DEFINITION

Heavy Use Area Protection is used to stabilize a ground surface that is frequently and intensively used by people, animals, or vehicles.

PURPOSE

Heavy Use Area Protection is used:

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

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where a frequently or intensively used area requires treatment to address one or more resource concerns.

CRITERIA

General Criteria for 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 the site foundation to ensure that the presumptive bearing capacity of the soil meets the intended design load and 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, geotextile, or a combination of materials 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, Part 642; Design Note 24, Guide for Use of Geotextiles; or other State-approved reference for geotextiles. Geotextile selection shall be in accordance with NRCS Ohio Construction Specification, Geotextile.
If there is the potential for ground water contamination from the heavy use area, select another site or provide an impervious barrier. Make provisions to treat contaminated surface runoff from the impervious area.

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.

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

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.

Concrete. Design slabs-on-ground subject to distributed stationary loads, light vehicular traffic, or infrequent use by heavy trucks or agricultural equipment in accordance with American Concrete Institute (ACI) Guide for the Design and Construction of Concrete Parking Lots (ACI 330R). Design slabs-on-ground subject to regular or frequent heavy truck or heavy agricultural equipment traffic in accordance with ACI Guide to Design of Slabs-on-Ground (ACI 360R). Design liquid-tight slabs in accordance with ACI Code Requirements for Environmental Concrete Structures, Slabs-on-Soil (ACI 350, Appendix H). Refer to Ohio NRCS Concrete Construction Specification for Type S-1 (light vehicular traffic), Type S-2 (heavy vehicular traffic), and Type S-3 (water-tight) concrete slab design criteria.

Design concrete structures in accordance with NRCS National Engineering Manual (NEM), Part 536, Structural Engineering.

Bituminous Concrete Pavement. Refer to AASHTO Guide for Design of Pavement Structures or the applicable State highway department’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. Asphalt is not permitted where livestock will be using the HUAP.

Other Cementitious Materials. Cementitious materials, such as soil cement, agricultural lime, roller-compactcd concrete, and coal combustion by-products (flue gas desulphurization sludge and fly ash),
can be used to provide a durable, stable surfacing material. Based on the properties of the surface material, develop a site-specific mix design with compressive strengths necessary for the expected use and loading on the heavy use area. Select materials that are non-toxic and that have chemical properties that are compatible with the intended use.

**Aggregate.** Design aggregate surfaces for expected wear and intended use. In lieu of a site-specific design for areas that will be subject to light non-vehicular use, install a minimum combined thickness for aggregate surfacing and base course of 6 inches for livestock, 8 inches for vehicular traffic, and 4 inches for other applications.

Place a 3-inch minimum thickness of AASHTO M 43 No.10 crushed limestone aggregate or screenings on top of the base in the designs for “livestock only.” Three inches of screenings are not necessary when the pad is for vehicular traffic use only. Consider the 3-inch pad surface as a sacrificial wear layer and not part of the structural base.

Table 1 describes alternative base and HUAP pad surface material design options, A, B and C, depending whether the pad will have livestock only or if the pad will have livestock and vehicular traffic.

**TABLE 1- HUAP Pad Material Configurations A, B, and C (minimum compacted thickness)**

<table>
<thead>
<tr>
<th>MATERIALS 1/</th>
<th>DESIGN OPTIONS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Livestock Only</td>
<td>Livestock &amp; Vehicular Traffic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BASE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AASHTO M43 #1 or #2 2/</td>
<td>4”</td>
<td>4”</td>
<td>--</td>
<td>6”</td>
<td>4”</td>
</tr>
<tr>
<td>AASHTO M43 #57 or #67 2/</td>
<td>2”</td>
<td>--</td>
<td>--</td>
<td>2”</td>
<td>--</td>
</tr>
<tr>
<td>ODOT 304.02 or 411.02 3/</td>
<td>--</td>
<td>2”</td>
<td>6”</td>
<td>--</td>
<td>4”</td>
</tr>
<tr>
<td>PAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SURFACE</td>
<td>SCREENINGS 4/</td>
<td></td>
<td>Required</td>
<td>Optional (for Vehicles Only)</td>
<td></td>
</tr>
<tr>
<td>Crushed Limestone (AASHTO M43 #10 or AASHTO M43 #9)</td>
<td>3”</td>
<td>3”</td>
<td>3”</td>
<td>3”</td>
<td>3”</td>
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</table>

1/ Materials are to be supplied from sources listed on the most current ODOT Aggregate Producer/Supplier list (see References section) and meet AASHTO M43 gradations. Steel slag and Recycled-Concrete Aggregate (RCA) (also known as Reclaimed Concrete Material (RCM)) from listed sources may be substituted for crushed gravel or limestone, meeting equivalent gradations of the materials listed in Table 1.

2/ The voids between the stone (AASHTO M 43, Nos.1, 2, 57 or 67) are to be choked with fines, ODOT 304 or 411, and/or screenings (AASHTO M 43 No.9 or AASHTO M 43 No.10) to create a smooth surface.

3/ Compaction is required for materials containing fines (e.g., 304 and 411). 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. Exception- 3-inches of screenings are not necessary when the pad is for vehicular traffic use only (the right hand side columns A, B or C are viable options). An additional 3” of ODOT 304 or 411 may be used in lieu of screenings.
Mulches. Use a minimum layer thickness of 6 inches for materials such as limestone screenings, cinders, tanbark, bark mulch, brick chips, or shredded rubber. Mulches are not recommended for livestock or vehicular applications.

Vegetation. Select vegetation that can withstand the intended use. Establish the vegetation in accordance with the criteria in NRCS CPS Critical Area Planting (Code 342) or the appropriate State reference.

Other. Other materials can be used if they will serve the intended purpose and design life.

Structures. When a roof is needed to address the resource concern, use NRCS CPS Roofs and Covers (Code 367). For non-waste applications, design structures according to the accepted engineering practice.

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 surface water from entering the heavy use area.

Stabilize all areas disturbed by construction as soon as possible after construction. Refer to the criteria in NRCS CPS Critical Area Planting (Code 342) for establishment of vegetation. If vegetation is not appropriate for the site, use the criteria in NRCS CPS Mulching (Code 484) to stabilize the disturbed area.

Additional Criteria for Livestock Heavy Use Areas

Include other practices to collect, store, utilize, or treat manure and contaminated runoff where contaminated runoff will cause a resource concern. When one of the purposes of the HUAP is to improve animal distribution or to allow better pasture utilization, planning for the HUAP must be documented in a Grazing Management Plan (Conservation Activity Plan (CAP) 110 or equivalent), or Prescribed Grazing (Code 528). Consider the use of NRCS Conservation Practice Standard guidelines in Short Term Storage of Animal Waste and Byproducts (318) for management of manure accumulation on heavy use areas.

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, 24-hour duration rainfall event, or larger if required by laws, rules, or regulations.

When a pad is located within 100 ft. of a watercourse that is likely to receive flow during the period the pad is in use, incorporate runoff and manure management measures into the design to prevent stream degradation from erosion and/or polluted runoff.

Do not locate facilities within an established Federal Emergency Management Agency (FEMA) regulatory floodway.

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.
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:

<table>
<thead>
<tr>
<th>Species</th>
<th>Pad area (ft²/head)</th>
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<tbody>
<tr>
<td>400-800 lb beef calves</td>
<td>40-50</td>
</tr>
<tr>
<td>800-1200 lb beef cattle</td>
<td>50-60</td>
</tr>
<tr>
<td>Beef cows</td>
<td>60-75</td>
</tr>
<tr>
<td>Mature dairy cows</td>
<td>50</td>
</tr>
</tbody>
</table>

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.

Additional Criteria for Recreation Areas

The Americans with Disabilities Act of 1990 (ADA) requires recreation areas that are used by the public to be accessible to people with disabilities. Address accessibility requirements for new construction and when existing facilities are being altered.

CONSIDERATIONS

Heavy use areas can have a significant impact on adjoining land uses. These impacts can be environmental, visual and cultural. Select a treatment that is compatible with adjoining areas. Consider such things as proximity to neighbors and the land use where the stabilization will take place.

Vegetated heavy use areas may need additional materials such as geogrids or other reinforcing techniques or planned periods of rest and recovery to ensure that vegetative stabilization will succeed. Choose durable plant species that can withstand the expected use.

Consider the safety of the users 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.

Paving or otherwise reducing the permeability of the heavily used area 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. Consider the effects to ground and surface water.

Installation of heavy use area protection on muddy sites can improve animal health. Mud transmits bacterial and fungal diseases and provides a breeding ground for flies. Hoof suction makes it difficult for cattle to move around in muddy areas. In addition, mud negates the insulation value of hair coat and the animals must use more energy to keep warm. As temperatures fall, animal bunching may occur, which can reduce or eliminate vegetative cover and lead to erosion and water quality concerns.

To reduce the negative water quality impact of heavy use areas, consider locating them as far as possible from waterbodies or watercourses. In some cases, this may require relocating the heavily used area rather than just armoring an area that is already in use.
To the extent possible, maintain a 2-foot separation distance between the bottom of the surface material and the seasonal high water table or bedrock.

To reduce the potential for air quality problems from particulate matter associated with a heavy use area, consider the use of NRCS CPS Windbreak/Shelterbelt Establishment (Code 380), Herbaceous Wind Barriers (Code 603), Dust Control from Animal Activity on Open Lot Surfaces (Code 375), or Dust Control on Unpaved Roads and Surfaces (Code 373) to control dust from heavy use areas.

Consider ways 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. Requirements for all drawings prepared by NRCS/SWCD as well as by others (Professional Engineer or Registered Architect) are contained in the National Engineering Manual (NEM) Part 541- Drafting and Drawings. As a minimum the plans and specifications shall include:

- A plan view with elevations showing the location and extent of the practice and detailing dimensions and proposed surface drainage requirements. Include the location and distances to adjacent features and known utilities.
- Typical section(s) showing the type and required thickness of paving or stabilization materials, including base material requirements (specifications for concrete, stone, filter fabric materials).
- A grading plan, as needed.
- Where appropriate, plans for required structural details.
- Method and materials used to stabilize areas disturbed by construction, including seeding and fertilization requirements.
- Construction specifications with site-specific installation requirements.
- Quantities
- Reference to O&M and Ohio NRCS Concrete Specification.

**OPERATION AND MAINTENANCE**

Prepare an operation and maintenance (O&M) plan and review with the operator prior to practice installation. The minimum requirements to be addressed in the O&M plan are:

- Periodic inspections – annually and 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, as needed.
- For vegetated heavy use areas, restrict use as needed to protect the stand and to allow vegetative recovery.
REFERENCES

American Concrete Institute, 2010, Design of Slabs-on-Ground, ACI Standard 360R-10, Farmington Hills, MI.


NRCS Engineering Field Handbook, Ohio Supplement, Chapter 17, Exhibit OH17-1 "Design and Construction Specification- Concrete”
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/oh/technical/engineering/?cid=nrcs144p2_029577

ODOT Construction Management Reporting System (CMRS), Contractors Reports, Certified Aggregate
http://www.odotonline.org/cmsportal/


Portland Cement Association (PCA), Soil- Cement

Portland Cement Association (PCA), Recycled Concrete Aggregate (RCA)