES

Remaining life expectancy tables are also included with the normal depreciation tables. These tables show a remaining life expectancy for an item at each age of its life. These tables are intended as general information for the appraiser and may or may not be applicable in a specific instance.

EXTENDED LIFE CONCEPT

The percent good tables incorporate an extended life concept. In this concept, percent good and remaining life expectancy are based upon the expectancy at any age of a surviving item of a larger original group. Thus, a given item that has a probable life expectancy of 20 years when new may have some remaining life, and therefore value, when it is 20 years old. This stems from the fact that the 20-year average life for the group is attained by the early retirement of some items and the later retirement of others.

EFFECTIVE YEAR

Two items must be known in order to select the proper normal percent good of a structure from the table—the average life and the age of the structure. The average life is obtained from the "average-life table," and the age is calculated by subtracting the *effective year* (see next paragraph) from the appraisal year. Normal percent good and remaining life can be found from the table by selecting the age in years from the age column and reading horizontally to the proper average life column.

In most buildings the effective year is the same as the year of construction. Changes in effective year should not be made unless a significant change has been made in the improvement. However, when a building has been remodeled or added to, or is not architecturally representative of its date of original construction, the effective year may differ from the actual year of construction.

The assignment of an effective year is an appraisal estimate rather than a mechanical calculation. Knowledge of architectural and functional characteristics of structures and the changes in these characteristics over time is the key to estimating the effective year of structures. These characteristics cause structures to fall into eras or age groups. Age groups may be identified by the appraiser, and a year that most nearly reflects the effective age of a structure is assigned.

PHYSICAL CONDITION

While the value of a building may vary considerably with its condition, effective year changes are not generally made as a result of condition. Normal percent good computations are based on the assumption that the building is in average condition for its age.

While the condition of a building does have a significant influence on its value, the effective year is not generally changed for this reason because it is a temporary situation relative to total building life. Building conditions may vary considerably in a short period of time; for example, a building may be in poor condition one year, completely renovated the next year, and then allowed to deteriorate again. Effective year changes should be reserved for permanent situations.

Value differences due to physical condition should be considered as a step in the appraisal process that is subsequent to the computation of replacement cost new less depreciation (RCNLD).

The estimation of an effective year is dependent upon the appraiser's knowledge and judgment. At best, an average age of construction tends to set the latest year that should be assigned for effective age.

DEPRECIATION

AVERAGE LIFE TABLES

MISCELLANEOUS IMPROVEMENTS

Use Type of Improvement	Quality/Type	Type of Schedule	Average Life
Barns (General Farm)	Poor	R.	20
Barns (General Farm)	Fair	R.	30
Barns (General Farm)	Good	R.	40
Barns (General Farm)	Excellent	R.	60
Barns, Dairy	Poor	R.	20
Barns, Dairy	Average	R.	20
Barns, Dairy	Good	R.	25
Cold Storage Food Lockers	Poor	O.R.	30
Cold Storage Food Lockers	Average	O.R.	40
Cold Storage Food Lockers	Good	O.R.	50
Cold Storage Warehouses	Poor	O.R.	40
Cold Storage Warehouses	Average	O.R.	50
Cold Storage Warehouses	Good	O.R.	60
Cotton Gins		O.R.	30
Drive-In Theaters	Poor	O.R.	20
Drive-In Theaters	Good	O.R.	30
Drying Sheds (Fruits & Nuts) (Wood Frame)	Poor	R.	10
Drying Sheds (Fruits & Nuts) (Wood Frame)	Fair	R.	20
Drying Sheds (Fruits & Nuts) (Wood Frame)	Good	R.	30
Fences, Wood or Wire	Poor	R.	10
Fences, Wood or Wire	Average	R.	20
Fences, Wood or Wire	Good	R.	30
Fences, Chain Link, Residence-Farm	Light	R.	20
Fences, Chain Link, Industrial-Commercial	Good	R.	30

DEPRECIATION

AVERAGE LIFE TABLES

MISCELLANEOUS IMPROVEMENTS

Use Type of Improvement	Quality/Type	Type of Schedule	Average Life
Frost Protection Wind Machines		R.	30
Grain Elevators	Concrete and Metal	O.R.	50
Grain Storage Bins	Metal	O.R.	40
Grain Storage Bins	Concrete	O.R.	60
Greenhouses, Commercial	Poor Wood Frame	O.R.	20
Greenhouses, Commercial	Average	O.R.	30
Greenhouses, Commercial	Good	O.R.	40
Greenhouses, Conservatory (Back Yard)	Poor	R.	10
Greenhouses, Conservatory (Back Yard)	Good	R.	20
Hog and Sheep Sheds and Corrals	Poor	R.	10
Hog and Sheep Sheds and Corrals	Fair	R.	20
Hog and Sheep Sheds and Corrals	Good	R.	30
Lath Houses	Poor	R.	10
Lath Houses	Fair	R.	20
Lath Houses	Good	R.	30
Motor Truck Scales	Wood Under-structure	O.R.	30
Motor Truck Scales	Wood Under-structure	O.R.	40
Poultry Houses	Poor	R.	10
Poultry Houses	Medium	R.	20
Poultry Houses	Good	R.	30
Rice Drying and Storage Plants	Concrete and Metal	O.R.	50

DEPRECIATION

AVERAGE LIFE TABLES

MISCELLANEOUS IMPROVEMENTS

Use Type of Improvement	Quality/Type	Type of Schedule	Average Life
Service Stations	Poor Wood Frame	O.R.	20
Service Stations	Good Wood Frame, or Light Steel, or Masonry	O.R.	25
Service Stations	Good Wood Frame, or Light Steel, or Masonry	O.R.	30
Silos, Wood	Poor	R.	20
Silos, Wood	Good	R.	30
Silos, Masonry - Tile and Basalite		R.	40
Silos, Masonry - Concrete		R.	50
Steel Building, Quonset or Straight Wall Type (Steel Frame)	Light	O.R.	40
Steel Building, Quonset or Straight Wall Type (Steel Frame)	Medium	O.R.	50
Steel Building, Quonset or Straight Wall Type (Steel Frame)	Heavy	O.R.	60
Storage Sheds (Frame)	Poor	R.	20
Storage Sheds (Frame)	Fair	R.	30
Storage Sheds (Frame)	Good	R.	40
Swimming Pools	Poor	R.	10
Swimming Pools	Fair	R.	20
Swimming Pools	Good	R.	30
Water Tanks, Elevated	Wood Frame and Tank	O.R.	30
Water Tanks, Elevated	Wood Frame and Tank	O.R.	60

Poor = Poorest grade of materials; not contractor erected.
Fair = Average materials; builder erected.
Good = Good materials; good design; erected by competent builder.

DEPRECIATION

NORMAL PERCENT GOOD TABLES - RESIDENTIAL BUILDINGS

	20 Years Avg Life		25 Years Avg Life		30 Years Avg Life		40 Years Avg Life	
Age Years	Rem Life Years	Percent Good	Rem Life Years	Percent Good	Rem Life Years	Percent Good	Rem Life Years	Percent Good
0	20	100	25	100	30	100	40	100
1	19	94	24	95	29	96	39	98
2	18	88	23	90	28	93	38	96
3	17	81	22	86	27	89	37	94
4	16	75	21	81	26	86	36	92
5	15	69	20	77	25	82	35	90
6	14	63	19	72	24	79	34	87
7	13	59	18	68	23	75	33	84
8	12	57	17	63	22	71	32	82
9	11	55	16	60	21	67	31	80
10	11	53	16	58	20	64	30	77
11	10	50	15	56	19	60	29	74
12	9	48	14	54	19	59	28	72
13	8	46	13	53	18	57	27	70
14	7	44	12	51	17	56	27	67
15	7	42	11	49	16	54	26	65
16	6	40	11	48	15	53	25	62
17	5	38	10	46	14	52	24	60
18	5	36	9	44	13	50	23	59
19	4	33	8	43	13	49	22	58
20	4	31	7	41	12	47	21	56
21	3	29	7	39	11	46	21	55
22	3	27	6	37	11	44	20	54
23	3	25	6	35	10	43	19	53
24	3	23	5	34	9	42	18	52
25	2	21	5	32	9	40	17	51
26	2	19	4	30	8	39	17	50
27	2	16	4	29	7	37	16	49
28	2	14	4	27	7	36	15	48
29	2	12	3	25	6	34	14	47
30	1	10	3	24	6	33	14	46
31			3	22	5	31	13	45
32			3	20	5	30	12	44
33			2	18	5	29	12	43
34			2	17	4	17	11	42
35			2	15	4	26	11	41
36			2	13	4	24	10	40
38			1	10	3	21	9	38
40					2	19	7	35
42					2	16	6	33
46					1	10	5	29
50							4	25
55							3	20
60							2	14
64							1	10

DEPRECIATION

NORMAL PERCENT GOOD TABLES - RESIDENTIAL BUILDINGS

	45 Years Avg Life		50 Years Avg Life		55 Years Avg Life		60 Years Avg Life	
Age Years	Rem Life Years	Percent Good	Rem Life Years	Percent Good	Rem Life Years	Percent Good	Rem Life Years	Percent Good
0	45	100	50	100	55	100	60	100
2	43	97	48	97	53	98	58	98
4	41	93	46	94	51	96	56	96
6	39	89	44	91	49	94	54	94
8	37	85	42	88	47	91	52	92
10	35	81	40	85	45	88	50	90
12	33	77	38	82	43	85	48	88
14	32	73	36	78	41	82	46	86
16	30	69	35	74	40	79	45	83
18	28	65	33	70	38	76	43	80
20	26	60	31	67	36	73	41	77
22	24	58	29	63	34	69	39	74
24	23	56	28	60	32	65	37	71
26	22	54	26	58	31	62	35	68
28	20	52	24	56	29	60	34	65
30	18	50	23	54	27	58	32	63
32	17	48	21	53	26	56	30	60
34	15	47	20	51	24	55	29	58
36	14	45	18	49	23	53	27	57
38	12	43	17	47	21	51	26	55
40	11	41	16	45	20	50	24	54
42	10	39	14	44	19	48	23	52
44	9	37	13	42	17	46	21	51
46	8	35	12	40	16	45	20	49
48	7	33	11	38	15	43	19	47
50	6	31	10	37	14	41	18	46
52	5	29	9	35	12	40	16	44
54	5	28	8	33	11	38	15	43
56	4	26	7	31	10	36	14	41
58	4	24	6	30	9	35	13	40
60	3	22	5	28	8	33	12	38
62	3	20	4	26	7	31	11	37
64	3	18	4	24	6	30	10	35
66	2	16	3	22	5	28	9	33
68	2	14	3	21	5	27	8	32
70	2	12	3	19	4	25	7	30
72	1	10	2	17	4	23	6	29
76			2	14	3	20	5	26
80			1	10	2	17	4	23
84					1	10	2	16
96							1	10

DEPRECIATION

NORMAL PERCENT GOOD TABLES - OTHER THAN RESIDENTIAL BUILDINGS

	20 Years Avg Life		25 Years Avg Life		30 Years Avg Life		35 Years Avg Life	
Age Years	Rem Life Years	Percent Good	Rem Life Years	Percent Good	Rem Life Years	Percent Good	Rem Life Years	Percent Good
0	20	100	25	100	30	100	40	100
1	19	95	24	97	29	98	34	99
2	18	90	23	93	28	96	33	97
3	17	85	22	90	27	93	32	95
4	16	79	21	86	26	90	31	93
5	15	73	20	82	25	88	30	91
6	14	67	19	78	24	85	29	89
7	13	61	18	74	23	82	28	87
8	12	56	17	70	22	79	27	85
9	11	51	16	65	21	75	26	83
10	10	49	15	60	20	72	25	80
11	9	48	14	56	19	68	24	78
12	9	46	13	52	18	65	23	75
13	8	44	12	50	17	61	22	72
14	7	43	11	48	16	58	21	69
15	6	43	10	47	15	54	20	66
16	6	41	9	46	14	50	19	63
17	5	39	8	45	13	49	18	60
18	5	38	8	44	12	48	17	57
19	5	37	7	43	12	47	16	54
20	4	35	7	42	11	47	15	51
21	4	34	6	41	11	46	14	50
22	4	33	6	40	10	45	13	49
23	3	32	5	39	10	44	13	48
24	3	30	5	38	9	43	12	47
25	3	29	5	37	9	43	12	47
26	3	28	4	36	8	42	11	46
27	2	27	4	35	8	41	11	45
28	2	25	4	34	7	40	10	44
29	2	24	4	33	7	39	10	43
30	2	22	3	32	6	38	9	43
31	2	21	3	31	6	37	9	42
32	1	20	3	30	5	36	8	42
33			3	29	5	35	8	41
34			3	28	5	35	7	40
35			2	27	5	34	7	39
36			2	26	4	33	6	38
38			2	24	4	32	6	37
40			2	22	3	30	5	36
42			1	20	3	28	5	34
45					2	26	4	32
48					2	23	3	30
52					1	20	3	27
56							2	24
62							1	20

DEPRECIATION

NORMAL PERCENT GOOD TABLES - OTHER THAN RESIDENTIAL BUILDINGS

	40 Years Avg Life		45 Years Avg Life		50 Years Avg Life		55 Years Avg Life	
Age Years	Rem Life Years	Percent Good	Rem Life Years	Percent Good	Rem Life Years	Percent Good	Rem Life Years	Percent Good
0	40	100	45	100	50	100	55	100
2	38	98	43	99	48	99	53	99
4	36	96	41	97	46	98	51	98
6	34	93	39	95	44	97	49	97
8	32	90	37	93	42	95	47	96
10	30	86	35	90	40	93	45	95
12	28	82	33	87	38	91	43	94
14	26	78	31	84	36	88	41	92
16	24	73	29	81	34	85	39	90
18	22	68	27	77	32	82	37	88
20	20	63	25	73	30	80	35	86
22	18	58	23	69	28	77	33	83
24	17	53	21	65	26	73	31	80
26	15	50	20	60	24	69	29	77
28	14	48	18	55	23	65	27	74
30	13	47	17	50	21	61	26	71
32	11	45	15	49	20	57	24	67
34	10	44	14	48	18	53	22	63
36	9	43	13	47	17	50	21	59
38	8	42	12	46	16	48	19	55
40	8	40	11	44	14	47	18	52
42	7	39	10	43	13	46	17	50
44	6	38	9	42	12	45	16	49
46	6	36	8	41	11	44	15	48
48	5	35	7	40	10	43	14	47
50	5	34	7	38	10	42	13	45
52	4	32	6	37	9	41	12	44
54	4	31	6	36	8	40	11	43
56	3	30	5	35	8	39	10	42
58	3	29	5	34	7	38	9	41
60	3	27	4	32	7	37	9	40
62	2	26	4	31	6	36	8	39
64	2	25	4	30	6	35	8	38
66	2	24	3	29	5	34	7	37
68	2	22	3	28	5	33	7	36
70	2	21	3	27	4	32	6	36
72	1	20	3	25	4	31	6	35
74			2	24	5	30	5	34
76			2	23	3	28	5	32
82			1	20	3	26	4	30
84					2	24	4	29
88					2	22	3	27
92					1	20	2	25
96							2	23
102							1	20

DEPRECIATION

NORMAL PERCENT GOOD TABLES - OTHER THAN RESIDENTIAL BUILDINGS

	60 Years Average Life		70 Years Average Life	
Age Years	Remaining Life Years	Percent Good	Remaining Life Years	Percent Good
0	60	100	70	100
2	58	99	68	99
4	56	99	66	99
6	54	98	64	99
8	52	97	62	98
10	50	96	60	98
12	48	95	58	97
14	46	94	56	96
16	44	93	54	96
18	42	92	52	95
20	40	89`	50	94
22	38	87	48	93
24	36	85	46	92
26	34	83	45	91
28	32	81	42	89
30	30	78	40	87
32	29	75	39	85
34	27	72	37	83
36	25	69	35	81
38	24	66	33	79
40	22	63	31	76
42	21	60	30	73
44	20	56	`29	70
46	18	52	27	67
48	17	49	26	64
50	16	48	25	61
52	15	47	23	58
54	14	46	22	56
56	13	46	21	54
58	12	45	20	52
60	11	44	19	50
64	10	42	17	48
68	9	40	15	46
72	8	38	13	44
76	7	36	12	43
80	6	35	11	41
86	5	32	9	39
92	4	29	8	36
100	3	25	6	33
108	2	22	4	29
112	1	20	3	27
122			2	24
130			1	20