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 or the current Missouri construction specification Geotextile (753).

On sites with porous foundations (high permeability rate), with a need to protect ground water from contamination, provide an impervious barrier. Heavy use areas shall not be outletted directly to karst features.

Surface Treatment. Select a surface treatment that is stable and appropriate to the purpose of the heavy use area. Table 1 provides guidance for selecting an appropriate surface treatment. Surface treatments must meet the following requirements according to the material used.

Concrete. Design the thickness and compressive strength of concrete according to the expected loading and use. Concrete shall comply with the current Missouri construction specification Reinforced Concrete (750). 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. Refer to *AASHTO Guide for Design of Pavement Structures*. Asphalt material and installation conforming to Section 403 of Missouri Department of Transportation (MoDOT) standard specifications for highway construction is satisfactory. 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 6 inches of well compacted base course consisting of gravel, crushed stone, or other suitable material. Geotextile in conformance with Missouri Construction Specification Geotextile (753) may be used in conjunction with base course material.

Use bituminous concrete mixtures commonly used for road paving in the area. 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 6-inches thick. If the surface will be compacted, choose a well graded aggregate.

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 and other facilities where livestock concentrations cause resource concerns.

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

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

Livestock watering access at streams and surface waters. Refer to conservation practice standard Prescribed Grazing (528) for water source travel distance requirements to determine access point numbers and locations.

Foundation preparation shall consist of removal and disposal of soil and other material that is not adequate to support the design loads.

The top surface of the watering access in a channel shall be a minimum of 6 inches below the existing channel bottom.

The ramp for the access shall extend up to the existing top of bank elevation.

Ramp slope shall be 6 (horizontal) to 1 (vertical) or flatter. An alternative configuration is a stairstep access with a minimum tread (horizontal distance) of 6 feet and a maximum rise (vertical distance) of 9 inches.

Construct a fence to exclude livestock from the remaining streambanks and surface waters. Conservation practice standard Fence (382) or Use Exclusion (472) shall be used as needed to meet the intended purpose.

Refer to NRCS, National Engineering Handbook (NEH), Part 650, Engineering Field Handbook, Chapter 16 - Streambank and Shoreline Protection for details and specifications on lakeshore watering access, streambank watering access, and floating electric fence.

Livestock access facilities shall have a stable surface. The surface may be coarse aggregate, concrete, or natural bedrock.

Coarse aggregate shall conform to ASTM (American Society of Testing and Materials) Specification C33 unless otherwise shown on the construction drawings or designated by the engineer. The size number shall be between 1 and 467, as defined in Table 2, ASTM C33. Fine aggregate may be size number 5 through 67. Equivalent size aggregate conforming to MoDOT Standard and Specifications for Highway Construction, Section (1005, 1006, or 1007) may be used.

For concrete surfaced ramps, use a minimum 5-inch thick concrete slab. Reinforcement is required for cast-in-place concrete slabs. The concrete surface shall be roughened to provide a non-skid surface. Concrete shall comply with the guidance in the current Missouri construction specification 750 Reinforced Concrete.

A minimum of 1/2-inch diameter steel reinforcement on 18-inch centers, in both directions, shall be used.

Precast concrete panels may be used in lieu of cast-in-place concrete slabs.

Concrete surfaced ramps shall be placed over firm, native mineral soil material or a minimum gravel sub base thickness of 4 inches.

Concrete surfaced ramps may not be placed on organic soils unless a suitable base is provided to support the anticipated loads.

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.

Byproducts from coal fired power plants such as fly ash and sludge from scrubbers can vary significantly. Therefore, their toxicity and cementation characteristics should be known to ensure they are compatible with the intended use.

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:

1. A plan view showing the location and extent of the practice.
2. Where appropriate, cross-sections showing the type and required thickness of paving or stabilization materials.
3. Where appropriate, plans for required structural details.
4. Where appropriate, vegetation establishment requirements.
5. 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:

1. Periodic inspections, especially immediately following significant rainfall events.
2. Prompt repair or replacement of damaged components especially surfaces that are subjected to wear or erosion.
3. For livestock heavy use areas include requirements for the regular removal and management of manure.
4. 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.

Missouri Department of Transportation, Standard and Specifications for Highway Construction.

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.

Table 1: Typical Surface Material Installation Conditions

Surface Treatment Description	Foundation Condition 1/	Maximum Loading Condition 2/
Raised Earth: Compacted, graded to drain and vegetated	Firm and Well Drained	Pedestrian
	Soft or Poorly Drained	N/A
Natural Mulch or Shredded Rubber: 4 inch thickness with underlayment of geotextile meeting Missouri construction specification 753 Geotextile.	Firm and Well Drained	Pedestrian
	Soft or Poorly Drained	N/A
Gravel: 2 inch thickness of fine aggregate (well graded 1" minus size) with underlayment of geotextile meeting Missouri construction specification 753 Geotextile or 4 inch thickness of fine aggregate without geotextile.	All	Pedestrian
Gravel: 2 inch thickness of fine aggregate (well graded 1" minus size) over 6 inch thickness of coarse aggregate (1" – 3" size) or 6 inch thickness of fine aggregate (well graded 1" minus size) with underlayment of geotextile meeting Missouri construction specification 753 Geotextile.	Firm and Well Drained	Heavy Vehicle
	Soft or Poorly Drained	Livestock or Light Vehicle
Gravel: 10 inch thickness of aggregate (3" minus size) with underlayment of geotextile meeting Missouri construction specification 753 Geotextile. Top 2 inches of surface may be dressed with fine aggregate (1' minus size)	Soft or Poorly Drained	Heavy Vehicles
Bituminous Pavement: 4 inch thickness of asphalt over 6 inch thickness of base material	Firm and Well Drained	Heavy Vehicles
	Soft or Poorly Drained	N/A
Concrete: 5" thickness of reinforced concrete on firm compacted earthfill (for small slabs not requiring joints, typically with all side dimensions less than 10 feet)	Firm and Well Drained	Heavy Vehicles
	Soft or Poorly Drained	Livestock or Light Vehicles
Concrete: 5" thickness of reinforced concrete over 4 inch thickness of base material (for large slabs requiring expansion joints, typically with at least one side dimension larger than 10 feet)	Firm or Soft and Well Drained	Heavy Vehicles
Concrete: 5" thickness of reinforced concrete over 6 inch thickness of designed granular drain material for wet conditions requiring drainage	Poorly Drained	Heavy Vehicles

1/ **Firm** - *Typical USCS classifications: GW, GP, GM, GC, SW or well compacted CL*
Soft - *Typical USCS classifications: SP, SM, SC, ML, MH, CH, or poorly compacted CL*

2/ **Light Vehicle** has weight of 6,000 pounds or less
Heavy Vehicle has weight greater than 6,000 pounds