

Instructions, Design Criteria, Inspection Requirements

6-Pen Dry Litter Piggery

General Description:

This piggery will have a footprint of 794 square feet; 949 square feet including the roof and overhang. The structure basically consists of: A six inch thick steel reinforced concrete slab, steel reinforced CMU columns, timber structural roof members, and a corrugated metal roof. As the title implies, there are six pens, each pen approximately six feet wide by ten feet long. A three foot wide walkway is located in front of the pig pens. The pens are enclosed and partitioned by a fabricated hogwire, framed by angle iron panel. A gate at the front of the pig pens that is able to open either to the left or right will help with the routing of the animals.

Limitations and Considerations:

You will notice that the floor of the pig pens has a 12% slope; and following the direction of the waste stream, a subsequent 2 foot drop to the “waste alley”. To balance earthwork cut and fill, this structure would be suited ideally to a hillside with a slope of 12-15%. However, it may be unlikely that this piggery would be sited to such optimum conditions. The NRCS planning process, particularly steps 1-6 will reveal considerations such as:

- Site specific earthwork cut/fill calculations that would be required.
- Suitability of foundation material: A soils investigation shall be required to determine if the bearing strength of the “subgrade” (under the concrete floor) meeting the required 3,000 lbs. per square foot is achievable.
- A specific plan for removing unsuitable subgrade material and replacing with compacted basecourse, crushed coral backfill, etc. shall be a determination made by the NRCS technical representative.
- Ancillary practices that can be considered when planning this facility:
 - Roof runoff management, NRCS practice standard (558); the cooperators may want to capture roof runoff for the purposes of providing livestock with drinking water.
 - Watering facility, NRCS practice standard (614); clean runoff water held in a tank to provide drinking water for livestock.
 - Pipeline, NRCS practice standard (516); for the infrastructure to deliver water from the watering facility to the livestock.
 - Sometimes overlooked surface water management practices; NRCS practice standards: Diversion (362), hillside ditch (423), lined waterway (468).
- A comprehensive nutrient management plan (CNMP) will determine the required volume for the solid waste storage facility (313) or composting facility (317). Note that the requirements, operations and maintenance for a “composting facility” are more complicated and may be difficult to achieve.
- Examine the piggery location regarding animal ingress and egress, vehicle access, and proximity to dwellings and agricultural operations.
- Location of this structure within the watershed. The piggery shall not be located where it will be subject to inundation. Nor, should the piggery be located where it will concentrate or adversely affect surface water runoff.

Design Criteria and Specifics:

Individual components of this project, sans “ancillary practices” shall conform to the following NRCS practice standards and specifications:

- Composting Facility – (317) Composting Facility
- Solid Waste Storage – (313) Waste Storage Facility (an alternative to Composting Facility)
- Pig Pens – (313) Waste Storage Facility
- Waste Alley – (634) Waste Transfer
- Roof – (367) Roofs and Covers
- Walkway – (561) Heavy Use Area Protection

The structural design is in accordance with the 2009 International Building Code, which references the American Society for Civil Engineer’s Minimum Design Loads for Building and Other Structures, and for some elements the American Concrete Institute Building Code Requirements for Structural Concrete is referenced. For purposes of analysis, the worst case scenario was considered. The design parameters are as follows:

- Open, monoslope pitched roof; building group U, “agricultural building” (2009 IBC section 312.1)
- Wind speed 170 mph (ASCE figure 6-1)
- Terrain, exposure, topographic, and building orientation considerations relating to the analytical method outlined in ASCE 6.5 are:
 - Exposure B (ASCE 6.5.6.3), “...Exposure B shall apply where the ground surface roughness condition, as defined by Surface Roughness B, prevails in the upwind direction for a distance of at least 2,600 ft.” Surface roughness B is defined as: “...wooded areas, or other terrain with numerous closely spaced obstructions...”
 - Wind resistance, monoslope roof, 8 degrees (ASCE figure 6-18A)
 - Wind pressure; roof slope 8 degrees, zone 1 monoslope open building (ASCE figure 6-19A), wind speed 170 mph, tributary area (for analysis) 8 square feet (ASCE figure 6-3)
 - Occupancy category I (IBC table 1604.5) “agricultural facility”
- Considerations for the seismic analysis are:
 - Site class D (IBC 1613.5.2) “stiff soil profile”
 - 0.2 sec, and 1 sec spectral response acceleration (IBC figure 1613.5(14))
 - Seismic category D (IBC table 1613.5.6(1))

Further analysis for steel reinforced concrete complies with ACI 318. 3,000 psi concrete is to be used. 40,000 psi deformed steel rebar is to be used for reinforcement.

Specifics regarding strength and stresses for wood beams, rafters, and purlins were found in The National Design Specification for Wood Construction published by the National Forest Products Association. All wood members shall be Douglass Fir, Structural Dense No. 1, pressure treated.

Guam and CNMI building permitting departments use the 2009 International Building Code as the reference for compliance. We examined the 2009 IBC closely; applicable findings are as follows:

- 107.3.4 – The design must be approved by a registered design professional.
- 312.1 – Agricultural Buildings are classified as “Utility and Miscellaneous Group U”.
- 603.1 – Fire Retardant Treated Wood is acceptable for type I & II construction.

- 504.1 – The height and area for this structure is well below the maximum limitations for utility buildings.
- 803.9 – There are no restrictions on interior finishes for “group U” buildings.
- 1003.2 – Minimum ceiling height is 7 feet 6 inches.
- 1507.4.3 – Galvanized steel roofing for “group U” buildings, meets ASTM A-653 G-90
- 1603.1 – The following information shall be located in the construction documents
 - Floor and roof live loads
 - Basic wind speed and wind exposure
 - Seismic design, category & site class
 - Flood design data
 - Load bearing of soils
- 1604.5 – Agricultural buildings are occupancy category I
- 1607.1 – Live load for a single story building is 20 lbs./sq.ft.

Quantities:

Material quantities are as follows:

Site Preparation		
Mobilization		l.s.
Excavation		cu.yd.
Subgrade (placement & compaction)		cu.yd.
Materials		
Concrete	17	cu.yd.
Grout/Mortar	4	cu.yd.
8 x 8 x 16	490	ea.
8 x 8 x 8	276	ea.
#3 rebar	500	l.f.
#4 rebar	2298	l.f.
#5 rebar	429	l.f.
#6 rebar	1444	l.f.
2 x 6 pressure treated lumber, (12' length)	70	ea.
2 x 4 pressure treated lumber, (12' length)	46	ea.
beam tie galvanized	22	ea.
rafter tie galvanized	104	ea.
purlin tie galvanized	338	ea.
5/8" bolts, nuts, washers	148	ea.
hog panels, (34" x 16' panels)	9	ea.
angle iron	326	l.f.
channel iron	24	l.f.
fabricated hinges	24	ea.
corrugated metal roofing, (2'8" x 14' pieces)	34	ea.
misc.		to be determined

Site Specific Additions:

In addition to the 9 pages construction drawings for this structure, one would anticipate adding the following (as additional pages to the construction drawings):

- Location, vicinity, and conservation plan map, General Notes (Including notes regarding construction safety) (1 page).
- Plan view (topographic map) with northing, easting, and elevations of the building corners clearly identified (1 page).
- Detail of site preparation and backfill requirements (1 page)
- Detail of roof runoff management (1 page)
- Detail of watering facility (tank) (3 pages)
- Detail of pipeline infrastructure to provide water for livestock (1 page)

A comprehensive nutrient management plan will likely be included, although not part of the construction drawings.

Design calculations may need to be submitted to permitting agencies.

Construction and Inspection:

It is important to make sure that the slab is placed on a well compacted material. Site preparation involves excavating the site to the called for elevation and dimensions. Placement of select backfill and compaction should be monitored to ensure adequate foundation. The NRCS technical representative shall determine the suitability of subgrade material.

Two concrete pours are required to complete the slab. The NRCS technician shall verify correct rebar placement (diameter, length, overlap and position), soundness of forms, and clearance from the rebar to the anticipated finished concrete surface. Forms and rebar shall be secured and firmly tied to prevent shifting while pouring concrete. Concrete chairs shall be used to maintain the position of reinforcement. Particularly, under the columns, there will be three layers of rebar. If the layers of rebar are placed side by side (rather than stacked on top of one another) the clearance from rebar to the finished concrete surface should be acceptable (within ½"). 3 inches of clearance is required from the subgrade to reinforcement; 2 inches is required from the finished concrete surface to reinforcement; lateral splices shall have an overlap of 42x the bar diameter. The NRCS technician shall verify concrete slump, per construction note number 4:

The concrete shall meet the provisions of ASTM C-94. Concrete shall have a minimum compressive strength of 3,000 psi at 28 days, have an air content of 4 to 7%, and contain a minimum of 6 bags of cement per cubic yard. Cement shall be ASTM C 150 type 1 or 1A (or JIS R-5210). Coarse aggregate shall conform to ASTM C-33 size numbers 467, 67 or 57. Slump shall be 3 ½" + or - 1". Concrete may be mixed on-site, providing concrete is proportioned and mixed to meet the above specifications.

Vertical bars from the floor pad should be securely tied into position. This will prevent misalignment of reinforcement when the blocks for the columns are added. Protruding steel shall be capped per OSHA regulations.

Concrete shall be allowed to cure for at least 7 days, per construction note number 9:

The concrete shall be moist cured for seven days following placement. Moist curing can be accomplished by keeping it covered with damp cloth, organic material, or plastic sheeting. Moisture shall be added to maintain the dampness during the curing period. Concrete shall be covered to prevent damage from rain during the curing period. Curing for grout (blockfill) and mortar is not required.

The NRCS technician should verify that horizontal rebar is placed within the column every 16 inches, and all block cells are filled with grout.

Wood rafters, beams, and purlins shall be pressure treated, structural type I, Douglass Fir. The NRCS technician should verify the adequacy of the galvanized steel beam, rafter, and purlin ties. Also, verify beam and rafter splicing is installed as shown on the construction drawings.

Roofing material is anticipated to be galvanized steel meeting ASTM A-653 G-90. If an alternative is proposed, verify adequacy by checking 2009 International Building Code 1507.4.3. Roofing material shall be secured with corrosion resistant self-tapping screws; every 6 inches on center at the edges, 12 inches on center everywhere else.