Forestry Note:

INTRODUCTION TO ROAD STREAM CROSSINGS



This Forestry Note presents guidelines and tips on the factors to consider in planning forest and farm road stream crossings and sources for information on design and construction.

Landowners often need to cross streams on their property. Crossing streams may adversely impact water quality. Crossings may add sediment, destabilize stream banks or cause channel erosion. Using these stream crossing guidelines will minimize these impacts. They are useful on large and small streams, including ephemeral streams (channels that may carry water only during rainstorms). Temporary crossings can be used for short-term access for logging or other management work.

Common stream crossings for both permanent and temporary use include rocked or concrete fords, culverts and bridges. Fords are natural or constructed “hard bottoms” and vehicles may run through the water. Culverts are commonly used to cross small streams. They are usually corrugated steel, aluminum or plastic pipe or heavy-walled steel pipe. Proper size and placement are critical. Bridges vary in expense and design. Temporary crossings consist of all the above as well as portable bridges, log structures, timber mats or even steel flat cars.

Crossing Tips

- Plan roads to minimize the need to cross streams.
- Cross streams at right angles with straight approaches and gentle grades.
- Minimize bank and channel disturbance during construction.
- Avoid construction during periods of high water flow.
- Stabilize disturbed areas as needed.

Choosing the Type of Crossing Structure

- How large and how steep is the stream?
- How large an area is drained?
- Is the channel deep and narrow or broad and shallow?
- Is the area rocky or does it have fine soils?
- How much and what kind of traffic will use the crossing?
- How much money is available?
- What kind of contractors and equipment are available in the area?

Example of well-designed rocked ford crossing

Choosing the type of structure often depends on site conditions at the crossing.

- More rock means less erosion and thus less protection is needed.
- Low wet crossings need local drainage.
- Where culverts and bridges would need a lot of fill, a ford may be preferable.

Where to Cross

- Least disturbance to stream banks.
- At right angles to a straight section of stream with minimal road grade.
- Banks and stream bed are firm. Banks protected by rocks or tree roots.
- Stream is the same gradient above and below the crossing.
- Avoid bends.

Crossings are designed to handle "high water" conditions. "High water" is determined mainly by stream size and gradient (slope or steepness), steepness of the watershed, soil type and, of course, rainfall. Some streams have flood plains and commonly leave their banks. This makes construction of crossings more difficult and expensive.

Tips on Culverts

- On steep terrain, use culverts only on ephemeral streams.
- Culverts can become clogged with debris and the fill eroded away by high flows.
- Fords are preferred to culverts in steep terrain as they do not clog up.
- Culverts, including multiple culverts, may work on larger streams that have low gradient, but they need plenty of fill on top.
- Concrete fords and bridges work on all stream sizes, but are expensive.
- Fords need low banks or gradual approaches.
- A stream in a wide, "shallow" flood plain may be better off with a concrete ford and culverts rather than a long bridge.

Large culvert in a road that crosses a small stream

Amount and kind of use

- Load weights relate to size and strength needed in the crossing structure.
- Higher speeds may be needed to navigate steep grades.
- Rocked fords are slow. Concrete fords, culverts and bridges are faster.
- Fords may be too deep to cross during major storms.

Vented concrete ford – a high dollar option.

Cost and Maintenance Requirements

Costs vary widely and depend largely on stream size and crossing type. The following table presents estimated structure costs and expected life of alternative types of stream crossings. These estimates should be used only as a general guide. Costs and expected life will vary by stream size, channel conditions and road use.

Table 1. Structure Costs and Expected Life

Type Structure	Constructed Cost	Maintenance Cost	Expected Life
Natural ford	1	1	1
Rocked ford	1	1	1
Concrete ford	3	3	3
Concrete "Box-bridge"	4	1	1
Vented concrete ford (galvanized steel pipe)	3	3	2
Vented concrete ford (plastic pipe)	3	3	2
Vented concrete ford (aluminum pipe)	3	2	2
Vented concrete ford (box opening)	4	2	1
Culvert, galvanized steel	2	4	4
Culvert, aluminum	2	4	3
Culvert, plastic	2	4	3
Culvert, used gas line	2	3	3
Timber bridge	4	2	3

Cost: 1=lower; 4=higher Life: 1=40 to 50 yrs; 4=15 to 20 yrs.

Equipment, Materials and Contractors

The landowner is responsible for seeing that stream crossings are properly constructed. Careful planning and design, and supervision, are critical to your success. Get expert help. Contractors or operators are not usually skilled in planning and design.

Planning and design. Consult experts with the USDA Natural Resources Conservation Service (NRCS), ODAFF Forestry Services or private consultants. Civil engineers have the expertise to lay out complicated projects.

Timing. Time the project to occur during the milder, drier times of year.

Materials. Develop a bill of materials. Specify details, culvert sizes, gravel type, rip-rap size, seed type, etc. Order well before they are needed to prevent delays. Inspect before purchase and upon arrival and reject substandard materials.

High flows can make good fords impassible!

Contractors. Contractors vary in many respects. At a minimum, make sure they:

- Have the right equipment for the job.
- Are experienced in local road building.
- Have high standards and do good work.
- Look at some of their previous work.
- Get references and talk to them.
- Use a written contract. Be sure they are clear on what to do and not to do. Consider their suggestions and resolve questions.
- Have someone supervise or personally inspect progress.
- Consider never paying more than 50% of the agreed price until you are satisfied with the job.

Legal Requirements

Forest and farm roads are exempt from Corps of Engineers permits ONLY as long as they meet baseline BMPs. These 15 BMPs (40 CFR Part 233.33) are detailed in a number of places and must be followed. In general, as they relate to stream crossings:

- Minimize dredge and fill into water or wetlands
- Design crossing to prevent restriction of flood flows
- Fill shall be properly stabilized and maintained to prevent erosion
- Vegetative disturbance shall be kept to a minimum
- The crossing shall not disrupt the movement of aquatic life in the water
- Borrow material (fill) shall be taken from upland sources whenever feasible
- Threatened or endangered species shall not be impacted
- Discharges into breeding or spawning areas or wetlands shall be avoided
- Crossings should not be located near a public water supply intake
- The discharge shall not occur in a component of the National Wild and Scenic Rivers System
- Fill should be free of toxic pollutants
- Temporary fills shall be removed and the area restored to original elevation

This is only a partial list and is condensed to provide very general guidance. Regulations are subject to change and the U.S. Army Corps of Engineers-Tulsa District office can supply specific information. Address each of the 15 requirements in the planning stage of your operation. The intent of these requirements is to protect water quality and habitat at the crossing and down stream from the installation - in other words, to minimize your impact!

Temporary creek crossing “bridge mats”

Other Information Sources

Introduction to Road Stream Crossings is the first in a series of Forestry Notes on stream crossings and forest road Best Management Practices (BMPs) produced by the Oklahoma Department of Agriculture, Food, & Forestry - Forestry Services Division.

.Additional Forestry Notes in this series include:

- How to Install a Forest Road Culvert
- Designing and Constructing Large Rocked Fords on Forest Streams
- Constructing Small Rocked Fords on Forest and Farm Roads in Oklahoma
- A Handy Gauge for Forest and Farm Road Construction Measurements

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Additional information on this and other forest road BMPs is available in the other fact sheets of this series, in videos produced by Forestry Services and in the OSU Extension handbook *Best Management Practices for Forest Road Construction and Harvesting Operations in Oklahoma* and a publication by the USDA Natural Resources Conservation Service, *Woods Roads*. These materials may be available at local offices of Forestry Services, the OSU Cooperative Extension Service and the Conservation Districts.

www.forestry.ok.gov

Your Number One Source for Forestry Information in Oklahoma

Forestry Services Division
Oklahoma Department of Agriculture, Food, & Forestry
2800 North Lincoln Boulevard
Oklahoma City, OK 73105-4298
405-522-6158

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