

**Natural Resources Conservation Service
Interim Conservation Practice Standard**

**STREAM CROSSING
(No.)
CODE 578**

DEFINITION

A stabilized area or structure constructed across a stream to provide a travelway for people, livestock, equipment, or vehicles.

PURPOSE

- Provide access to another land unit
- Improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream
- Reduce streambank and streambed erosion

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where an intermittent or perennial water course exists, and a ford, bridge, or culvert type crossing is needed. It also applies where livestock is currently crossing the water course.

CRITERIA

Location. Stream crossings shall be located in areas where the streambed is stable. Avoid sites where channel grade or alignment changes abruptly, where there is instability, where overfalls exist, or where large tributaries enter the stream. Wetland areas shall be avoided if at all possible. If impact to wetlands cannot be avoided, the prospective permittee must notify the Corps of Engineers district engineer with a Pre-Construction Notification (PCN) and shall not begin the activity unless 30 days have passed from the district engineer's receipt of the notification. Stream crossings for normal farming and silviculture activities are exempt from the U.S. Army Corps of Engineers 404 permit requirements as long as construction and maintenance is in accordance with Best Management Practices.

Crossings shall be installed perpendicular to the direction of the flow of the stream.

Width. Multi-use crossings shall be no less than 10 feet and no more than 20 feet wide in the upstream-downstream direction. "Cattle only" crossings may be as narrow as 6 feet wide. Width is defined as the crossing surface and does not include the side slopes.

Side slopes. All cuts and fills for the stream crossing shall have side slopes that are stable for the soil or soil material involved. Side slopes of earth fills shall be no steeper than 2.5 horizontal (H) to 1 vertical (V). Rock fills shall be no steeper than 1.5 (H) to 1 (V). Cut slopes shall be no steeper than 2.5 (H) to 1 (V) unless in rock or hard shale, in which case they shall be no steeper than 1/2 (H) to 1 (V).

Entrance and exit approaches. Entrance and exit approaches to the stream crossing shall blend in with existing site conditions where possible, but shall not be steeper than 5 (H) to 1 (V). The entrance and exit approaches shall be underlain with geotextile filter fabric and covered with 8 inches of stone or gravel. The width of the approaches shall be equal to the width of the structure.

A diversion shall be installed across the entrance and exit of the approach to prevent erosion. Roadside ditches shall be directed into the diversion or away from the crossing surface.

Fencing. Stream channel areas above and below the stream crossing shall be permanently fenced to prevent livestock access to the stream except at the crossing.

A "break-away" fence may be installed across streams where damage from runoff is likely to occur. The fencing wire shall be placed on the downstream side of the posts on each fence line. Strands of wire shall not be continuous across the crossing, but shall be cut and

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secured lightly to the posts so that a build-up of trash will pull the wire away from the post, allowing the trash to move downstream.

In lieu of “break-away” fences across the stream, other appropriate means of preventing livestock access to the stream, such as swinging gates, electrified chains, or positive control measures may be used.

Fencing shall be built to meet NRCS Technical Guide Standard 382 - Fencing except in areas with “break-away” sections.

Safety. The specifications contained in this practice pertain primarily to flow capacity and resistance to washout of the structure. From a safety and utility standpoint, the designed must also be sure that the structure is capable of withstanding the expected loads from farm equipment that will be crossing the stream. A gauging rod may be needed at ford crossings to determine depth of flow and safety of crossing.

Shade. Ford crossings with free access by cattle shall have limbs pruned near the ford to minimize shade and thereby reduce cattle loafing time in the stream.

Culvert crossings. The structure shall be large enough to convey the bank full flow without appreciably altering the stream flow characteristics. The cross-sectional area of the pipe structure shall equal or exceed 60 percent of the average cross-sectional area of the upstream bank full flow. Culvert crossings shall be limited to two 36-inch diameter culverts. The culvert shall be adequately protected so that out-of-bank flows safely bypass without culvert or stream bank damage.

The length of the culvert shall be adequate to extend the full width of the crossing, including side slopes. The culvert pipe shall be placed on-grade with the existing stream bottom.

Acceptable culvert materials include concrete, corrugated metal, corrugated plastic, and new or used high quality steel. Other materials may be deemed appropriate by the engineer.

Compacted fill will be used to form the crossing. The minimum depth of compacted fill over the culvert shall be equal to 24 inches. The compacted fill shall be built up over the culvert so that any stream overflow will cross the road at a point no less than 25 feet either side of the culvert.

Fords using geotextile and stone. Geotextile filter fabric material shall be installed on the excavated surface of the ford according to the specifications contained in this standard. The fabric shall extend across the bottom of the stream and at least 20 feet up each approach section. Fabric may be omitted in streambeds with stable rock, gravel, or cobbles. All edges of the fabric shall be keyed as described under construction specifications.

The stream crossing must be designed to remain stable during the bank full event. As a minimum, a D_{50} stone size of 7.6” shall be used to construct the stream crossing. This stone size equates to NRCS standard rock riprap gradation having a maximum stone weight of 90 pounds. The minimum thickness of layer shall be two times D_{50} or 15” whichever is greater.

Rock crossings for livestock shall be surfaced using ground limestone, rock screenings, crusher run, or similar materials to provide a smooth walking surface. See Table 1, Coarse Aggregate (Crushed Stone) of Conservation Practice Standard “Heavy Use Protection Area – Code 561” for acceptable gradation of surface material. This material does not have to meet any velocity criteria. This layer is expected to be replaced periodically by the landowner as livestock traffic or runoff events erode the surface material.

The final surface of the stone in the bottom of the watercourse shall be no higher than the original stream bottom on both the upstream and downstream edges of the ford in order to eliminate any overfall and possible scour problems.

Fords using concrete. Concrete fords shall not be used unless the foundation of the stream crossing is determined to have adequate bearing strength. The concrete design must be in consultation with the State Design Head.

Concrete fords shall have a minimum compressive strength of 3,000 psi at 28 days. The concrete shall be reinforced with wire mesh and be at least 5 inches thick. Fiber reinforcement shall not be used in lieu of wire mesh. An 18-inch footer shall be placed around the perimeter of the ford and parallel to the stream at each slope change of the ford. Extend the footer along the stream approaches to the bankfull flow elevation. The footer shall be reinforced with standard reinforcing bars. Additional design considerations deemed necessary by the State Design Head to support

farming or logging equipment shall be placed at locations shown on the drawings.

CONSIDERATIONS

Fords made of stabilizing material such as rock riprap are often used in steep areas subject to flash flooding, where normal flow is shallow or intermittent. Fords are especially adapted for crossing wide, shallow watercourses with firm streambeds. Generally, fords should not be used where bank heights exceed 5 feet. Mud and other contaminants are brought into the stream by vehicular and animal traffic where fords are used. Access to fords will be prevented during high flows. Cut slopes of 3 (H) to 1 (V) or flatter are recommended to facilitate vegetation and ease of maintenance.

For heavily used areas, consider using a culvert instead of a ford. However, culverts are not recommended for large drainage areas. Evaluate each specific site carefully to determine if a ford or culvert is most appropriate. When a culvert is utilized, consider using riprap outlet protection since culverts concentrate flow and often create streambed scour.

Roads or trails leading to stream crossings will normally slope into the stream. Water diversions should be installed to move sediment laden runoff from the trail or road and to disperse the runoff onto an undisturbed area for filtering.

Stream crossings should provide a way for normal passage of water and aquatic animals within the channel.

Consideration should be given to erosion and sedimentation which will be caused by the installation of the crossing and any necessary stream diversion. Construction should be done during the driest part of the year.

PLANS AND SPECIFICATIONS

Plans and specifications for stream crossings shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

As a minimum, include the following in the plans and specifications:

- Location of stream crossing.
- Stream crossing width and length with profile and typical cross sections.
- Design grades or slopes of stream approaches.

- Thickness, gradation, quantities, and type of rock or stone.
- Type, dimensions, and anchoring requirements of geotextile.
- Thickness, compressive strength, reinforcement and other special for concrete, if used.
- Vegetative requirements that include seed and plant material to be used, seeding rates, and season of planting.
- Location, type, and extent of fencing required.
- Method of surface water diversion and dewatering during construction.
- Location of utilities and notification requirements.

All disturbed areas not covered or protected shall be vegetated as soon as possible. Vegetation shall be established and maintained in accordance with the specifications for Critical Area Planting, NRCS Technical Guide Standard 342.

OPERATION AND MAINTENANCE

The stream crossing and associated fence should be inspected on an annual basis, especially after major storm events. Any disturbed materials should be repaired or replaced as soon as possible to prevent further damage from occurring. Surfacing stone used for livestock crossings should be replaced as needed. Break-away type fences will need to be repaired after major runoff events.

During high flows, sediment and deposition will occur on approaches to fords. This berm of soil and debris will need to be occasionally removed.

REFERENCES

AASHTO, 2010. American Assoc. of State Hwy Transportation Officials Load and Resistance Factor Design (LRFD) Bridge Design Specs, Customary Units, 5th Ed., with 2010 edits

Bunte, Kristin; Abt, Steven R. 2000. Sampling surface and subsurface particle-size distributions (abbr.) GTR-74. Fort Collins, CO. USDA.
(http://www.fs.fed.us/rm/pubs/rmrs_gtr74.html)

Conservation Practice Standards:

342 – Critical Area Planting

561 – Heavy Use Area Protection

382 - Fence

**Natural Resources Conservation Service
Construction Specification**

STREAM CROSSING

1. SCOPE

This item shall include all plans, specification and construction operations required for the installation of stream crossings. Construction operations shall be carried out in such a manner that erosion, air, water, and noise pollution will be minimized within legal limits as established by state regulations.

2. CLEARING AND GRUBBING

Clearing and grubbing shall be kept to the minimum needed in order to install the structure. All trees and brush shall be removed from the area before excavation starts. The foundation shall be cleared of all stumps, roots, brush, sod, and other debris. All waste materials shall be disposed of in a designated area outside the natural floodway. Limbs shall be pruned around ford crossings which have free access by cattle in order to minimize shade in the crossing.

3. FOUNDATION EXCAVATION

All material shall be removed from the foundation of the stream crossing to the depths, widths, and lengths required by the design. Excavation may be limited to one side of the stream at a time in order to facilitate diversion of the stream. It may be advantageous to divert the stream flows around the site using a pipe or ditch. The stream may also be temporarily impounded during construction. Note, however, that stream diversion during construction shall be conducted in a manner that minimizes erosion and sedimentation.

For ford construction, trenches shall be excavated along the upper ends of entrance and exit approaches and on both the upstream and downstream sides of the stream crossing.

4. DIVERSIONS

Diversions and side ditches shall conform to the lines, grades, and sections as specified on the plans.

5. GEOTEXTILE FILTER CLOTH

Geotextile filter cloth shall be a non-woven-needle-punched geotextile material with a minimum tensile strength of 120 lbs. (minimum average roll value).

A geotextile filter cloth shall be installed under the entire crossing as well as in the toe trenches.

Longitudinal ends of the geotextile filter cloth shall be lapped back over the top of the backfill toe trench a minimum of one foot beyond the edge of the trench and anchored to the fabric using anchoring pins placed on five foot centers. When more than one width of cloth is required, the downstream panel shall be installed first. The next upstream panel shall be installed with a minimum of 18 inches overlap over the first section. Anchoring pins shall be installed on 3-foot centers, 6 inches from the downstream edge of the lap. Pins shall penetrate both sections of cloth in the lap.

Every precaution shall be taken not to tear the geotextile filter cloth. Tears shall be repaired immediately by removing all surface material and soil from the tear for a minimum distance of 18 inches in all directions of the tear. Spread a new section of cloth over the cleared area and anchor with anchoring pins around all sides.

Where stream channels are composed of a stable coarse rocky material or solid bedrock, the requirement to extend fabric filter cloth across the channel bottom may be waived upon the approval of the engineer.

6. CULVERT PIPES

Pipes shall be on a firm foundation to the neat lines and grades shown on the plans. Selected backfill shall be placed around the pipes in 4-inch layers and thoroughly compacted. Gravel can be used to bed pipe under wet conditions and the gravel shall be protected with larger stone at the upper and lower ends of the pipe.

Joints of pipe will be sealed in accordance with the manufacturer's specifications. Pipes will not be laid directly on rock; there must be a soil bed or gravel cushion of at least 6 inches between the pipe and rock.

The outlet end of culverts shall terminate on the natural streambed unless protective outlet structures are installed.

Culvert materials shall be as specified by the engineer or as shown on the drawings.

7. STONE AGGREGATE

Acceptable material consisting of coarse sands and/or gravel, if present in the foundation excavation, may be stockpiled for later use in the toe trenches or on the

roadway. Large washed stone or creek gravel may be used to prepare a foundation for the geotextile filter cloth in unstable soils. Coarse stone may also be used as a subgrade filler between the filter cloth and the surfacing material.

No equipment shall operate directly on the geotextile until surfacing material is spread with a minimum of 6 inches of cover over the geotextile.

8. INSPECTION

All materials shall be inspected by the technician before installation. Written certification of conformance to specifications will be required if physical inspection is not conclusive.

9. CONSTRUCTION DETAILS
