

Chapter 4

Construction Specifications

This chapter contains construction specifications intended to be used in conjunction with building plans found in the Appendix of this handbook. These specifications can be modified or supplemented by the NRCS engineer for job specific requirements.

The chapter contents are as follows.

- commentary on building materials and methods, pages 5-1,2
- construction specifications for composter or stacking shed construction, pages 5-3 to 5-11
- a construction checklist, pages 5-12,13.

Commentary - Nails

Early reviews of this manual suggested a need for more discussion on fasteners, specifically nails. Discussed below are recommendations on the types of nails that should be used in NRCS designed composters and stacking sheds.

Material - Steel nails shall be used in all structural framing and pressure treated lumber. Aluminum nails may only be used in roofing applications for which they are designed.

Corrosion resistance - Hot-dipped type zinc coated nails should be used for all structural framing to prevent premature rusting and insure long time corrosion resistance. According to a U.S. Forest Products Laboratory study, hot dipped nails were proven to resist rust far better than electrogalvanized and mechanically galvanized nails in humid climates. Double hot-dipped nails provide even better resistance.

Shanks - **DO NOT** use common nails in pressure treated lumber or structural framing. The plain nail (below) is not threaded and has less withdrawal resistance.



Ring shank nails (below) with annular threads are preferred for use in all of the buildings discussed in this handbook. Ring shank nails can carry considerably higher loads than common nails.



Spiral shank nails are also acceptable for use in all of the buildings discussed in this handbook. Spiral nails (below) are normally used in harder wood or to attach hardboard siding.



Nail Dimensions - Specific size nails are required for certain connections. These requirements are listed in the construction specifications and are indicated on the construction drawings. Below is a chart for quick identification of nails by size.

<u>Pennyweight</u>	<u>Length</u>
2d.....	1”
3d.....	1 1/4”
4d.....	1 1/2”
5d.....	1 3/4”
6d.....	2”
7d.....	2 1/4”
8d.....	2 1/2”
9d.....	2 3/4”
10d.....	3”
12d.....	3 1/4”
16d.....	3 1/2”
20d.....	4”
30d.....	4 1/2”
40d.....	5”
50d.....	5 1/2”
60d.....	6”
70d.....	7”
80d.....	8”
90d.....	9”
100d.....	10”

CONSTRUCTION SPECIFICATION

WASTE MANAGEMENT BUILDING STRUCTURE

1. Scope

This specification shall consist of the clearing, grubbing, excavation, backfill, concrete, forms, reinforcing steel, timber, fasteners, other appurtenances and services required for the construction of waste management structures (i.e., dry stacks and composters) and the disposal of all cleared and excavated materials. Construction shall be carried out in such a manner that erosion, water, air, and noise pollution will be minimized and held within legal limits as established by state and federal regulations.

2. Site Evaluation

The site for a dead animal composting and/or dry stack structure shall be evaluated by a soil scientist, engineer, or his/her qualified agent. Attention should be given to soil suitability for a foundation, surface drainage, and proximity to the production houses.

3. Design

All structures shall be constructed according to plans prepared in accordance with the Natural Resources Conservation Service's engineering standards for these practices, as well as local building codes and current industry standards. Any change or deviation from the approved drawings and specifications must be approved by the engineer prior to construction.

4. Construction Inspection

The landowner will advise NRCS of the date construction will begin and notify NRCS during foundation preparation, prior to backfill of post footings, during concrete placement, during truss erection and upon completion of the work. Where cost-sharing assistance from government agencies is provided, inspection and concurrence of the work by NRCS is required. The landowner shall give reasonable notice to NRCS regarding the above activities. Absence of inspections during construction will not relieve the landowner and contractor from the responsibility of completing the work in strict compliance with the plans and specifications.

The United States government and its employees are in no manner a party to any verbal or written contract or agreement between the landowner and the contractor. NRCS employees, within the limit of personnel available, will assist the landowner during construction to help obtain satisfactory compliance with the plans and specifications.

5. Clearing and Grubbing

All trees, brush, stumps, boulders, rubbish and manure shall be removed from the foundation, storage, and spoil area(s) before excavation is performed. All material cleared from the area shall be disposed by burning or burying on-site or hauling to an appropriate landfill. All burning shall conform to state and federal laws and regulations. Trees and other cleared vegetation will be cut flush with the ground surface in spoil areas. The fountain and/or storage area will have all stumps, roots and vegetation removed. The general area around buildings will also require grubbing as necessary to complement the use intended for the structure. The limits of this grubbing will be staked by the engineering or his/her agent.

6. Excavation

Top soil excavated from the site will be stockpiled for later placement around the completed structure. Soils containing excessive organic material will be removed from the foundation area. The completed excavation and placement of spoil material shall conform as nearly to lines, dimensions, grades, and slopes shown on plans or staked on the ground as skillful operation of the excavating equipment will permit. Generally, spoil will be placed and spread to blend with the existing terrain of the spoil area. Runoff from outside drainage areas will be diverted away from the excavation area.

7. Fill Placement

Earth material placed for pads, flooring, or fountains shall be clayey or clayey-gravelly material, free of detrimental amounts of sod, roots, stones, and other debris.

Begin placing and spreading the fill material at the lowest point of the foundation and bring the fill up in approximately horizontal layers not exceeding eight (8) inches thick. These layers shall be reasonably uniform in thickness and shall extend over the entire area of the fill. Operate the earth hauling or compacting equipment over each layer for a minimum of two (2) passes so that compaction of the fill material will be obtained.

If a minimum required density is specified, each layer of fill shall be compacted as necessary to obtain that density. A standard tamping roller over each lift will be required to obtain the specified compaction.

The outer edges and slopes of the fill shall blend with the surrounding landscape.

Moisture Control. All fill material shall have a moisture content sufficient for the required compaction. Fill material which is too dry shall be moistened by adding water and/or thoroughly mixing with moist fill until an acceptable moisture level is obtained. Fill material which is too wet shall be allowed to dry out naturally or by machine rolling and/or

shall be thoroughly mixed with dry fill material until an acceptable moisture level is obtained.

The moisture content of the fill shall be maintained within the limits to:

1. Prevent bulking or dilatence of the material under the action of the hauling or compacting equipment.
2. Prevent adherence of the fill material to the equipment.
3. Ensure the crushing and blending of the soil clods and aggregation into a homogeneous mass.
4. Contain adequate moisture so that a sample will remain formed when molded in the hand without soil or water squeezing through the fingers.

8. Timber Fabrication and Installation

The structure shall be constructed on a firm foundation to the lines and grades shown on the plans. Dimensions and spacings shown on the plans and drawings are minimums required for the fifty year wind and snow loads. These dimensions and spacings may be altered if the result is a stronger structure, with prior approval of the engineer. In no case will the dimensions and spacings be modified in a way which would reduce the strength of the structure. All framing shall be true and exact. Timber shall be accurately cut and assembled to a close fit.

Appropriate bracing for safety and structural stability during construction shall be practiced in accordance with applicable building codes.

Wood and Timber: All material shall be sound wood, free from decay, and of good quality. All lumber shall be graded in accordance with the Standard Grading Rules for Southern Pine Lumber, with a minimum grading of Number 2 (No. 2 non-dense grading is not acceptable). Unless otherwise specified, all material shall be furnished in American Standard dressed sizes. All sizes specified are nominal sizes.

All structural timber and lumber, except roof girders, rafters, purlins, trusses, knee braces, and attic bracing shall be pressure treated. Treated timber and lumber shall be impregnated with the specified type and quantity of preservative and conform to Federal Specification TT-W-571. The minimum net retention of the common preservative, chromated cooper arsenate, shall be 0.4 pcf for dimension lumber used above ground in contact with manure and 0.6 pcf for structural posts or timbers in contact with the ground.

Posts shall be set plumb and to the depths shown on the drawings. Backfill around posts shall be concrete as shown on the drawings or shall be hand tamped earth if allowed on the

drawings. Posts shall be temporarily braced until girders, plates or other members are installed to maintain plumb alignment.

Handling and Storing: All timber and lumber, including trusses, stored at the site of the work shall be neatly stacked on supports at least twelve inches above ground surface and protected from the weather by suitable covering. Untreated material shall be so stacked and stripped as to permit free circulation of air between the tiers and courses. Treated timber may be close-stacked. The ground underneath and in the vicinity of all stacks shall be cleared of weeds and rubbish. The use of cant hooks, peavies, or other pointed tools, except end hooks, will not be permitted in the handling of structural timber, lumber, or trusses. Treated timber shall be handled with rope slings or other methods which will prevent the breaking or bruising of outer fibers, or penetration of the surface in any manner.

Fasteners: Connections between wood members requiring bolts may be initially done with appropriately sized nails until such time as it is expedient to add the bolts, unless specified otherwise in the drawings. Bolts shall be added as soon as practicable, before the building is declared structurally sound, and before being accepted as complete. Nails and spikes shall be driven with just sufficient force to set the heads flush with the surface of the wood. Holes for machine bolts shall be a minimum of 1/32' larger than the bolt but no more than 1/16' larger. Appropriately sized washers shall be used in contact with all bolt heads and nuts that would otherwise be in contact with the wood.

Hot-dipped zinc coated nails shall be used in all structural framing and all connections containing pressure treated lumber. Spiral or annular ring shank nails shall also be used in these connections to provide a higher withdrawal resistance.

Nails to fasten rafters, girders, cleats, scabs, wooden sidewalls, and/or braces to the pressure treated post shall be 16d to 30d size. Untreated framing members shall be fastened to each other with 12d to 16d nails. Examples include roof purlins to rafters, and tie-down cleats or braces to rafters or girders. Six inch (60d) nails are used to fasten 2" x 4" purlins on edge to wooden trusses. All bolts, washers, and nuts shall be galvanized unless otherwise specified.

Trusses: Trusses may be metal or wood and shall be designed to handle the loads specified by the Natural Resources Conservation Service (NRCS) planner. Trusses may be pre-fabricated, manufactured trusses. All truss designs shall be approved (signed and sealed) by a registered professional engineer. A truss specification sheet completed by NRCS shall be signed by the truss manufacturer. A copy of the truss certification shall be provided to the NRCS approving official prior to truss installation.

Manufactured trusses will be installed in accordance with the manufacturer's instructions, on the spacing compatible with the design. Trusses shall have a minimum of twelve (12) inches of overhang and more overhang is advisable.

Truss anchorage and associated supports shall be as shown on the drawings or other acceptable method as approved by the NRCS engineer. Bracing details shall be provided by the truss manufacturer.

Roofing: Roofing shall be galvanized metal in standard lengths and widths. Roofing material shall be minimum twenty-nine (29) gauge with 3/4" ribs. Roofing shall be installed in accordance with manufacturer's recommendations. If any other type of roofing material is desired, it must first be approved by the engineer. Nails used to attach roofing material to the purlins shall be lead-headed nails, aluminum nails with neoprene washers, or other type as approved by the NRCS engineer.

9. Steel Reinforcement

Reinforcement steel and welded wire fabric shall be new, clean, and free of oil, grease, paints and flaky rust. Steel bars for concrete reinforcement shall be deformed billet-steel bars, conforming to ASTM Specification A-615, Grade 40 or 60. Welded wire fabric shall conform to the requirements of ASTM Specification A-185.

Reinforcement steel shall be accurately placed as specified and secured in position in a manner which will prevent its displacement during placement of the concrete. If reinforcing steel is spliced, the splices shall provide an overlap equal to 30 times the diameter of the smaller bar in the splice and shall be tied at both ends of the splice. Steel reinforcement in concrete block walls shall be tied in place prior to laying the blocks. Dropping or placing required steel reinforcement into the holes of concrete blocks without properly overlapping and tying the steel together with the foundation steel is not acceptable. Field bending of steel will be permitted. Heating of steel for bending will not be permitted.

Reinforcement steel and welded wire fabric shall be suspended off the ground and other concrete contact surfaces by using scotches of concrete bricks, concrete blocks or pieces of blocks, wire stands, or other approved method prior to the placing of concrete. Scotches of stones, wood materials, earth, earth clods, clay bricks, scrap metal and other unapproved materials are not acceptable. Unless otherwise specified, welded wire fabric shall be spliced in the following manner:

1. Adjacent section shall be spliced end to end (longitudinal lap) by overlapping a minimum of one full mesh plus two inches, plus the length of the two end overhangs. The splice length is measured from the end or the longitudinal wires in one piece of fabric to the end of the longitudinal wires in the lapped piece of fabric.
2. Adjacent sections shall be spliced side to side (transverse lap) by overlapping a minimum of one full mesh plus two inches. The splice length shall be measured from the center of the first longitudinal wire in one piece of fabric to the center line of the first longitudinal wire in the lapped piece of fabric.

10. Concrete

Design Mix: The concrete mixture shall be no less than five bag per yard mix. The water content shall not exceed six gallons per bag of cement in the mixture. Any mix used shall have a designed minimum 28 day compressive strength of 3,000 pounds per square inch (psi). The concrete shall contain a standard known brand of Portland cement with washed sand and gravel. Clean water shall be used in the mix. Calcium Chloride and other chemical admixtures for concrete will not be accepted unless expressly specified in the drawings or specifications.

Consistency: The amount of water used in the concrete shall be the minimum necessary to obtain the required workability. The consistency of the concrete shall be such that it can be worked readily into the corners and angles of the forms and around reinforcement but without permitting the materials to segregate or excess free water to collect on the surface. The slump shall be between two and five inches as tested by “The Test for Slump for Portland Cement Concrete,” ASTM Specification C-143.

Fiber Reinforced Concrete: Where fiber reinforcement is used in the concrete floor of dry stack/composter facilities the following requirements shall be met:

1. Fiber shall consist of ¾” length virgin homopolymer, fibrillated polypropylene fibers. Fibers shall be chemically inert meeting the requirements of ASTM C-1116. The minimum rate of application is 1.5 pounds of fiber per cubic yard of concrete, added at the point of mixing.
2. The addition of fiber to a concrete mix may cause an apparent reduction in slump. However, no additional water should be added to the mix to improve workability. If needed, a suitable plasticizer should be added to the concrete mix.
3. During placement the fiber mix will generally require more effort and vibration to move the mix and consolidate it into the forms due to the lower slump nature. Properly controlled internal vibration is acceptable, but external vibration of the forms and exposed surfaces is preferable to prevent fiber segregation.
4. Contraction joint spacing will be reduced from a maximum of thirty feet to a maximum of fifteen feet in any direction. Sawn joints shall be one-fourth of the slab’s thickness in depth.
5. Fiber reinforcement in concrete does not take the place of structural steel reinforcement. Where steel reinforcement is shown on drawings it shall be placed as shown.

Forms: Forms shall be of wood, steel, or other approved material.

Forms shall be true to line and grade, mortar tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces shall be smooth, free from

irregularities, dents, sags, or holes when used for permanently exposed surfaces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, metal will not be less than one inch from any concrete surface. Forms for walls and vertical sections two (2) feet high and over shall be stabilized with adequate tie rods, walers, cat-heads and sufficient bracing to prevent shifting or movement of forms during placing of concrete.

Forms for exposed surfaces shall be coated with a non-staining form release agent which shall be applied before the concrete is placed. All excess release agent on the form surfaces and any on surfaces requiring bonding with concrete shall be removed.

All form removal shall be accomplished in such a manner as to prevent injury to the concrete. Forms for floor slabs and such work may be removed after a minimum of 24 hours. Forms for walls shall be left in place for a minimum of three (3) days. All repair work must be done immediately after removal of forms.

Timing and Temperature: Concrete shall be placed within one-and-one-half (1 ½) hours after introduction of water to the cement and aggregates. Concrete shall not be placed when the outside temperature is expected to fall below 40 degrees F. at the time the concrete is delivered and placed at the work site. Concrete shall not be exposed to freezing temperatures during the curing period. Concrete, when deposited in forms during hot weather, will have a temperature not greater than 90 degree F., at the time of placement. Ice may be used as a portion of the mixing water to control temperature provided all ice is melted in the mixing process. When the outside temperature reaches or exceeds 90 degrees F., the concrete shall be placed within 45 minutes after batching.

Conveying and Placing: No concrete shall be placed until the approving official has given approval of the in-place sub-grade, form, reinforcing steel, and any other items involved or affected by the concrete placement.

Concrete shall be conveyed from mixer to forms as rapidly as practicable by methods which will prevent segregation or loss of ingredients. Hoppers and chutes, pipes, or “elephant trunks” may be used. There shall be no vertical drop greater than five feet.

Unless otherwise authorized, all concrete shall be placed upon clean, damp surfaces free from frost, ice, standing and running water, and never upon soft mud, dried porous earth, or fill that does not meet specified compaction requirements. Soft mud or other unacceptable foundation material shall be removed and replaced with gravel or other approved material.

Concrete shall be deposited as close as possible to its final position in the forms. Concrete shall be thoroughly consolidated by rodding or mechanically vibrating the concrete in place supplemented by hand-spading and tamping to remove air voids. Vibrating equipment shall be used when pouring walls and other thin sections.

Concrete for floor sections shall be placed in one continuous layer, however, all sections of the floor do not have to be poured at one time. Construction joints shall be placed in the floor slab at no more than thirty (30) foot intervals in any direction across the slab. The joint may be cut, or may be a groove tooled into the green concrete if the groover depth is at least one-fourth of the slab's thickness. The joint may be formed into a key way by using a metal or wooden form. A smooth, vertical construction joint will not be permitted.

Finishing: Defective concrete, honeycombed areas, voids left by the removal of tie rods, and unacceptable ridges left on concrete surfaces shall be repaired immediately after the removal of forms unless otherwise authorized and directed. Voids left by the removal of tie rods shall be reamed and completely filled with mortar.

Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be secured with keys, dovetails or anchors. Excessive rubbing of formed areas will not be permitted. All unformed surfaces of concrete, exposed in the completed work, shall have a wood float finish without additional mortar.

Curing. Concrete shall be prevented from drying for a curing period of at least seven days after it is placed. All exposed surfaces of concrete shall be protected from the direct rays of the sun for at least these first seven days. All concrete shall be cured by keeping continuously moist for the entire curing period, or until curing compound is applied. Moisture shall be maintained by sprinkling, flooding, fog spraying, or by covering with materials kept continuously moist such as canvas, cloth mats, straw, sand polyethylene, or other approved material. Wood forms (except plywood) left in place during the curing period shall be kept wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

If a curing compound is used, two coats of it will be applied to all concrete surfaces except construction joints and surfaces to which other concrete will be bonded. The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. Curing compound shall meet the requirements of ASTM Specification C-309, Type 2, white pigmented.

11. Final Grading and Seeding

The area adjacent and in the immediate vicinity of the structure shall be shaped to blend with the natural surroundings and to compliment the structure and work area around it. Shaping shall be in such a way as to drain or divert all overland and roof runoff safely away from the structure and surrounding work area. The NRCS planner shall provide grading details to remove the 25 year 24 hour storm without flooding of the structure.

All distributed areas around the structure, including spoil areas, shall be vegetated and/or surfaced with gravel, chert, or some other acceptable covering as permitted by the NRCS approving authority. Spoil areas not used for any other purpose shall be vegetated.

Permanent vegetation will be established to the plant species and by methods prescribed by the approving official. All vegetating of disturbed areas will be done as critical area planting and shall include liming, fertilizing, seedbed preparation, seeding and mulching. Temporary vegetation may be used when conditions permanent vegetation. Disturbed areas shall be mulched regardless of seeding dates.

If farm animals will have access to the vegetated area, it will be appropriately fenced until vegetation is well established.

12. Maintenance

The structure should be inspected at least twice each year when the facility is empty. Replace any wooden parts, hardware, or other replacement parts which are damaged or show excessive wear or decay. Roof structures should be examined for structural integrity.

(End of Construction Specification)

**CONSTRUCTION CHECKLIST
FOR LITTER STORAGE/COMPOSTER BUILDING**

Type Facility: _____

The following items were discussed as a construction checklist prior to the construction of the subject facility, on _____.
(Date)

NRCS Representative

Landowner

Contractor

Construction items to be checked:

Explain any deviations or deficiencies in Section VII of this checklist.

I. SITE:

A. Was site properly prepared prior to construction? Yes _____ No _____
(Size of pad, compaction, drainage, etc.)

II. POSTS:

A. Does post size, treatment, and spacing meet specifications? Yes _____ No _____

B. Does post depth and anchorage meet specifications? Yes _____ No _____

III. TRUSSES, PURLINS, AND ROOF BRACING:

A. Is manufacturer's certification on hand for truss design? Yes _____ No _____

B. Is truss design sealed by a Registered Professional Engineer? Yes _____ No _____

C. Method of truss to post fastening: Bolts _____ Strips _____ Clips _____
Other _____

D. Method of rafter to girder fastening: Bolts _____ Strips _____ Clips _____
Other _____

E. Do knee brace sizes and fastenings meet specifications? Yes _____ No _____

F. Are trusses diagonally braced at intervals or 40' or less? Yes _____ No _____

G. Are purlins, trusses, rafters, girders, and all other lumber of the specified size and treatment? Yes _____ No _____

IV. NAILS, BOLTS, AND FASTENERS:

A. Are galvanized (or threaded) fasteners used where specified? Yes _____ No _____

B. Are all nails and bolts properly sized? Yes _____ No _____

V. ROOFING AND EXTERIOR WALL MATERIALS:

A. Is roof and wall covering constructed of specified material(s)? Yes _____ No _____
Roof material used _____ Wall material used _____

B. Is all material new and of the specified gauge? Yes _____ No _____

C. Is roof and wall covering properly installed? Yes _____ No _____

VI. CONCRETE

A. Does the concrete mix meet specifications? Yes _____ No _____

B. Does fiber reinforcing meet specifications? Yes _____ No _____ N/A _____

C. Does welded wire fabric meet specifications? Yes _____ No _____ N/A _____

D. Is reinforcing steel properly sized, spaced, and tied? Yes _____ No _____ N/A _____

VII. COMMENTS

Explain any deviations or deficiencies here.

(Attach additional sheets as necessary)