

Selecting the Type of Farm Building

Consider the following to help decide the type of building that will best serve your needs. Considering these factors and applying ideas from sources referred to in the right-hand column of the center-fold table will help provide a functional and economical building.

Use a plan—Show dimensions, basic construction details, door locations, windows, and other features to others so they can make a materials estimate, cost estimate, authorize a loan, or suggest improvements. An agreed-on plan should be a part of the signed contract to avoid misunderstandings.

Cost—Estimates from at least three different suppliers will help establish realistic costs. Use a plan so estimates are based on materials of similar quality and quantity. Check that delivery location and construction labor are comparable.

Width, length, height—Length over three or four times the building width is highly questionable. A round building encloses the most space for the least exterior surface area. A square building is nearly as efficient but widths over about 80 feet (especially clear span) can be a limiting factor. Most heated buildings have 8- to 12-foothigh walls and a flat ceiling to conserve heat. An inside clearance more than 16 feet is seldom needed except for hay storage barns and some machine sheds.

Design loads—A building must support its own weight, loads from stored products (hay, grain, etc.), snow, and wind loads. A minimum snow load of 25 pounds per square foot on the roof should be used for design purposes. This may increase to over 100 pounds per square foot for high snowfall areas and elevations. Wind load depends on wind speed, building height, and shape. An 80-mile-per-hour design wind speed is adequate except for along the coast and the Columbia River to past Pendleton. Design wind speeds as high as 125 miles per hour are used for those areas.

Other loads—In addition to snow and wind, a building must resist rodents, birds, machinery bumps, fire, weight of stored products, repeated pressure washings, poor ventilation, manure, airborne corrosion, lightning, and noise problems.

Durability—A written certification or warranty of design loads and material life should be available through the supplier. Words such as "water-resistant," "lifetime," "X% more" (than what?), "economical," "fire-retardant," and "guaranteed," can be mislcading in building advertising and sales. Comparison to existing structures and reputation of the supplier are major checks. Service—A reputable supplier or builder can supply references to previous work that has been done. Followthrough on time and reliable service by a good dealer is worth extra. Dealing with someone locally is more convenient than with someone hundreds of miles away, especially if the project is a large, complex building setup where delays can be costly.

Doors—Extra framing is needed for, say, 16- to 24-foot wide doors in sidewalls of clear span buildings. Using only end wall doors can give access problems in long buildings (over 80 feet). Provide a small walk-through door and a drive-through door for regular use.

Windows—Locate in the upper part of walls (not in the roof) for fewer leakage problems, more lighting, passive solar heating, and better cross ventilation. Provide a view from inside the shop, milking parlor, and house out to the farmyard for convenience.

Foundation and floor—Both affect building alignment, general drainage, dust control, manure handling, rodent access, etc. Pressure-treated poles need to be embedded at least 4 feet. Usually a concrete foundation is used with stud or post frame walls. A minimum 4-inch-thick concrete slab on compacted fill is required for durability. Install thickened edges at door approaches.

Materials—Wood is economical, especially for small or irregular-shaped buildings. Steel is used with large prefabricated construction. Concrete is durable but heavy to work with. Quality lumber is becoming difficult to find. Metal is a uniform quality material, but corrosion and bending are problems. Durability for fire, water, ice, termites, carpenter ants, people, and corrosion is needed.

Insulation—A stud-frame, truss-rafter building is the most practical to heavily insulate since framework simplifies interior sheathing. Pole frame, post frame, rigid frame, arch roof, and concrete buildings are more applicable for uninsulated buildings. Cover insulation to protect against birds, rodents, moisture, and mechanical abuse.

Appearance—A pleasing shape and color that blends with other buildings on the farmstead is desirable for a new building. Large doors can be unsightly. Consider landscaping with trees and shrubs for shade, screening, and reduction of noise.

Alternate uses—Flexibility for more than one use can spread costs, but avoid building for so many uses that the structure is not good for any. A hay shed can be used for lambing, for example, but a machine shed usually is not durable enough to use for hogs.

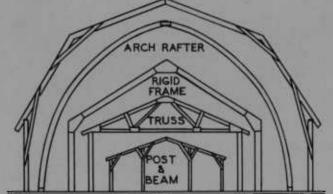
Expansion—Consider how and where future additions can be made to the new building. This affects door locations, sidewall height, roof drainage, manure handling, and access.



A farm building purchase is a major project that is not often repeated. Frequent changes in construction methods, building designs, and layout arrangements, plus the availability of new building materials make it advisable to review current literature prior to selecting a specific structure. This exercise will help the buyer obtain a more functional and practical farm building. Sources of plans and additional planning information are listed. These are available (costs range from \$1.00 to \$10 per item) from the Western Regional Agricultural Engineering Service (WRAES), Oregon State University, Corvallis, OR 97331 (phone 754-4021).

Before beginning construction, consider the complete farmstead arrangement, and where future buildings will be situated. Sketch alternate locations for buildings and major facilities to help determine the best locations to build now and in the future. At this stage of planning it may help to avoid details of each building planned. A simple oval or "X" will suffice to show where to locate a barn or pump house.

BRACED RAFTER



Extension Circular 1076



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Planning Farm Buildings

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Types of Farm Buildings

When planning a specific building, consider the various types of construction (shown below). The various types of farm buildings have different names and it improves communication to refer to these with proper terminology.

Braced rafters are used in two-story barns to gain clear spans up to 40 feet wide. Rafters are usually on 2-foot centers.

Arch rafter, round roof, or gothic buildings provide high, clear span areas up to about 40 feet wide. "Quonset" is a trade name for this type.

Rigid frame buildings have the wall and roof frames together in a single unit. Widely used with steel buildings, these can clear span to approximately 60 feet.

Truss rafters can be used with pole frame, post frame, stud, and other kinds of walls. These work well for buildings with ceilings as the lower chord provides the ceiling framework.

Post and beam roof support is simple to build. Clear span is limited to about 20 feet between rows of poles.

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	Approximate	Typical or recommended	Usual size or	Floor and	Wall and roof	Insulation "R" values	Ventilation type and	Heating system, approxim
name Home \$3	bldg. cost 30 to \$50 per sq. ft.	type of construction Insulated, wood frame 1 & 2 story. Hip roof or gable "W" truss rafter.	space requirements 24 to 34 ft. wide, 40 to 80 ft. long. Carport or attached double garage.	foundation Vented crawl space or basement of pourcd con- crete, concrete block or pressure-treated wood.	construction 2x4 or 2x6 stud-frame wall, insulation board, wood siding, shakes, wood or asphalt shingles.	Found. Walls Ceiling 8 11 to 19 30 to 38 Floor over crawl space R=19	approximate rates Exhaust fans for kitchen and bath. Vented ridge and soffits @ 1 sq. ft. per 300 sq. ft. of attic floor.	capacity, fuel types Approximately 30 to 50 Btu-per-hour capacity oil, wood, or heat pu Electric heat, 8 to 15 wa sq. ft.
storage	\$3 to \$6 per sq. ft.	Metal covered, uninsulated, 24 ft. or wider door in end walls, open side walls or doors 10 to 14 ft. high.	40 to 60 ft. wide, 80 to 120 ft. long, 14 ft. high walls. May in- clude shop at side or at end.	Packed clay with gravel drive or 4 in. thick rein- forced concrete floor.	Pole type with truss raft- er, steel rigid frame or cornigated steel arch roof.	· · · · · · · · · · · · · · · · · · ·	Cravity-type roof vents, 1 sq. ft. per 800 to 1,200 sq. ft. floor area. Screen for birds.	Consider walls, roof and tic as solar collector for drying or stored heat. F ant heat for temporary v area.
Farm \$ shop	\$6 to \$12 per sq. ft.	Insulated stud wall, block or steel building. Windows in upper parts of walls.	32 to 60 ft. wide, 40 to 100 ft. long, 10 to 16 ft. eeiling. Large and small doors for people and equipment.	Slope 5 in. reinforced concrete floor to drain or doorway, 10 ft. or more concrete ramp.	2x6 framing and truss rafter, steel rigid frame, metal siding and roof.	8 11 19	Welding exhaust fan with hood. Vehicle exhaust pipe vent. Air circulating fans.	Hot water pipes in floo wall radiators. Stored in floor or electric rad Forced air, gas, or ele suspended heaters.
	0.60 to \$1.10 per bushel	Round bins or large flat pole or steel buildings. Conveyor system plus overhead bins for handling grain in and out for large operations.	18 to 30 ft. diameter by 20 to 40 ft. high or 40 x 100 ft. flat. (1 cu. ft. = 0.8 bu.)	Reinforced concrete 5 in. or more thick. Include aeration. Consider ro- dents, sunlight and gen- eral drainage.	Round corrugated, arch roof or rigid frame steel, tilt-up concrete, wood frame.		0.05 to 0.1 cfm/bu. for aeration, 1 to 5 cfm/bu. for drying. Roof vents at top.	Cas or burn biomass heated drying. Consider lar collector. Plan wiring locate for fan noise.
	2.50 to \$6.00 per sq. ft	Metal-clad, part open walls or overhead storage in barn. Tractor loader or self-feed.	Loose: 4.4 to 2 lb./cu, ft. Chopped: 8 to 5 lb./cu, ft. Baled: 12 to 5 lb./cu, ft.	Cravel over packed clay. Well-drained site. Use 4 in. reinforced concrete feeding floor.	Pole-frame shed roof or gable trussed rafter. In- terior post and beams.		Use 1 sq. ft. roof ridge vent per 800 sq. ft. floor area. Inside feeding takes more venting.	Solar-assisted, forced-air drying. Natural-air duct cubed and chopped hay
silo	10 to \$40 per ton capacity	Hillside trench, plastic tube, wood or concrete bunker above grade.	20 to 40 ft. wide, 50 to 100 ft. long, 8 to 16 ft. high.	Sloped concrete floor, 5 in. thick. Cravel ap- proach.	Tilt-up concrete or pres- sure-treated wood.		Adjustable roof openings. Beware of gas hazards.	South slopes dry off fa Large shadows from tall right silos hinder thay and drying.
	\$30 to \$100 per ton capacity	Upright concrete or oxygen- limiting with unloader.	20 to 30 ft. diameter by up to 90 ft. high. (Silage weighs approx. 40 lbs./cu. ft.)	To manufacturer's speci- fications.	Precast concrete or cor- rosion-resistant steel.			
	\$10 to \$20 per sq. ft.	Insulated above ground. En- vironment controlled. Some below grade small storage.	30 to 80 ft. wide, 100 to 200 ft. long, 16 to 20 ft. high. (Spuds 48 lb./cu. ft., Onions 38 lb. cu. ft.)	Packed soil, 5 in. rein- forced concrete. Vent duct system in floor and/ or walls.	Insulated 2x12 stud or steel frame above grade. Concrete below grade.	10 30 40	Natural venting (small). Fans rated 1 to 1.5 cfm/ cwt. spuds; 1 to 2 cfm/ cwt. onions.	Refrigeration system cool Some supplemental heat be needed for condition in storage before unload
Greenhouse	\$10 to \$24 per sq. ft.	Steel, aluminum or wood frame. Insulated head house, Prefabrieated units avail- able.	8 x 10 ft. home gardner. 24 x 100 ft. commercial size.	4 in. eonerete floor and gravel; 6 in. concrete or pressure-treated wood foundation.	Plastic: 2 to 4 yr. life. FRP: 5 to 10 yr. life; Class + insulation north wall for energy conserva- tion.	8 Fold-up blankets, Reflective for summer,	Adjustable ridge vents and wall openings and circulation fans.	Radiant heat on walls. S storage in rock bed ur henches or floor.
Bcef barn	\$3 to \$8 per sq. ft.	Uninsulated for shelter and cattle handling. Insulated treatment barn.	Calves: 18 sq. ft./head. Yearlings: 22 sq. ft./head. Cows: 28 sq. ft./head.	Sloped-packed clay, 4 to 5 in. concrete (sloped), perforated metal.	Treated wood and con- crete. Pole-frame shcd or gable.	Straw 11 19 (calving barn)	Open ridge air outlet with adjustable open wall in- lets or walls left open.	Radiant heat in calf c space. Hot forced-air treatment barn.
Beef feedyard	\$150 to \$300 per hcad	Uninsulated barn to cover year-round feeding system. Covered feeder in open yard.	200 to 400 sq. ft./head, depends on drainage. 1-2 ft./head bunk space.	4 to 6% slope to drain. Resting mounds and con- crete traffic lanes.	Pole walls and shed roof. Windbreak and sunshade required.	Straw or shavings	Provide free air move- ment under summer shades. 25 to 100 cfm/ head in barns.	Heated waterers. Ho heated cattle treats barns. Radiant heat in lo ized areas of barn, offic
Dairy barn	\$1,000 to \$3,000	Free stall for 50 head or more, Loose housing for	4 x 7.3 ft. free stall & alleys. Loose @ 80 sq. ft./cow. Tie stalls 4 x 6	4 in. reinforced rough concrete alleys. Packed	Pole frame with clcar- span truss or post and	Cold housing 4 Warm housing	Ridge vent air outlets and Exhaust fans 25 to 100	adjustable wall openings Floor heat in steps & ran
	per head	small herds. Tie stalls for special and small herds.	ft. plus manger and alleyways.	clay and/or bedded stalls.	beam. Mow over stall barns.	8 11 19	cfm/1,000 lb. body unit.	Heated waterers.
	\$10 to \$25 per sq. ft.	Insulated. Windows in up- per part of walls. Wide milkhouse door. Concrete slab outside main entrance.	16 x 20 ft. wide, 20 to 30 ft. long, 8 ft. high insulated ceiling. Indi- vidual calf stalls for newborn calves.	4 in. reinforced sloped concretc. Floor drains to disposal. Foundation up 6 in. above floor aids eleaning.	6 in. insulated exterior walls. Concrete block partition walls. Water- proof construction.	8 11 19	Exhaust fans with ceiling air inlets. Provide for 3 to 5 air changes an hour.	Hot-air heat 5,000 Btu- hour in milkhouse. Abou 30,000 Btu-per-hour in lor and calf barn.
Hog farrow nursery	\$10 to \$30 per sq. ft.	Insulated, controlled envi- ronment. Need to keep clean and use less labor are major items.	24 ft, wide x 60 ft. long x 8 ft. high ceiling. Crates 5 x 7 ft. plus feed and manure alleys.	Heatcd, slopcd concrete to floor drain. Part slat floor, liquid manure.	4 in, insulated walls. Post and beam roof or gable trussed rafter with insul- ated ceiling.	8 11 19	20 cfm/sow (minimum). 80 cfm/sow is normal plus summer cooling.	2,000 Btu-per-hour per Hot-air heat plus floor in creep and nursery p
Hog growing	\$6 to \$15 per sq. ft.	Insulated, durable, liquid manure handling, separated groups. Allow 3 to 4 litters/ pen.	30-60 lb.: 3-4 sq. ft./pig. 60-150 lb.: 4-6 sq. ft. pig. 150-210 lb.: 6-9 sq. ft./pig.	Floar: 4 in. reinf., sloped concrete w/part slats. "Open" pen partitions over slats.	Pole frame walls and gable trussed rafters or post and beam shed roof.	8 11 19	Ridge air outlets and adju trolled environment barns lb. body wgt. Fan ventilat	provide 25 to 100 cfm/1
Shecp lambing	\$6 to \$15 per sq. ft.	Insulated, wood or steel framed. Shavings or straw bedding, shorn ewes for con- finement lambing.	4 to 5 ft. pens plus alleys. 15 to 20 sq. ft./ewc & lamb plus storage space for feed, etc. Bum (orphan) lamb area.	Packed clay or 4 in, sloped concrete. Wood slat or metal mesh raised floors and manure seraped underneath.	Pole frame or stud walls, trussed rafter or post and beam roof. Old two-story barns.	8 11 19	Air outlets at ridge plus adjustable wall openings. For warm barns, fans @ 25-100 cfm/1,000 lb. body weight,	Some hot air to dry h Radiant heat over creep to dry off lambs or ren chill.
Sheep feeding	\$5 to \$10 per sq. ft.	Insulated confinement for year-round operation or open shed with insulated roof.	Barn space: 6-8 sq. ft./head. Yard space: 15-20 sq. ft./head. Feeder space: 8-12 in./head.	Packed elay or concrete with bedding. Wood or metal-mesh slat floor cuts space to 4 sq. ft./hd.	Pole frame, stud frame or steel frame with clear span or post and beam roof.	4	Ridge vent air outlet and adjustable wall openings. Fan vent for hot weather.	Heated or constant-flow tering. Radiant heat in pital area.
Horses	\$5 to \$10 per sq. ft.	Uninsulated with hayloft. Tack space & office room. Metal bin for grain storage.	30 x 60 ft. and up, 12 x 12 ft. box- stalls. Tie stalls, alley, tractor, etc. Arenas 50 ft. widc (minimum).	Packed clay stalls, 4 in. concrete alleys sloped to doors. Consider rodents.	Polc frame, 2x6 stud frame, post and beam with hayloft or clear span truss.	Shavings 4 or straw 4 or bedding hayloft	Ridge vent air outlet and adjustable wall openings. Fan venting 25-150 cfm /1,000 lb.	Heated barns for show s —forced hot air. Radi electric heat for office,
Poultry brooding, layers	\$6 to \$12 per sq. ft.	Floor system for brooding, grow, and up to 1,000 lay- ers. Cages for over 1,000 layers.	To 6 weeks: 0.5 sq. ft./chick. Layers: 1-2.5 sq. ft./bird.	4 in. concrete, bedding or slats over packed soil. Liquid manure systems for large layer opera- tions.	Pole frame with clear span truss rafters or post and beam. Consider ro- dents.	or straw 11 19	0.1 cfm per chick; 3-5 cfm/layer. Extra venting and evaporative cooling for hot weather.	Brooder radiant heating 20 Btu-per-hour per h Hot-water wall radiant office heat and egg proc ing.
Poultry broilers	\$6 to \$10 per sq. ft.	Floor system with me- chanical feeding, watering, scraped out manure.	To 6 weeks: 0.6 sq. ft./hird. Over 6 weeks: 0.75 sq. ft./bird.	Packed soil and bedded with straw and/or shav- ings.				

ximate es	Plans, some information sources, regulations, comments, etc.
50,000 gas, pump. watts/	See MWPS-16 "Family Housing Hand- book," USDA Extension house plans, architect design, building supplier. Build- ing permit. Consider solar and earth- sheltered construction.
nd at- or crop Radi- y work	USDA Extension plans for 30, 40, 48 and 60 ft. wide buildings. Alternate use for crop storage, emergency livestock shelter.
oor or l solar adiant. electrie	AAVIM "Farm Shop" booklet, USDA Extension plan, Midwest Plans for 30 x 40 ft., 40 x 48 ft., and 40 x 64 ft. Con- sider water system, sewage disposal, lighting.
iss for der so- ng and	USDA Extension plans for hin arrange- ments and elevators. See MWPS-13 "Grain Feed Handling Handbook." MW- PS plans for wood granaries and hopper bins. APA plan for moveable bin walls.
air hay icts for iay.	USDA Extension plans. MWPS plans for 24, 30, 40 and 48 ft. wide clear span buildings. Alternative use for livestock or machinery in off-season.
faster. all up- awing	USDA Extension plan. MWPS-AED 15 "Tilt-up Concrete Silos." MWPS-1, "Structures & Environment Handbook."
ooling. at may ioning ading.	OSU EC 948 "Onion Storage." NRAES-7 "Home Storage of Fruits and Vegetables." USDA Extension plans; USDA C119, "Storing Vegetables and Fruits."
. Solar under	NE-77 "Hobhy Creenhouses & Other Gardening Structures." NRAES-3 "Ener- gy Conservation and Solar Heating for Greenhouses." USDA Extension plans.
creep ir in Hot-air atment local- fice.	USDA Extension plans. MWPS-6 "Beef Housing & Equipment Handbook." USDA F1584 "Feedlot & Ranch Equipment." Western Beef Cattle Handbook. MWPS beef feedlot plans. Feedyard runoff con- trol.
gs ramps.	MWPS-7 "Dairy Housing & Equipment Handbook." USDA F2266 "Solar Heat- ing for Milking Parlors."
tu-per- out 10- n par-	USDA Extension plans. MWPS plans. OSU EC 1007 "Planning a Dairy Waste Handling System." PNW 71 "Housing for Dairy Calves."
er sow. or heat plans. or con- /1,000	Building selection depends on size and management. MWPS-8 "Swine Housing & Equipment Handbook." USDA Exten- sion Plans, MWPS Plans. Orcgon Pork Producers' Handbook.
barn. p only emove	MWPS-7 "Sheep Housing & Equipment Handbook." USDA Extension plans. US- DA F2242 "Housing & Equipment for Sheep." OSU EC 1001 "Adoption Crates."
n hos-	
v stock idiant- e, etc.	MWPS-15 "Horse Housing & Equipment Handbook." Building company plans. USDA AB 353 "Horsemanship and Horse Care."
ing at bird. nt for rocess-	MWPS-1 "Structures and Environment Handbook." USDA Extension plans. US- DA F2198 "Automatic Feeding Equip- ment for Livestock & Poultry, and B 2262 "Small Poultry Flocks." MWPS plans.