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Case Studies

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Introduction to the Case Studies

Traffic use, hydrologic regime, available materials, channel type, stability, and aquatic species passage needs are all critical variables affecting the choice of structure type at a site and its success. Each crossing situation involves a unique combination of these variables, so each site is an individual engineering challenge. The following case studies illustrate a variety of structure types in different hydrogeographic areas around the country. Studying examples like these is the best way to learn from other people's experience, and the case studies should help you generate ideas for fitting new structures to individual sites.

Most of the structures described here are compromises, because the fit of the structure to the road, landform, or stream is rarely perfect. The structures are of very different ages, representing the development of low-water crossing design over the past few decades. Some demonstrate popular designs that have worked well in the past from a transportation or road-use perspective but which caused channel erosion and blocked aquatic species. Many have required repairs or improvements to make the structure functional today. Few achieve all the goals we would set for new structures. However, both their flaws and their successes demonstrate important points about locating, designing, and constructing low-water crossings. Use them as a resource to help you learn from, rather than repeat, the experiences of others.

About the case studies:

- The "Crossing Description" section, at the beginning of each case study, highlights the key points about the structure and is intended as a summary for people browsing through the appendix.
- Ecological unit information, under the "Setting" heading in each case study, comes from McNab and Avers' (1994) descriptions of the ECOMAP sections, shown on the map "Ecoregions and Subregions of the United States." In some instances, where forests have completed landtype mapping, the sections include more details.
- We frequently cite Rosgen's (1996) channel types. Because we identified the channels only visually, consider our classifications as estimates.
- Information was available in different levels of detail. We have attempted to be as consistent as possible in describing and evaluating the structures. However, in some cases, information supporting an informed judgment about performance was not available.

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Structures highlighted in BLUE in table A1 are similar to the numbered case study just above them. Their descriptions are included at the end of that case study under the heading Similar Structures in Other Locations.

Table A1—Case study index by structure type.

	Crossing Name	Forest	State	Structure Type
		Unvented Fords		
1	Red Clover	Plumas	California	Rock dip
2	20-mile Cr	Okanagan	Washington	Rock dip
3	Nurse Cr	Umpqua	Oregon	Large-rock fill
		Idaho Panhandle	Idaho	Vented rock fill structure
4	FR 732	Prescott	Arizona	Jersey barriers/riprap
	FR 136	Prescott	Arizona	Jersey barriers/riprap
	7-Springs Rd	Tonto	Arizona	Jersey barriers/gabions
5	Willow Cr	Plumas	California	Concrete planks
6	Fitzpatrick Cr	Coos Bay BLM	Oregon	Concrete blocks
	E. Fk. So. Tongue R; Copper Cr	Bighorn	Wyoming	Concrete blocks
7	Woodrock	Bighorn	Wyoming	Geoweb
	Little Brush Cr	Ashley	Utah	Geoweb
8	Agua Fria R	Tonto	Arizona	Concrete slab
	Ashdale Admin Site	Tonto	Arizona	Concrete slab
9	Messman	Fremont	Oregon	Concrete slab with slot
		Vented Fords		
10	Black Canyon	Clearwater	Idaho	Concrete planks with culvert
11	Babcock	Plumas	California	Concrete with culverts
	Harris Creek	Ouachita	Arkansas	Concrete with culverts
12	Grubbs	Plumas	California	Concrete slab with grated top vent
13	N Fk Consumnes R	Eldorado	California	Concrete box with grated top
14	Rocky Cr	Ouachita	Arkansas	Concrete box with curbs
	FR 512	Ouachita	Arkansas	Embedded concrete boxes
15	Moonlight	Plumas	California	Concrete box with fish ladder
16	Sibley Cr	Mt Baker Snoqualmie	Washington	Concrete box-removable top
	Catherine Cr	Industrial land	British Columbia	Large-rock fill
17	Stoney R	Superior	Minnesota	Embedded timber boxes
18	French Cr	Plumas	California	Embedded concrete boxes
19	Mill Cr	Mark Twain	Missouri	Embedded concrete boxes
	Kincaid	Shawnee	Illinois	Embedded concrete boxes
		Low-water Bridges		
20	Deep Cr	Osceola	Florida	Double T-sections with concrete deck
21	Capps	Eldorado	California	Concrete piers; cattleguard
	Jones Wreckum	Eldorado	California	Concrete piers; cattleguard

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The case study index (table A1) is arranged by structure type. Table A2 lists the case studies by channel characteristic, so that users confronted by a certain channel type can see which structures have or have not worked in a similar channel. We also list flow regime (perennial, intermittent, ephemeral) and special site considerations that pertain to each case study.

Table A2. Case studies indexed by channel characteristics and streamflow regime.

Channel Characteristic	Flow Regime	Fishery	Structure Type	Name	Case Study Number	Special Design Considerations
Unentrenched	Intermittent	Y	Unvented ford	20-mile	2	Spring trout spawning; seasonally closed road
	Perennial	Y	Unvented ford with slot	Messman	9	Juvenile trout passage in summer; headcut control
	Perennial	Y	Vented ford	Mill	19	Debris-jamming hazard (wood)
	Perennial	Y	Vented ford	French	18	Wide flood plain; high stream power; debris
	Perennial	Y	Low-water bridge	Deep	20	Very low gradient; wide flood plain; soft soils
	Ephemeral	N	Unvented ford	Red Clover	1	Discontinuous, poorly defined channel
Moderately Entrenched	Ephemeral	N	Unvented ford	732 Road	4	Flow diversion down riparian road; channel downcutting
	Perennial	Y	Unvented ford	Woodrock	7	Compressible stream-bank soils; RVs and ATVs
	Perennial	Y	Vented ford	Stoney	17	Damming (ice); scenic values
	Perennial	Y	Vented ford	Rocky	14	Summer passage for weak-swimming fish; debris
	Perennial	Y	Vented ford	Babcock	11	Trout passage; reservoir releases
	Perennial	Y	Vented ford	Grubbs	12	Trout passage; very high stream power; coarse sediment
	Perennial	Y	Vented ford	North Consumnes	13	Juvenile trout passage; debris flow deposition zone
	Perennial	Y	Low-water bridge	Capps	21	Preexisting channel damage—widened channel
	Intermittent	Y	Unvented ford	AguaFria	8	very high stream power during floods; steep approaches

Table A2. *Continued.*

Channel Characteristic	Flow Regime	Fishery	Structure Type	Name	Case Study Number	Special Design Considerations
Entrenched	Perennial	N	Unvented	Nurse	3	Steep, high energy stream
	Perennial	Y	Unvented	Willow	5	Trout passage; channel incision at tributary junction
	Perennial	Y	Vented	Fitzpatrick	6	Aquatic organism passage; large woody debris
	Perennial	N	Vented	Black Cyn	10	Snow avalanches
	Perennial	N	Vented	Sibley Cr	16	Debris torrents
Laterally Unstable	Intermittent	Y	Unvented	20-mile Cr	2	Spring-spawning steelhead, seasonally closed road; alluvial fan
	Perennial	Y	Vented	French	18	Potential for channel shift if blocked during flood
	Perennial	Y	Low-water bridge	Capps	21	Preexisting channel and flood plain damage
Vertically Unstable	Perennial	Y	Unvented	Mesman	9	Grade control, fish passage
	Perennnial	Y	Vented	Moonlight	15	Grade control, fish ladder
	Perennial	Y	Vented	North Consumnes	13	In depositional zone