

*DRAINAGE*  
*AND*  
*INCIDENTAL CONSTRUCTION*

# *Drainage and Incidental Construction*

## **SECTION 601 - MINOR CONCRETE STRUCTURES** (Labor 40 percent)

**Method A or B:** Concrete for minor structures (about 30 CY or less). Unit price may vary from \$400 to \$500 per CY, depending upon quantity, distance from concrete source, forming difficulty, etc.

Where applicable, make a subsidiary allowance to this item for contractor quality control.

**Method C:** Very small quantities of concrete for fence posts, gate post, etc. (no forms required). Cost will be about \$100/ CY or greater, depending on number of sites, access, etc.

## **SECTION 602 CULVERTS AND DRAINS**

Labor for culverts to and including 36 inches in diameter and CMPA's to and including 42 inches by 29 inches: compaction Method A, 30%; compaction Methods B and C, 40-60%. Labor for larger culverts and CMPA's: 40-60%. Method A should not be used for these pipe sizes.

Average unit costs for metal culverts in this guide may be used without adjustment for projects having culverts in excess of 10,000 pounds total. For quantities less than 10,000 pounds, an additional allowance for material only (not installation costs) should be made using the following factors:

To 5,000 lbs, factor = 1.35    5,000 - 10,000 lbs, factor = 1.25

*There are 3 compaction conditions, Methods A, B, and C noted in the standard specification and FSSS 209.11. The unit prices shown in this Section need to be adjusted for the compaction method and quality control as follows:*

Compaction Method:

- Method A.    Multiply unit costs by 0.90.
- Method B.    No adjustment.
- Method C.    Multiply unit costs by 1.10.

Quality Control:

Where applicable, make a subsidiary allowance to this pay item for contractor quality control.

Costs for *excavation* for culverts 36" and smaller in diameter and for CMPA's 42" x 29" and smaller are included in the table below. Unit cost for culverts installed in existing roads and pipes installed "after grade" will normally be higher than for pipes in new construction due to the increased amount of excavation. The following culvert prices which include bands should be used for the condition indicated:

Size	New Construction	"After Grade" & Reconstruction (Shallow Installation)
	ID and MT*	ID and MT*
	\$/ ft	\$/ ft
15"	\$26	\$28
18"	\$28	\$30
24"	\$34	\$36
30"	\$45	\$48
36"	\$55	\$57

\* In Montana check local Material Costs, and include costs for all required permits under Section 151.

Increase the above costs by a factor of 1.1 to 1.3 to reflect longer lengths or steepness of side slopes. Estimate larger pipes by time and equipment methods. Following are some items that should be considered under Sections 602 and 209 when estimating installation of larger pipes:

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Analyze the cost of materials for different culvert corrugations. Often a lighter metal thickness can be used with the wider corrugations which may result in a savings in materials costs.

Allow costs for metal end sections, culvert end treatments, shop ellipsing, special coatings, and adjustment for pipe arches if required. Call culvert suppliers for quotes.

Estimate the amount of time and equipment required (excavation equipment, compaction equipment, labor, operators, etc.) to excavate and construct the culvert bed including excavation below the invert elevation for removal of unsuitable or unstable material and to bed and backfill the pipe (compaction method C). Allow time for diversion of the stream and cost for special materials or equipment needed for diversion such as plastic sheeting, piping, pumps, etc. Check results against bid history.

If springs, seeps, or underground flows are expected in the culvert area, allowance should be made for filter cloth, drain rock, cutoffs, special bedding, or special backfill material.

Costs for excavation of culverts larger than 36 inches or the squash equivalent is not included in the cost for the culvert under Section 602. The cost for this type of excavation is approximately \$30/ CY. Bedding material for culvert backfill ranges from \$10 to \$25/ CY, actual cost will depend on haul distance, excavation conditions, etc.

The following materials and shop prices are provided as a guide for use in estimating culvert prices (based on truck load quantities). Local suppliers' prices and discounts may be substituted, if available.

## **Culvert Material Base Price**

### **Polyethylene Corrugated Pipe**

Polyethylene Corrugated Pipe 20 Foot Sections

Double Wall Rigid	Double Wall Rigid
<i>Size inches</i>	<i>Cost/ft</i>
12	\$5.46
15	\$9.29
18	\$12.00
24	\$16.50
30	\$28.24
36	\$30.51
42 (bell & spigot)	\$61.06
48 (bell & spigot)	\$73.81

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## Corrugated Metal Pipe

Metal - 2.66"x1/2" Corrugations							
<i>Thickness</i>	<i>Size inches</i>	<i>Cost/ft</i>	<i>Wt/ft</i>	<i>Thickness</i>	<i>Size inches</i>	<i>Cost/ft</i>	<i>Wt/ft</i>
0.064	12	10.37	10	0.079	18	20.84	18
(16ga)	15	12.86	12	(14ga)	24	27.58	24
	18	15.32	15		30	35.93	30
	24	20.5	19		36	42.98	36
	30	27.62	24		42	58.05	42
	36	33.06	29		48	63.53	48
	42	41.79	34		54	69.91	54
	48	49.69	38				
0.109	24	41.21	33	0.138	60	134.25	103
(12ga)	30	51.36	41	(10ga)	66	146.68	113
	36	61.41	49		72	160.85	123
	42	71.4	57				
	48	81.5	65				
	54	93.16	73				
	60	103.81	81				
	66	114.13	89				

## Corrugated Metal Pipe (Continued)

Metal - 3"x1" and 5"x1" Corrugations							
<i>Thickness</i>	<i>Size inches</i>	<i>Cost/ft</i>	<i>Wt/ft</i>	<i>Thickness</i>	<i>Size inches</i>	<i>Cost/ft</i>	<i>Wt/ft</i>
1.064	42	44.93	39	0.109	54	101.31	83
(16ga)	48	51.15	44	(12ga)	60	112.58	92
	54	57.39	50		66	123.3	101
	60	63.77	55		72	134.33	110
	66	69.84	60		78	145.32	119
	72	76.08	66		84	156.33	128
	78	82.32	71		90	167.33	137
	84	88.56	77		96	178.32	147
					108	200.33	165
					120	148.23	183
0.079	42	59.66	47	0.138	108	254.93	211
(14ga)	48	67.92	54	(10ga)	120	282.93	234
	54	76.22	61		132	310.95	259
	60	80.4	67		144	338.93	282
	66	87.32	74				
	72	95.94	81				
	78	103.79	87				
	84	111.66	94				
	90	119.51	100				
	96	127.35	107				
	102	135.23	114				
	108	143.09	120				

**Coupling Bands - Equivalent cost:** Up to and including 72" diameter = 2' of pipe  
 Greater than 72" diameter = 3' pipe

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**Arched pipe:** More than 100' of one diameter, add 15 percent. Between 30 to 100' of one diameter, add 25 percent, less than 30' of one diameter add 40 percent.

**Culvert Pipe End Treatment** (does not include material).

<i>Diameter or equivalent Span &amp; Rise</i>	<i>Price per cut (skew or bevel)</i>	<i>Diameter or equivalent Span &amp; Rise</i>	<i>Price per cut (skew or bevel)</i>
18	18.00	48	48.00
24	24.00	54	54.00
30	30.00	60	60.00
36	36.00	66	66.00
42	42.00	72	72.00

**Five percent Shop Ellipse** (same cost additions as for arch pipe) Call for quotes.

**Special Coatings** Call culvert distributor for quotes.

**End Sections (Flared End Terminal Sections)**

<i>Diameter of pipe</i>	<i>Gage</i>	<i>Price</i>	<i>Galvanized Weight</i>	<i>Dimensions of Arch</i>	<i>Gage</i>	<i>Price</i>	<i>Galvanized Weight</i>
12	16	65.81	28	17x13	16	95.85	30
15	16	83.35	36	21x15	16	129.04	37
18	16	112.21	50	28x20	16	187.97	60
24	16	163.45	76	35x24	14	377.51	109
30	14	328.27	157	42x29	14	573.68	165
36	14	498.85	209	49x33	12	925.04	276
42	12	804.38	430	57x38	12	1075.05	361
48	12	934.83	509	64x43	12	1461.86	520
54	12	1105.85	630	71x47	12/ 10	1783.24	790
60	12/ 10	1488.08	826	77x52	12/ 10	2311.18	818
72	12/ 10	1796.28	998	88x57	12/ 10	2487.63	887
84	12/ 10	2181.70	1200				

**SECTION 603 – STRUCTURAL PLATE STRUCTURES** (Labor 20 percent)

Costs do not include the cost of the footing, structural excavation, embankment, or riprap. Each project should be estimated on material, time, and equipment basis. When applicable, make a subsidiary allowance to this pay item for contractor quality control.

Call for quotes on material cost.

**SECTION 604 - MANHOLES, INLETS, AND CATCH BASINS** (Labor 25 percent)

Call culvert manufacturer for prices. Use time and equipment for installation.

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## **SECTION 605 – UNDERDRAINS, SHEET DRAINS, AND PAVEMENT EDGE DRAINS**

(See items below for labor and reductions)

**Underdrains:** Perforated pipe cost per lineal foot (Labor 40 percent). Add 15 percent to standard culvert price.

**Special sections:** Material cost is per table below. The labor cost is in the table is a production cost therefore do not reduce. Costs for bands are in Section 602E. Add labor for installation. Add 20% for arch pipe fittings.

<i>Diameter inches</i>	<i>Labor Cost (Each)</i>		<i>Wyes &amp; Tees</i>	<i>Material Cost per Lineal ft</i>
	<i>Elbows (30-90 degrees)</i>			
6	\$50.00		\$50.00	\$13.90
8	\$72.85		\$87.42	\$13.90
12	\$72.85		\$87.42	\$13.90
15	\$93.12		\$111.74	\$17.12
18	\$124.51		\$149.41	\$20.35
24	\$243.21		\$291.85	\$27.15

**Porous backfill** (filter material) (Labor 10 percent): Develop price from rock costs plus the haul cost as determined from the chart in haul section of the cost guide. Haul cost to be estimated from the nearest point of manufacture.

**Geotextiles** (Labor 10 percent): When using geotextiles, the pipe must be placed in open graded porous material.

**Granular underdrain** (Labor 25 percent): The cost of granular underdrain is normally on a CY basis which includes cost of production, loading, hauling, spreading, and compaction. Develop cost by using same criteria as used for Section 301 (screened material).

**Sheet Drains** (Labor 30 percent): Due to the variable nature of availability, type and gradation of the rock, the different geotextile materials that may be specified, and the different site conditions that may be encountered this work should be estimated using the "time and equipment" estimating procedures.

## **SECTION 606 - CORRUGATED METAL SPILLWAYS**(Labor 20 percent)

Use time, material, and equipment.

If round pipe is used, 70 percent of the unit price in Section 602 will apply, unless difficult slope conditions are encountered.

Elbows - include two connecting bands.

Anchors - Estimate by material and time.

Berm Drain - Unit cost consists of installation of prefabricated corrugated metal catch basin 12" diameter with slip joint and 20 feet of 8" corrugated metal downspout with downspout anchors.

Flexible Downdrain - lowest price for larger quantity of 200 or more lineal feet.

Inlet assemblies are estimated the same as Section 602, End Sections.

Downpipe is measured by the quantity of lineal feet installed including accessories except inlets. Inlet assemblies are measured by the number installed and accepted. Estimates should include gaskets. An 18" downpipe with all accessories will cost about \$60/ LF installed.

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Anchors are required for downpipes. Anchors should be placed approximately every 10 feet and at the outlet. A culvert anchor installation may consist of stakes and bands or two metal fence posts and wire. The metal fence post culvert anchor may be used for downpipe up to 30" in diameter. 30" diameter pipe and larger will require anchors especially designed for them.

## **SECTION 607 – CLEANING, RECONDITIONING, AND REPAIRING EXISTING DRAINAGE STRUCTURES** (Labor 75 percent)

Caution needs to be taken in using this item on metal culverts that have any significant age and or deterioration. Unit price should take into consideration costs related to removing, cleaning, relaying and/ or stockpiling pipe.

Excavation for removing pipe should be estimated at the unit price for culvert excavation, or use time and equipment. Removing, cleaning, and relaying of pipe should cost approximately 70 percent of the in place price per foot for new construction for a given size of pipe as listed in Section 602.

## **SECTIONS 609 - CURB AND GUTTER** (Labor 40-50 percent)

Use time, materials, and equipment estimate.

## **SECTIONS 615 – SIDEWALKS, DRIVE PADS, AND PAVED MEDIANS** (Labor 40-50 percent)

Use time, materials, and equipment estimate.

## **SECTION 617 - GUARDRAIL** (Contract Item)

Use \$50-\$100 per lineal foot (installed). Cost includes posts on 6'3" centers and regular sections. Add 20 % to unit price for curved rail sections. Estimate about \$1000 - \$3000 each for end anchorage or terminal sections based on type of system used. Add 40 % for Rustic guardrail.

Call manufacturer for price quotes on material prices.

When guardrail is required on both sides of the roadway, include the total length of rail on both sides. The length of the rail is determined by measuring the length necessary where it is installed adjacent to the road shoulder, and not from the road centerline length. Also, the length of guardrail is determined by slope distance, not horizontal distance.

## **SECTION 618 – CONCRETE BARRIERS AND PRECAST GUARDWALLS** (Contract Item)

Concrete barriers (Jersey) will cost about \$45-\$60 per lineal foot installed.

Call manufacturer for price quotes on material prices.

## **SECTION 619 - FENCES, GATES AND CATTLE GUARDS**

Use this specification only for facilities being built for campgrounds and rights-of-way. Use FSSS 640 for Road closure Devices.

**Fences:** (Labor 60 percent) Four strand barbed wire

Estimate by time, equipment and material. Costs average about \$4.00/ LF for fencing.

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**Gates:** (Labor 15 percent metal gates, 65 percent wire gates)

Costs range from \$2,000 to \$4,000 each for double-lane metal gates, and \$1,500 to \$2,000 each for single-lane metal gates. Wire gates cost about \$100 to \$200 each. Powder River type gates cost from \$300 to \$500 each.

**Cattleguards:** (Labor 10 percent)

Costs range from \$4,000 to \$6,000 for 16'-0" width cattle guard. Price include wings and base. Check with supplier for current cost and estimate installation using time and equipment based on actual installation site.

Cattleguard, Steel Decked with HS20-44 Loading				
Cost Adjustment Factors				
12'-0"	14'-0"	16'-0"	24'-0"	28'-0"
0.75	0.9	1.0	1.5	1.75

Precast concrete base weighs 5,250 pounds/ side (2,381 kg/ side).

## **SECTION 621 – MONUMENTS AND MARKERS** (Labor 25 percent)

Estimate by time, equipment, and material.

## **SECTION 622 – RENTAL EQUIPMENT**

Equipment rental includes the equipment rate and the operator rate. Equipment rates can be found in the "Equipment Rates" section. Operator rates can be found in the "Labor Rates" section. The cost of moving most equipment to the job is included in Section 151 - Mobilization

## **SECTION 624 - TOP SOILING** (Labor 50 percent)

Topsoil needed on disturbed areas of backslopes and fillslopes to establish vegetation will be estimated from a known source before the contract is awarded. Include the following in cost estimates:

Loading costs - Use time and equipment.

Spread - Use time and equipment.

Haul - see Haul Section in this cost guide.

Clearing and development of pit area - see Section 641.

The cost of pit development must be included if Section 641 is not included. Elements to consider are move-in costs of equipment needed to clear pit area, cost of clearing and disposal, shaping-up of pit after use, planting and seeding after use, purchase price for topsoil on other than USFS land, etc.

## **SECTION 625 – TURF ESTABLISHMENT** (Labor: Dry Method = 30-40%, Dry Method W/ Mulch = 60%, Hydraulic Method=40-50%)

*Note: The costs for seeding and fertilizing are based on applying seed and fertilizer in one application. There are no allowances in the costs for watering or compacting the seedbed. If you include these requirements an additional allowance will have to be made*

Cost for Dry Method is about \$450/ acre; cost for Hydraulic Method is about \$2,800/ acre. Cost of fertilizer, where required, should be included in the base item. Fertilizer, Section 625.06, should be used only for supplemental applications.

If Native Grass Seed is required, get a quote from a supplier.

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## **SECTION 629 – ROLLED EROSION CONTROL PRODUCTS AND CELLULAR CONFINEMENT SYSTEMS**

Costs for erosion control blankets and netting range from \$2 to \$4 per SY.

## **SECTION 633 – PERMANENT TRAFFIC CONTROL** (Labor 60 percent)

Prices are for estimating only. Call for quotes.

<b><u>Materials</u></b>	<b><u>Material Cost</u></b>
Wood Post	\$1 to \$3/ Lineal Ft
Steel u-channel post (3 lbs./ ft)	\$4.90/ Lineal Ft
Signs	\$100 to \$200/ Ea
Route Markers	\$20 to \$30/ Ea
Aluminum Sign Panels	\$20/ Sq Ft
Fiberglass Sign Panels	\$20/ Sq Ft
Wood Sign Panels	\$20/ Sq Ft
Regulatory/ Warning Signs	\$170 to \$225/ Ea
Sign and Post(s)	\$125 to \$300/ Ea
Delineators w/ posts	\$15 to \$25/ Ea
Delineator only Double Sided	\$10 EA
<b><u>Installation Only*</u></b>	<b><u>Price</u></b>
Sign and Post (one)	\$35-\$60/ Ea

\*Costs must be increased if sign posts are to be installed in rocky fills or other situations requiring difficult excavation.

## **SECTION 634 – PERMANENT PAVEMENT MARKINGS**(Contract Item)

Costs can be estimated on the basis of the gallons of paint required including the cost of glass beads, paint, cleaning surface to be painted, application, and protection of markings until dry. Rough estimate is that an average two-lane road will require \$1,600 to \$2,000 per mile to do all customary striping work. Estimator should use designed lengths of single solid, single dashed, and double solid to make estimate; or time, equipment, and materials. Campground and parking area striping will cost more due to the short lengths, intermittent markings, and tighter working areas. Call local suppliers for current materials cost or local contractors for a project specific estimate.

See Standard Specification , FP-03, Section 634 for application rates for paint and beads.

## **SECTION 640 - ROAD CLOSURE DEVICES**(Labor: Metal Gates - 15 percent, Concrete Barriers - 10 percent, Guardrail Barriers - 30 percent)

**Metal Gates:** Costs range from \$2,000 to \$4,000 each for double-lane metal gates, and \$1,500 to \$2,000 each for single-lane metal gates.

**Concrete Barriers:** Estimate by time, equipment and material. Call for quotes.

**Guardrail Barriers:** Estimate by time, equipment and material. Call for quotes.

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## **SECTION 641 - DEVELOPMENT OF PITS AND QUARRIES** (Labor percent and reduction as per sections used in estimating)

Clearing, grubbing, and slash clean-up should be estimated as recommended for Section 201, include additional allowance for difficult terrain.

Access roads may be estimated as lump sum based upon equipment and labor hours or unit prices for construction items as covered in Section 204. Pay particular attention to materials and terrain encountered in access road construction that will affect cost of construction.

Quarry stripping, slope rounding, restoration, and clean-up should be estimated as lump sum based upon equipment and labor hours or unit prices for construction items as covered in Section 204.

Turf establishment may be estimated per instructions in Section 625.

Ground and traffic control estimated per requirements in Section 635.

If Section 641 is not included in the contract, development costs should be incidental to the items requiring the pit or quarry. Estimator should pay close attention to requirements shown on the pit development plan, and R-1 supplements to FSH 7109.21 (Geotechnical & Materials Engineering Handbook).

## **SECTION 660 – TIMBER CROSSDRAINS** (Labor 30 percent)

Designer and estimator are reminded that extreme caution is warranted for designing and/ or use of open-top culverts due to relatively high initial costs and potential maintenance problems. Open-tops are not recommended for surfaced roads, particularly Traffic Service Level A through C roads. Use on low-standard roads where nothing else is practical on a short-term basis may be warranted. Costs nearly equal conventional PE or metal culverts including catch basin construction over the long-term.

Drainage deflectors with rubber belting have usually proven to be better than open-tops for diverting water off the road surface on steeper grades. They generally require less maintenance, except on heavily traveled roads where the belting needs replacement on a periodic basis. The in-place cost of these deflectors is about the same as cost per foot of an 18" installed CMP, plus riprap for slope protection if required.

End of Drainage and Incidental Construction