

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

HEAVY USE AREA PROTECTION

(Ac.)

CODE 561

DEFINITION

The stabilization of areas frequently and intensively used by people, animals or vehicles by establishing vegetative cover, surfacing with suitable materials, and/or installing needed structures.

PURPOSE

To provide a stable, non-eroding surface for areas frequently used by animals, people or vehicles
To protect and improve water quality

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to agricultural, urban, recreational and other frequently and/or intensively used areas requiring treatment to address one or more resource concerns.

CRITERIA

General Criteria Applicable to All Purposes

Plan and design heavy use areas to comply with federal, state, and local laws and regulations.

Design Load. Base the design load on the type and frequency of traffic, (vehicular, animal, or human) anticipated on the heavy use area.

Foundation. Evaluate all site foundations for soil moisture, permeability, texture and bearing strength based on the design load and planned frequency of use.

Where necessary, prepare the foundation by removal and disposal of materials that are not adequate to support the design loads.

Use a base course of gravel, crushed stone, other suitable material and/or geotextile on all sites that need increased load bearing strength, drainage, separation of material and soil reinforcement. Refer to Natural Resources Conservation Service (NRCS), National Engineering Handbook, Parts 642 and Design Note 24, Guide for Use of Geotextiles, for guidance on geotextile selection.

On sites with porous foundations (high permeability rate), with a need to protect ground water from contamination, provide an impervious barrier.

Surface Treatment. Select a surface treatment that is stable and appropriate to the purpose of the heavy use area. Surface treatments must meet the following requirements according to the material used. The subgrade must be reasonably uniform without abrupt changes from hard to soft. The upper 12" of the subgrade shall be of uniform material and compacted to a uniform density throughout. All fill material used in the preparation of the subgrade shall be similar to the in-place material and shall be compacted to the density of the in-place material. Compacted aggregate may be used in lieu of in place material. The entire subgrade must have positive drainage.

The final surface shall have enough slope to eliminate ponding, without eroding the surface material.

Concrete. Design the thickness and compressive strength of concrete according to the expected loading and use. .

A 4-inch thick layer of crushed gravel or limestone shall be provided as a uniform subbase. Where the subgrade is uniform and dense, a Type S-1 concrete slab is acceptable. Type S-2 concrete slabs shall be used where the subgrade material is non-uniform or has variable density, and it is not economical or feasible to improve the subgrade. The subgrade thickness in question is generally 12 inches, but could be more, depending on the soil profile. Design Criteria for Type S-1 and S-2 concrete slabs is found in the Ohio NRCS Concrete Construction specification.

For installations where it is necessary to limit the permeability of the concrete, refer to NRCS Conservation Practice Standard, Waste Storage Facility (313) and ACI 360R-06, Design of Slabs-on-Ground, for design criteria for slabs on grade

Bituminous Concrete Pavement (Do not use for livestock applications). Refer to *AASHTO Guide for Design of Pavement Structures* or the applicable state department of highway's specification for design criteria for bituminous concrete paving.

In lieu of a site specific design, for areas that will be subject to light use, pave with a minimum of 4 inches of compacted bituminous concrete over a subgrade of at least 4 inches of well compacted gravel. Use bituminous concrete mixtures commonly used for road paving in the area. The mixing and placing of these materials shall be in accordance with Ohio Department of Transportation (ODOT), item 401 - Asphalt Concrete Pavements or 422 - Chip Seal with Polymer Binder, for the expected loading. Compact the surface with a heavy steel wheel roller until the bituminous concrete is thoroughly compacted and roller marks are eliminated.

Other Cementitious Materials. Other cementitious materials such as soil cement, roller compacted concrete, and coal combustion by-products (flue gas desulphurization sludge and fly ash) can be used to provide a durable, stable surfacing material. Develop site specific mix designs based on the properties of the material with compressive strengths necessary for the expected use and loading on the heavy use area.

Aggregate. Design fine or coarse aggregate surfaces at least 4-inches thick (4" thickness limited to human traffic as primary use).

Aggregate pads designed primarily for vehicular or livestock usage shall consist of a geotextile fabric, overlain with aggregate base material, overlain with surface material as described below. Where pads are installed on well drained soils and the sub-base will not be subjected to saturation (dry subgrade), the requirement for the geotextile underlayment may be waived by the NRCS Engineer.

A "dry subgrade" design must meet the following criteria and be documented in the design folder:

- The soil must be mapped as "well drained" or be in hydrologic soil group A or B
- The site topography must be such that water will not pond on the planned pad
- The planned usage does not require access by livestock or vehicles during periods when the subgrade is likely to be saturated

Geotextile Fabric Minimum Average Roll Values (MARV):

- Minimum tensile strength (ASTM D 4632) – 120 lb
- Elongation at failure (ASTM D 4632) -- < 50% for woven; ≥ 50% for non-woven
- Minimum burst strength (ASTM D 3786) – 210 psi
- Minimum puncture strength (ASTM D 4833) – 60 lb
- Apparent opening size (ASTM D 4751)
- # 40 U.S. Standard Sieve (AOS) ≥ # 100 U.S. Standard Sieve (≤0.42mm (AOS) ≥ 0.149mm)
- Permittivity (ASTM D 4491) ≥ 0.03 sec⁻¹ , ≤ 0.70 sec⁻¹
- Minimum ultraviolet light protection (% residual tensile strength, ASTM D4355) – 70%

The minimum compacted base thickness of crushed gravel or limestone, subjected only to livestock access, is 6 inches. Where the pad is subjected to vehicular traffic, an 8 inch compacted base is required.

The minimum thickness for limestone or crushed gravel screenings placed on top of the base, for use as a surface on livestock pads, is 3 inches. This 3-inch layer is considered only as a sacrificial wear surface and not part of the structural base.

Table 1 describes quality criteria for pad materials and can be used to configure stone pads using alternate base and surface materials.

Pad Material Configurations (minimum compacted thickness)						
Pad Material <u>1/</u>	Livestock only			Livestock & Vehicular Traffic		
	A	B	C	A	B	C
<u>2/</u> AASHTO M 43 # 1 or 2	4"	4"		6"	4"	
AASHTO M 43 # 57 or 67	2"			2"		
<u>3/</u> ODOT 304.02 or 411.02		2"	6"		4"	8"
<u>4/</u> Screenings (pad surface) AASHTO M 43 No. 9 or 10 limestone aggregate	3"	3"	3"	3"	3"	3"

Table 1

1/ Materials are to be supplied from sources listed on the most current ODOT S1069 Aggregate Producers/Suppliers list and meet ODOT 703.01 grading requirements. Steel slag and recycled Portland cement concrete (RCP) from listed sources may be substituted for crushed gravel or limestone. Materials from sources not listed on the ODOT list may be used when listed as acceptable on the quarry list maintained by the NRCS Ohio Geologist

2/ The voids between the stone are to be choked with fines (57s', 67s', 304s' or 411s') to create a smooth surface.

3/ Compaction is required for materials containing fines (e.g. 304's & 311's). Compact by tracking over the entire surface with a minimum of 4 passes of a drum roller, or vibratory drum roller. Rubber tired equipment having a 4000 lb minimum wheel load may be used when the entire surface can be uniformly tracked. Addition of water may be necessary to obtain maximum compaction. The moisture content should be sufficient that a hand held ball can be formed, and material will stain the hands.

4 Select screening materials appropriate to the type of livestock that utilize the pad (see special requirements for horses). Screenings are not considered part of the structural pad thickness, and are not necessary when the use is vehicular traffic only. An additional 3" of ODOT 304.02 or 411.02 may be used in lieu of screenings.

Sprays and Artificial Mulches. When utilizing sprays of asphalt, oil, plastic, manufactured mulches, and similar materials, follow the manufacturer's recommendations for design requirements.

Other. Surfacing materials, such as limestone screenings, cinders, tanbark, bark mulch, brick chips, shredded rubber and/or sawdust, shall have a minimum layer thickness of 4 inches.

Structures. Design any structures associated with the heavy use area including roofs, according to appropriate NRCS standards. Where NRCS standards do not exist, design structures according to the requirements of the particular construction material and accepted engineering practice. Base environmental design loads for buildings associated with heavy use areas on criteria in ASCE 7 - Minimum Design Loads for Buildings and Other Structures: ASCE/SEI 7-05.

Drainage and Erosion Control. Include provisions in the design for surface and subsurface drainage, as needed. Include provisions for disposal of runoff without causing erosion or water quality impairment. To the extent possible, prevent runoff from entering the heavy use area.

Vegetative Measures. Where appropriate, stabilize all areas disturbed by construction with vegetation as soon as possible after construction. Refer to NRCS Conservation Practice Standard, Critical Area Planting (342). If vegetation is not appropriate for the site, use other measures to stabilize the area.

Additional Criteria for Livestock Heavy Use Areas

The treated area can include all areas where livestock congregate and cause surface stability problems. This includes feeding areas, portable hay rings, watering facilities, feeding troughs, mineral boxes, animal trails and walkways requiring surface stabilization, and other facilities where livestock concentrations cause resource concerns.

Use NRCS Conservation Practice Standards Wastewater Treatment Strip (635), Manure Transfer (No.) (634), Critical Area Planting (342); Fencing (382); Prescribed Grazing (528); Filter Strip (393); Vegetated Treatment Area (635); Access Control (472), Animal Trails and Walkways (575) or other similar standards as companion practices, when needed to meet the intended purpose of the heavy use area protection.

When this standard is used for the installation of structural surfaces for Animal Trails and Walkways or when the heavy use area may also be used as a vehicular access road, the installation will follow the alignment and water management criteria found in Conservation Practice Standard 560, Access Road.

Include provisions in the design of the heavy use area to collect, store, utilize and/or treat manure and contaminated runoff.

Planning. Feeding pads installed in areas other than total livestock confinement are to be planned as a component of a Grazing Management Plan meeting Conservation Practice Standard 528- Prescribed Grazing. The grazing plan is to include the following minimum information (including a map) for sizing, locating, and managing the feeding pad:

- Number, species, and size of livestock

- Time interval livestock is expected to utilize the pad, including feeding frequency, type of feed, and time intervals livestock are expected to be confined to the pad
- Distance from streams, ditches, and waterways
- Location of livestock watering facilities, consider locating water on the pad
- Location of livestock access roads associated with feeding, watering, and confinement buildings
- Management of manure accumulation on pad including frequency of manure removal; all manure stockpiles associated with the pad will follow guidelines in the “Manure Stockpiling Job Sheet” referenced with practice standard 634-Manure Transfer
- Other components such as waste storage structures, pasture management, winter feeding planning, livestock watering systems, roof runoff management, fencing, buffer strips, access roads, and diversions shall be considered in the overall conservation plan or grazing plan and incorporated into the design as needed. Livestock stream crossings needed as part of a livestock use area are to follow crossing criteria in Conservation Practice Standard 578-Stream Crossing.
- For materials other than concrete, pad durability will be impacted by the amount of manure accumulation, cleaning frequency, cleaning methods, presence of frozen material, exposure to weather conditions, and moisture conditions of the pad surface. Cleaning will require care to prevent removal of the pad surface, or the operator will need to plan on frequent maintenance (resurfacing) to maintain the minimum required base thickness.

Location. To minimize the potential for contamination of streams, pads should be located outside of flood plains. However, if site restrictions require location within a flood plain, protect the pad from inundation and damage from a 25-year flood event, or larger if required by laws, rules, or regulations.

- If the pad is located within 100 ft of a watercourse that is likely to receive flow during the period the pad is in use, runoff and manure management measures will be incorporated into the design to prevent stream degradation from erosion and/or polluted runoff.
- Locate the pad a minimum 300 ft from neighboring residences
- Not within the 1 year time of travel area for a public water supply well delineated under Ohio’s Source Water Assessment and Protection Program, or not within 1000 ft. of a public water supply well when the 1 year time of travel area has not been established
- Not within the emergency management zone of public surface water supply as designated under the Source Water Assessment and Protection Program, or not within 1500 ft. of the surface supply intake when a emergency management zone has not been established
- Not within 300’ of a non-community public, or neighboring private water supply well
- Not within 50’ of a well controlled by the owner of the facility planned for installation under this standard.

The Federal Emergency Management Agency (FEMA) has designated Established Regulatory Floodways in the floodplains of some Ohio rivers and streams. Do not locate facilities within an Established Regulatory Floodway.

Manure Management. If accumulated manure on the pad needs to be scraped for livestock management objectives, or to prevent environmental degradation while in use, then a manure management system meeting current Ohio Conservation Planning Policy must be developed.

Sizing. For feeding pads located within a grazing area where livestock have continuous access to the pasture, the pad is to be sized to provide stability for the intensively used area under and adjacent to the feeder. A single 8½’ diameter hay ring requires an area of 32’x32’.

Where livestock need to be periodically confined to a pad as part of a winter feeding plan for pasture protection or on a feedlot adjacent to housing, the pad size is to be determined from recommendations from Midwest Plan Service, livestock industry publications, or from written recommendations from an experienced livestock housing specialist working as a consultant to the producer. The following stocking densities may be used in lieu of specific recommendations:

Species	Pad area (ft ² /head) <u>1/</u>
400-800 lb beef calves	40-50
800-1200 lb beef cattle	50-60
Beef cows	60-75
Mature dairy cows	50

1/ - plus area of feeders located on the pad

Cleaning Frequency. If planning criteria requires the area to be cleaned of manure or waste feed more frequently than three times each year, the surface material shall be concrete. If the planning criteria allow cleaning the area three times each year or less, the area may be surfaced using other acceptable materials.

EQUINE USE AREA PROTECTION

This section addresses special criteria for pads installed for equine loafing, travelways, exercising, or temporary confinement.

Pads may be installed within 300 ft. of neighboring residents. Where pads are to be located within 50 ft. of a neighboring residence, the landowner is to provide written evidence that the neighbor has been contacted and has no objection to the location.

The recommended minimum pad size ranges from 40'x40' for a single horse up to 60'x60' for multiple horses on the pad at once. These minimum pad sizes consider the horses to be stabled the majority of the time and brought onto the pad periodically for exercise and training. Where horses are planned for confinement to the pad for long periods, the recommended pad size needs to be increased as recommended by an equine specialist. Livestock feeding on the pad is not recommended unless measures are made to remove excess/discarded feedstock from the pad surface. Accumulated manure or waste hay will soften the pads.

The pads shall be designed and maintained to minimize the potential of foot/h hoof damage by preventing contact with coarse aggregate. Slag should be avoided.

Aggregate pads consist of a geotextile fabric, overlain with a finished thickness of 6" of compacted AASHTO M 43 No. 9 or 10 limestone aggregate, as specified in the ODOT Construction and Material Specifications, 703 Aggregate. Where required for weak subgrade conditions, 4 to 6" of AASHTO No. 1, 57, or ODOT 304 limestone aggregate may be used to stabilize the pad foundation.

Pads are to be graded for positive drainage to prevent ponding and excessive velocities that could displace fines on the pad surface. Grades between 1 and 2 percent are recommended.

Fencing may be necessary to restrict animal access or for confinement purposes. Where fencing is necessary, consideration should be given to fencing that is highly visible and will not pose a safety hazard to the animal(s). Such fencing can include rail/board, rubber, high-tensile polymer, mesh, electric or combinations of these types. Minimum height for fencing shall be 60 inches to deter most horses from jumping over. The minimum height from the ground shall be no lower than 6 inches.

Additional Criteria for Recreation Areas

Heavy use protection in recreation areas that are accessible to the public must meet the requirements of the Americans with Disabilities Act.

CONSIDERATIONS

Heavy use areas can have a significant impact on adjoining land uses. These impacts can be environmental, visual and cultural. Care should be taken when selecting the type of treatment to ensure that it is compatible with adjoining areas. Consider such things as proximity to neighbors, utilities, cultural resources, environmentally sensitive areas and the land use where the stabilization will take place. Stabilization techniques used in a cattle feeding area may not be appropriate for a recreation area.

By its very nature, a heavy use area will be subject to intensive use. If vegetation will be part of the stabilization technique, consider the durability of the vegetation. Choose plant species that can withstand the expected use. Additional techniques such as geogrids, other reinforcing techniques or planned periods of rest and recovery may need to be employed to ensure that vegetative stabilization will succeed.

Heavy use areas will be intensely used by animals, people or both. Consider the safety of the users both human and animal during the design. Avoid slippery surfaces, sharp corners or surfaces and structures that might entrap users. For heavy use areas used by livestock avoid the use of sharp aggregates that might injure livestock hooves.

For livestock heavy use areas, provide positive drainage to prevent ponding of water. Such wet areas can have adverse affects on animal health and comfort.

Heavy use area protection often involves paving or otherwise reducing the permeability of the heavily used area. This can reduce infiltration and increase surface runoff. Depending on the size of the heavy use area, this can have an impact on the water budget of the surrounding area. During the planning and design, consider the effects to ground and surface water.

Heavy use areas are places where animals, people or vehicles are concentrated. The resulting manure, sediments, bacteria, petroleum products and trash that might accumulate on the heavy use area can result in degraded runoff water quality. During planning and design consider how these pollutants will be handled to reduce offsite impacts.

To reduce the negative water quality impact of heavy use areas consider locating them as far as possible from waterbodies or water courses. In some cases this may require relocating the heavily used area rather than just armoring an area that is already in use.

Surface erosion can be a problem on large heavy use areas that do not use a hard surface such as concrete. In these cases the designer may need to include measures on the area that reduce the flow length of runoff to reduce erosion problems.

To reduce the potential for air quality problems from particulate matter associated with heavy use areas, consider the use of NRCS Conservation Practice Standards Windbreak/Shelterbelt Establishment (380), Herbaceous Wind Barriers (603) or the use of palliative treatments such as lignosulfonate, synthetic polymers, organic oils, or chloride compounds to control dust from bare heavy use areas.

Heavy use areas for livestock can vary widely in size depending on how the operator manages his livestock. Because heavy use areas can be expensive to construct and maintain, a significant consideration should be to reduce the size of the heavy use area as much as possible. This may require changes in how the livestock are managed but in the long run may result in less maintenance and a more efficient operation.

For areas that will need to be cleaned frequently by scraping, loose aggregate or other non-cementitious materials may not be the best choice. Consider a more durable surface such as concrete.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for Heavy Use Area Protection that describe the requirements for installing the practice according to this standard. As a minimum the plans and specifications shall include:

A plan view showing the location and extent of the practice.

Where appropriate, cross-sections showing the type and required thickness of paving or stabilization materials.

Where appropriate, plans for required structural details.

Where appropriate, vegetation establishment requirements.

Construction specifications that describe in writing site specific installation requirements for the heavy use area protection.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for the operator. The minimum requirements to be addressed in the O&M plan are:

Periodic inspections, especially immediately following significant rainfall events.

Prompt repair or replacement of damaged components especially surfaces that are subjected to wear or erosion.

For livestock heavy use areas include requirements for the regular removal and management of manure.

Where vegetation is specified, periodic mowing, fertilization and control of vegetation.

REFERENCES

American Association of State Highway and Transportation Officials. 2006. Standard Specification for Geotextiles Used for Highway Applications. AASHTO Standard M288. Washington, DC.

American Association of State Highway and Transportation Officials. 1998. Guide for Design of Pavement Structures with 1998 Supplements. Washington, DC

American Concrete Institute. 2008. Building Code Requirements and Specifications for Masonry Structures. The Masonry Standards Joint Committee. Farmington Hills, MI.

American Concrete Institute. 2006. Design of Slabs-on-Ground. ACI Standard 360R-06. Farmington Hills, MI.

American Concrete Institute. 2005. Building Code Requirements for Structural Concrete. ACI Standard, 318-05. Farmington Hills, MI.

American Forest & Paper Association and American Wood Council. 2005. National Design Specification for Wood Construction. Washington, DC.

American Institute of Steel Construction Inc. 2005. Steel Construction Manual, 13th Edition. Chicago, IL.

American Society of Civil Engineers. 2005. ASAE-7, Minimum Design Loads for Buildings and Other Structures. ASCE Standard 7-05. Reston, VA.

The Asphalt Institute. 1975. Full Depth Asphalt Pavement for Private Driveways, Construction Leaflet No. 11. Lexington, KY.

Korcak, R. F. 1998. Agricultural Uses of Coal Combustion Byproducts. P. 103-119. *In* Wright, R. J., et al (eds.) Agricultural Uses of Municipal, Animal and Industrial Byproducts. USDA-ARS, Conservation Research Report 44.

Portland Cement Association. 1970. Thickness for Soil Cement Pavements. Skokie, IL.

USDA-Natural Resources Conservation Service. 2008. National Engineering Handbook, Part 642. Washington, DC.

USDA-Natural Resources Conservation Service. 1991. Guide for the Use of Geotextiles, Design Note Number 24. Washington, DC.

ACI. 1992. 360R. Design of Slabs on Grade. ACI, P.O. Box 9094, Farmington Hills, MI.

Midwest Plan Service. 1987, MWPS-6, *Beef Housing and Equipment Handbook*, Iowa State University, Ames, IA.

Midwest Plan Service. 1983, MWPS-1, *Structures and Environment Handbook*, Iowa State University, Ames, IA. (No longer in publication)

Ohio Conservation Planning policy (180-GM, Part 409) :
http://www.oh.nrcs.usda.gov/intranet/GenManual/180_gm_cons_plan_applic.html

OSU Extension, 1997, AEX-304-97, *Using Geotextile Fabric in Livestock Operations*, The Ohio State University, Columbus, Ohio: <http://ohioline.osu.edu/aex-fact/0304.html>

OSU Extension, 1999, AEX-332-99, *Construction of Livestock Feeding and Hay Bale Storage Pads Using FGD Material*, The Ohio State University, Columbus, Ohio:
<http://ohioline.osu.edu/aex-fact/0332.html>

Construction & Material Specifications (NRCS Ohio concrete standard & ODOT Construction & Material Specifications):
<http://www.oh.nrcs.usda.gov/technical/engineering/neh20.html>