

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

STREAM CROSSING

(Each)

CODE 728

DEFINITION

A trail or travelway constructed across a stream to allow livestock, people or equipment to cross with minimal disturbance to the stream ecosystem.

PURPOSE

To improve water quality by removing access to the stream except where livestock, people or equipment must cross the stream by providing a single, stable crossing.

CONDITIONS WHERE PRACTICE APPLIES

Where livestock, people or equipment must cross an intermittent or perennial watercourse.

CRITERIA

General Criteria Applying to All Stream Crossings

Location. Stream crossings shall be located in areas where the streambed is stable. Where practical, crossing shall be located just upstream of any natural barrier such as a rock seam, large boulder, road culvert or other similar stable obstruction. Avoid sites where channel grade or alignment changes abruptly, overfalls exist, or large tributaries enter the stream. Wetland areas shall be completely avoided.

Crossings shall be installed perpendicular to the direction of the flow of the stream. Skewed crossings shall not be installed.

Stream crossings shall not be installed in a newly located or constructed channel until it has stabilized.

The location of the stream crossing shall be considered in conjunction with access to buildings, ease of access to approaches, number of cattle and/or machinery to use the crossing.

Permits. 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. If impact to wetlands cannot be avoided, consult the local Corps of Engineers and/or State Agency representatives for permit requirements. The State Stream Alteration Engineer shall review all proposed stream-crossing designs and shall be notified at least one week prior to the construction and installation of all stream crossings.

Surveys. Surveys to determine the stability of the stream shall be recorded. As a minimum, cross sections shall be taken at the centerline of the crossing showing deepest point along with enough shots to define the shape of channel and the entire length of the entrance/exit ramps.

Cross sections along the upper and lower edge of the crossing shall define the channel and show the lowest point along the sections.

A profile showing channel slope shall extend 100 feet upstream and downstream of the crossing. Shots shall be taken at intervals close enough to define channel slope.

Widths. Crossings shall be no less than 10 feet and no more than 20 feet wide in the upstream-downstream direction between the fence posts.

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| <p>Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.</p> |
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Side Slopes. All cuts and fills for the stream crossing shall have side slopes that are stable for the soil 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 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.

The finished surface of the aggregate placed in the channel portion of the crossing shall be the same grade as the natural streambed grade at the crossing.

Stream crossings shall not be used to convey surface runoff. Surface runoff shall be diverted away from the entrance and exit approaches of the crossing to a point where it cannot flow back toward the entrance or exit approaches.

Livestock Water Access. Ford stream-crossing criteria may be used to install watering access points along the stream provided an alternate watering source is not readily available.

Fencing. Fencing may not be necessary at all sites. For livestock exclusion, permanent fencing of the stream bank areas above and below the crossing will be necessary.

At ford crossings, wire shall be placed on the downstream side of the posts on each fence line. Wire should not be continuous across the channel portion of the crossing, but secured lightly to the posts so that a buildup 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 the Field Office Technical Guide (FOTG) standard Fencing, Code 362.

Shading. Limbs should be pruned at ford crossings and livestock watering access points to minimize shade and thereby reduce cattle loafing time in the stream.

Vegetation. Disturbed areas not covered or protected shall be established to vegetation as soon as practicable after construction. Seedbed preparation, fertilizing, liming, seeding, and mulching shall be in accordance with FOTG standard Critical Area Seeding, Code 342.

Types. Stream crossings may be a ford or culvert type crossing. A bridge might be more appropriate at some sites. Bridges shall be designed in accordance with sound engineering principles.

Additional Criteria Applying to Ford Type Crossings

Figure 576-2 shows a typical layout for a ford crossing (fence not included).

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 or to temporarily impound the stream during construction. Trenches shall be excavated in the upstream and downstream sides of the ford stream crossing. The minimum depth of the trenches shall be 1.5 feet from the excavated crossing bottom. The minimum width of the trench shall be 1 foot. Geotextile shall be toed into these trenches and the trenches backfilled with the same size and kind of aggregate used on the surface of the crossing. The trenches may be omitted at the grade where rock is encountered.

Geotextile shall be installed across the entire crossing as well as in the toe trenches when foundation excavation is complete.

Where stream channels are composed of stable coarse rocky material or solid bedrock, the requirement to extend the geotextile and surface aggregate across the channel bottom may be waived upon approval by an engineer.

Base and Surfacing Material. Acceptable material consisting of coarse sands and/or gravel, if present in the foundation excavation, may be stockpiled for later use as a base material in the toe trenches and between the geotextile and surfacing material of the roadway portion of the crossing.

Base material used as a subgrade filler between the geotextile and surfacing material shall consist of a minimum 6 inch layer of AASHTO designated No. 4 or similar coarse aggregate. A minimum 2 inch compacted layer of surfacing material as designated in the Construction Specification of this standard shall be placed on top of the base material.

In lieu of coarse aggregate as base material, 8 inches of compacted surfacing material may be used in the crossing.

Other types of ford crossings consisting of mats shall be installed on an individual basis as approved by the engineer. Follow manufacturer's recommendations for installing these materials.

Additional Criteria Applying to Culvert Crossings

The structure shall be large enough to convey the bank full flow without appreciably altering the stream flow characteristics. The culvert shall be adequately protected so that out-of-bank flows safely by pass the structure without culvert or stream bank damage. Culvert capacity shall be as shown in Table 1.

Table 1

| Road Type | Storm Frequency |
|--|------------------------|
| Forest Access Roads, Farm Field Access Roads | 2 year - 24 Hour |
| Farm Driveways, Recreation Facility Access Roads | 10 year - 24 Hour |
| Public Access Roads, Camp grounds, Etc. | 25 year - 24 Hour |

The length of the culvert shall be adequate to extend the full width of the crossing, including side slopes. The culvert 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 or other materials as approved by the design engineer.

Compacted fill will be used to form the crossing over the culverts. The minimum depth of compacted fill over the culvert shall be equal to one-half the diameter of the culvert, or 24 inches, whichever is greater. The high point of the compacted fill shall be a minimum of 2 feet above the high existing ground on either side of the crossing.

Base and surfacing material shall be as designated in Ford Crossings section.

If protection of the sides of the fill from erosion is needed, riprap shall be used as shown in figure 576-1. The total thickness of the riprap shall be at least 18 inches.

Free access both up and down a stream network is necessary to protect valuable fisheries resources. One fish barrier in a stream can seriously affect the entire fish population in that stream. An improperly installed culvert may create such a barrier. The following is a list of general criteria that should be followed when designing a culvert where fish passage is essential.

1. Resting pools shall be provided above and below the culvert.
2. Each jump must be negotiable by the smallest fish species, usually not greater than one foot for an adult trout.
3. Water velocity must be less than the sustained swimming speed of the smallest fish passing through the culvert. The recommended maximum velocity is four feet per second for trout.
4. Culverts longer than 100 feet shall be provided enroute rest areas or the velocities should be reduced below the established minimums.

CONSIDERATIONS

Temporary and long-term effects on erosion and sedimentation.

Effects on the visual quality of the water resource.

Stream diversion during construction shall be conducted in a manner that minimizes erosion and sedimentation.

Equipment loads on the culvert and bridge crossings.

Use of washed stone in channel portion of crossing in trout streams

Construction Equipment. Experience has shown that certain types of construction equipment are more suitable for installation of stream crossings. Where crossings are on small drains with stable subsoils, equipment choice may not be critical. Where non-plastic silts and clays or unstable fines are anticipated in the subgrade material, the following observations should be noted:

- Track mounted hydraulic excavators (track hoe) with reaches of 25 feet or more provide the best and fastest installation.
- Attached front-end loader with a 4 in 1 clamshell type bucket and a large rubber tired backhoe provide the best installation if a hydraulic excavator is not available.
- Smaller, lighter dump trucks to deliver surfacing material will cause less damage to approaches than large trucks.
- Tracked equipment is superior to rubber tired equipment.
- Crawler tractors with angle dozer or bulldozer blades and fixed bucket front end loaders should be avoided.

Landowners and contractors should be advised of the use of proper equipment. Improper equipment will result in an inability to properly construct the crossing possibly resulting in excessive cost of construction.

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.

OPERATION AND MAINTENANCE

The stream crossing will be inspected on a frequent basis and surfacing material will be replaced as needed. The stream crossing and associated fence should be inspected after each major storm and all repairs made as needed.

Construction Notes. As a minimum, the following data will be recorded:

1. Slope of approaches
2. Profile on stream channel to show crossing and stream are on a uniform grade
3. Type and quantity of geotextile used
4. Gradation, quantity, and type of gravel
5. Adequacy of vegetation
6. Other pertinent data
7. Statement to the effect that practice meets plans and specifications
8. Signature and date of person making certification

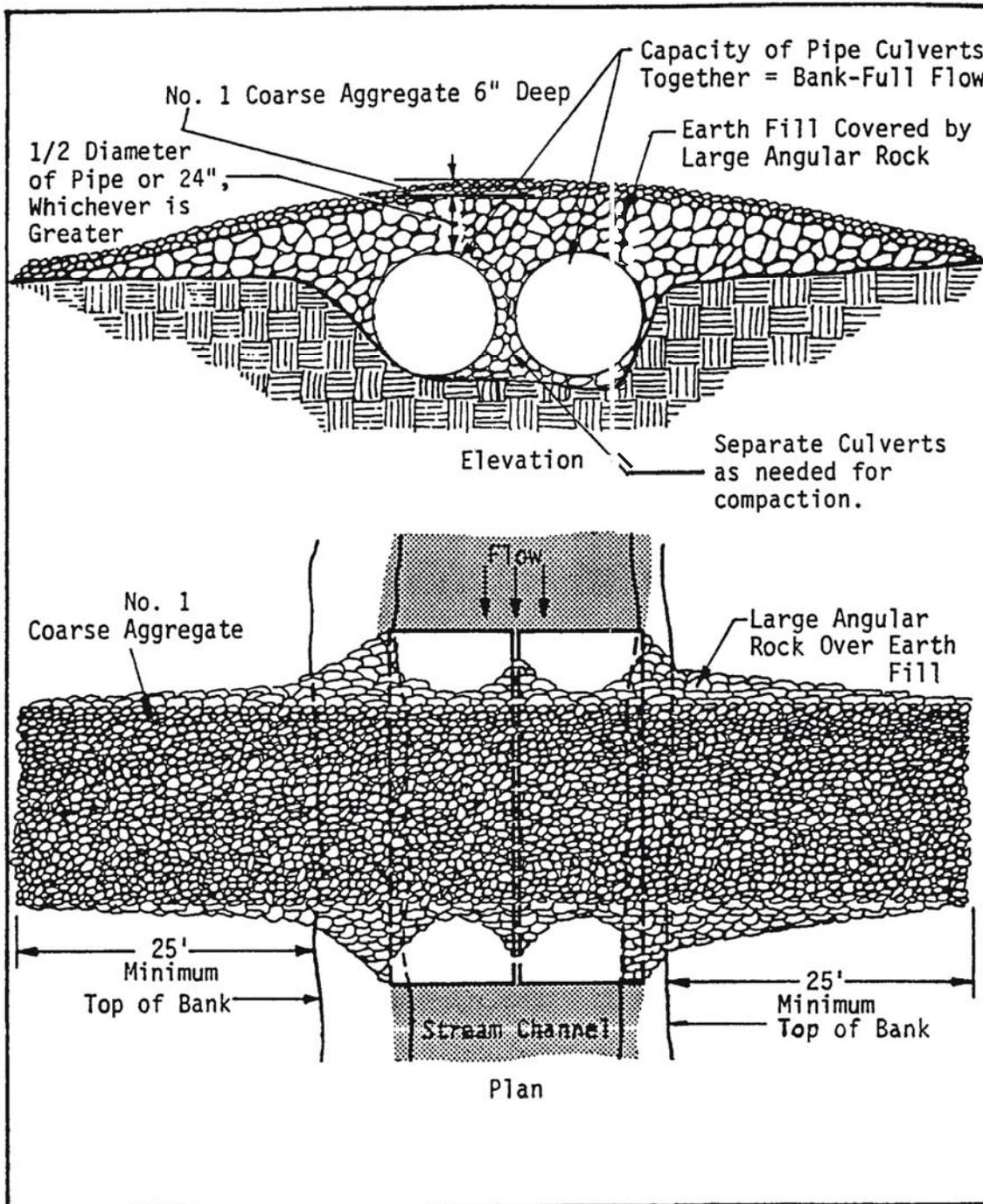


Figure 576-1. Culvert Stream Crossing

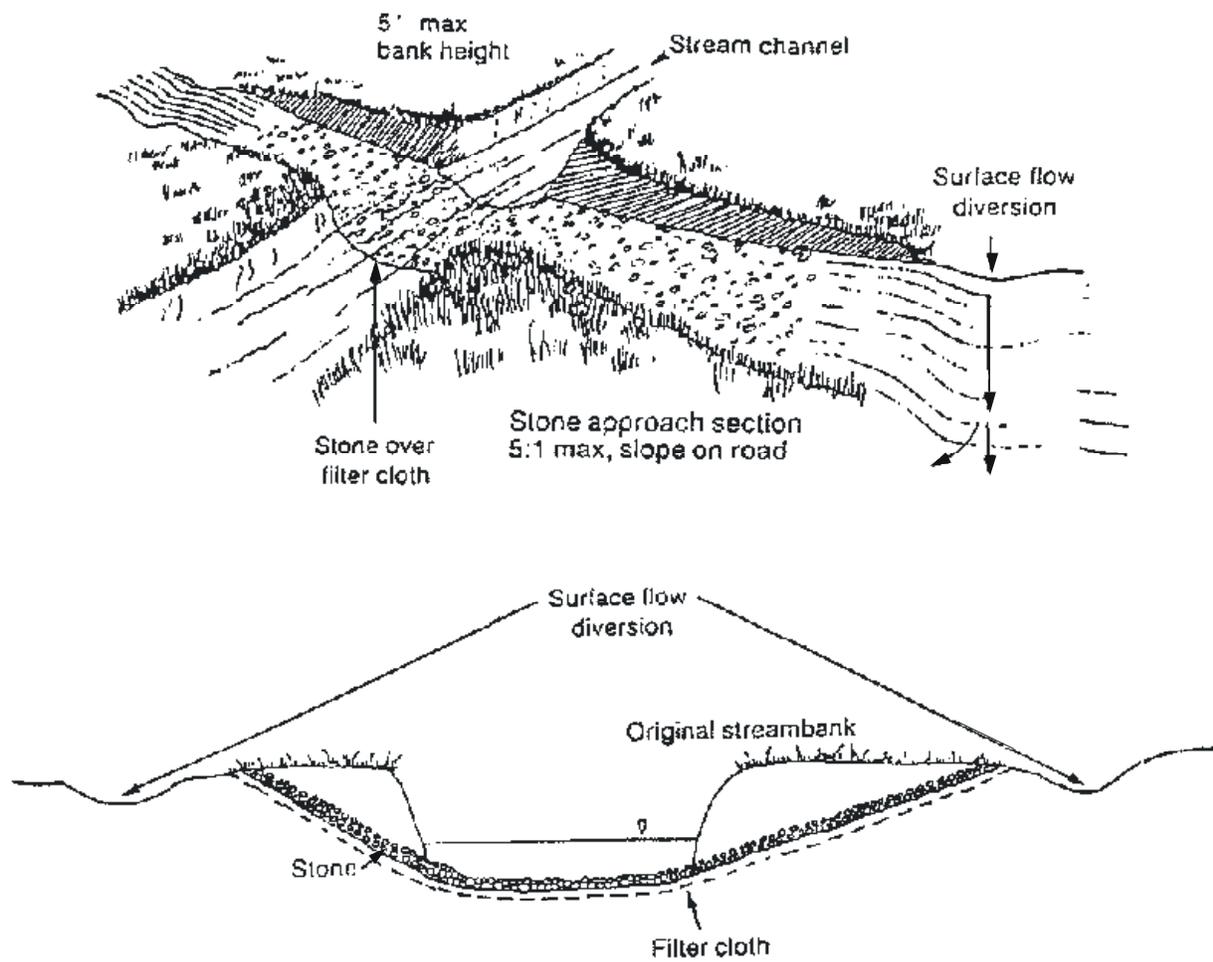


Figure 576-2. Ford Stream Crossing.

STREAM CROSSING CONSTRUCTION SPECIFICATIONS

Site Preparation. The foundation area shall be cleared of trees, stumps, roots, sod, loose rock, or other objectionable material. The cross section shall be excavated to the neat lines and grades as shown on the plans. Over-excavated areas shall be backfilled with moist soil compacted to the density of the surrounding material.

Construction operations shall be done in such a manner that erosion and water pollution are minimized and held within reasonable and legal limits. State and Federal laws shall be followed when working in streams.

Clearing. 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 sightly and workmanlike manner in a designated area out of the natural floodway.

Materials

Geotextile. The geotextile shall be a non-woven non-heat bonded needle-punched fabric having a minimum tensile strength of 150 pounds (minimum average roll value) and weighing a minimum of 6 ounces per square yard.

In the upstream and downstream toe trenches of ford crossings, the geotextile shall be lapped back over its own trench a minimum of 1 foot beyond the edge of the trench and anchored to the fabric using anchoring pins placed on 5 foot centers. When more than one width of geotextile is required, the downstream panel shall be installed first. The next upstream panel shall be installed with a minimum of 24 inches overlap over the first section. Anchoring pins shall be installed on 3 foot centers 6 inches from the downstream edge of the lap.

Tears in the geotextile should be repaired immediately by removing all surface material and soil around the tear a minimum distance of 24 inches. Spread a new section of geotextile material over the area and anchor with anchoring pins around all sides.

Anchoring Pins. Anchoring pins shall be fabricated using a minimum of 8 gauge galvanized wire. Pins shall be 8 inches long by 1 inch across by 8 inches long and be fully driven into the ground. All anchor pins shall be installed with the top width lying perpendicular (at right angles) to the direction of flow in the stream. Pins may also be fabricated from No. 3 rebar as shown on the drawing.

Anchoring pins shall be placed through the geotextile in all excavated trenches and overlaps on approximately 3 foot centers.

Care should be taken not to rip the geotextile while installing anchor pins. Pins should be sharpened to permit easy penetration through the geotextile. If a pin must be removed for any reason, plug the created opening with a wadded ball of geotextile.

Minimum No. of Anchoring Pins Required

| Number of Fabric Strips Across Channel | Factor Times Total Length of Crossing |
|---|--|
| 1 | 0.85 |
| 2 | 1.3 |

Example: Stream crossing 80 feet in total length using two adjacent strips of fabric for a crossing width of 20 feet. Minimum number of pins is 1.3 times 80 feet for a total of 104 pins. Specify 110 anchor pins.

Surfacing Material. Aggregates for the surfacing material may be crushed stone, crushed slag, or crushed or uncrushed gravel, crushed or uncrushed chert, together with such material as manufactured sand or other fine material naturally contained or added thereto as needed to conform to the requirements. The size and gradation of rock and aggregate shall be as shown on the drawings.

Base Material. AASHTO designated No. 4 or similar coarse aggregate shall be used. A minimum 6 inch compacted layer shall be placed on the geotextile before placement of surfacing material.

Culverts. Pipes shall be laid on a firm foundation to the neat lines and grades shown on the plans. Selected backfill shall be placed around the pipes in 6 inch layers and thoroughly compacted. Gravel can be used to bed pipe under wet conditions. The gravel shall be protected with larger stone at the upper and lower ends of the pipe.

Joints of pipe shall be sealed in accordance with manufactures' specifications. Pipes shall not be

laid directly on rock. There must 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.