United States
Department of
Agriculture

Forest Service

Intermountain
Southwestern
Rocky
Mountain
Regions

Engineering

Cost Estimating Guide for Road Construction

March 2009

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GENERAL INFORMATION AND INSTRUCTIONS

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Tables Of Weights And Measures

Table 1 - Linear Measure

1 inch	= 0.0833 foot	= 2.54 centimeters
12 inches	= 1 foot	= 0.3048 meter
3 feet	= 1 yard	= 0.9144 meter
5 1/2 yards or 16 1/2 feet	= 1 rod (or pole or perch)	= 5.029 meters
40 rods	= 1 furlong	= 201.17 meters
8 furlongs	= 1 (statute) mile	= 1,609.3 meters
1,760 yards	= 1 (statute) mile	= 1,609.3 meters
5,280 feet	= 1 (statute) mile	= 1,609.3 meters
3 miles	= 1 (land) league	= 4.83 kilometers

Table 2 - Square Measure (Area)

1 square inch		= 6.45 square centimeters
144 square inches	= 1 square foot	= 929 square centimeters
9 square feet	= 1 square yard	= 8361 square centimeters
30 1/4 square yards	= 1 square rod (or square pole or square perch)	= 25.29 square meters
160 square rods	= 1 acre	= 0.4046 hectares
4,840 sq yards	= 1 acre	= 0.4046 hectares
43,560 sq ft	= 1 acre	= 0.4046 hectares
640 acres	= 1 square mile	= 259 hectares
640 acres	= 1 square mile	= 2.59 square kilometers

Table 3 - Cubic Measure (Volume)

1 cubic inch		= 16,387 cubic centimeters
1,728 cubic inches	= 1 cubic foot	= 0.0283 cubic meter
27 cubic feet	= 1 cubic yard	= 0.7646 cubic meter
	(in units for cordwood, etc.)	
16 cubic feet	= 1cord foot	
8 cord feet	= 1 cord	= 3.625 cubic meters

Table 4 - Dry Measure

1 pint		= 33.60 cubic inches	= 0.5505 liter
2 pints	= 1 quart	= 67.20 cubic inches	= 1.1012 liters
8 quarts	= 1 peck	= 537.61 cubic inches	= 8.8096 liters
4 pecks	= 1 bushel	= 2,150.42 cubic inches	= 35.2383 liters
1 British dry quart		= 1.032 U.S. dry quarts	

Table 5 - USA Liquid Measure

1 gill	= 4 fluid ounces	= 7.219 cubic inches	= 0.1183 liter
4 gills	= 1 pint	= 28.875 cubic inches	= 0.4732 liter
2 pints	= 1 quart	= 57.75 cubic inches	= 0.9463 liter
4 quarts	= 1 gallon	= 231 cubic inches	= 3.7853 liters
1 barrel	= 31.5 gallons	= 7276.5 cubic inches	= 119.2370 liters

Table 6 - English Liquid Measure

4 quarts	= 1 gallon	= 277.42 cubic inches	= 4.546 liters
1 barrel	= 36 gallons	= 9987.12 cubic inches	= 163.656 liters

Table 7 - USA Avoirdupois Weight

1 grain		= 0.0648 gram
1 dram	= 27.34 grains	= 1.772 grams
16 drams	= 1 ounce	= 28.3495 grams
1 ounce	= 437.5 grains	= 28.3495 grams
16 ounces	= 1 pound	= 453.59 grams
1 pound	= 7,000 grains	= .45359 kilograms
100 pounds	= 1 hundredweight	= 45.36 kilograms
2,000 pounds	= 1 ton	= 907.18 kilograms

Table 8 - English Avoirdupois Weight

14 pounds	= 1 stone	= 6.35 kilograms
112 pounds	= 1 hundred weight	= 50.80 kilograms
2,240 pounds	= 1 long ton	= 1,016.05 kilograms

The Metric System

Table 9 - Metric Linear Measure

10 millimeter	= 1 centimeter	= 0.3937 inch
10 centimeters	= 1 decimeter	= 3.937 inches
10 decimeters	= 1 meter	= 39.37 inches
10 decimeters	= 1 meter	= 3.28 feet
10 meters	= 1 decameter	= 393.7 inches
10 decameters	= 1 hectometer	= 328 feet 1 inch
10 hectometers	= 1 kilometer	= 0.621 mile
10 kilometers	= 1 myriameter	= 6.21 miles

Table 10 - Metric Square Measure (Area)

100 square millimeters	= 1 square centimeter	= 0.15499 square inch
100 square centimeters	= 1 square decimeter	= 15.499 square inches
100 square decimeters	= 1 square meter	= 1,549.9 square inches
100 square decimeters	= 1 square meter	= 1.196 square yards
100 square meters	= 1 square decameter	= 119.6 square yards
100 square decameters	= 1 square hectometer	= 2.471 acres
100 square hectometers	= 1 square kilometer	= 0.386 square mile

Table 11 - Metric Land Measure

1 square meter	= 1 centiare	= 1,549.9 square inches
100 centiares	= 1 are	= 119.6 square yards
100 ares	= 1 hectare	= 2.471 acres
100 hectares	= 1 square kilometer	= 0.386 square mile

Table 12 - Metric Cubic Measure (Volume)

1,000 cubic millimeters	= 1 cubic centimeter	= .06102 cubic inch
1,000 cubic centimeters	= 1 cubic decimeter	= 61.02 cubic inches
1,000 cubic decimeters	= 1 cubic meter	= 35.314 cubic feet

Table 13 - Metric Weights

10 kilograms	= 1 myriagram	= 22.046 pounds
10 myriagrams	= 1 quintal	= 220.46 pounds
10 quintals	= 1 metric ton	= 2,204.6 pounds

General Information

Adjusted Annual Consumer Price Index (CPI) + 2% = Annual Multiplier

Table 14 - Past CPIs

Year	CPI
2008	3.8%
2007	2.8%
2006	3.2%
2005	3.4%
2004	2.7%

Current CPI is available online from the US Bureau of Labor Statistics at:
http://www.bls.gov/cpi/

Factors such as local increases in fuel costs, transportation/freight costs, local labor or materials shortages, etc. should be included in any calculations to adjust unit costs.

The unit costs published in the Guide were developed using Idaho Area 1 wage rates and equipment rates. The Davis-Bacon wage rate adjustments ***must*** be applied to all unit costs published in the Guide if the project is outside Idaho Area 1.

In addition, an adjustment factor table to compensate for differences in equipment hourly rates appears in the Engineer's Estimate section. For projects in Colorado, Idaho, Kansas, Nebraska, or Nevada no adjustment is necessary. See Table 22 in the Engineer's Estimate section.

Significant Changes in the 2009 Cost Guide.

Equipment costs, labor rates, unit item costs and construction material costs were updated in 2009.

Construction Materials Supplier contact information was verified and updated. All Supplier information was moved to the back of the guide. This section can easily be printed separately for easy reference.

Idaho's Timber Sale Wage Rate Adjustment changed from 45% in 2008 to 27% in 2009 (*reference Table 24*).

Current logging costs were not available at the time of publication for use in determining Temporary Road Construction costs. Therefore, the logging costs were adjusted using the CPI plus 2% as described above in the General Information Section.

General Instructions

A. *Revisions and Updates.*

There is one annual revision of the Cost Guide that is typically published in February.

B. Section Numbers

The Forest Service has adopted the FP-03 (Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects). This has resulted in a major change in the cost guide and required a set of FSSS (Forest Service Supplemental Specifications) so that the specifications will conform to the Forest Service contract requirements. As a result, the descriptions of the specification items have changed for some of the items and many of the specification numbers have changed. The items have also been rearranged. However, the content of the information in this cost guide has changed very little except for the updated costs. The FP-03 and FSSS are available in either Metric or US Customary (English) units. Verify that cost estimates allow for all work required by the various FSSS in the contract. Since the FSSS are being modified over time, unit costs shown in this guide may not accurately reflect the work required.

C. Time and Equipment (Construction) Estimates.

On some items, it may be necessary to develop estimates by "time and equipment." When making time and equipment estimates, be sure to include allowances for:

1. Supervision:
On very small jobs this may be provided by an operator/supervisor at essentially no additional cost.

2. Taxes on Purchase of Material:
Also, allow for delivery cost to job site.

3. Bonding Cost:
Bonding may be included in Section 151 Mobilization.

4. Stand By Time:
"Standby time" for equipment and operators that are part of a "spread" performing a segment of work, but who are not working at full capacity all the time, averages 2 to 2 1/2 percent of the total contract cost. For example, during placement of aggregate, a grader, roller and water truck are needed. The grader and roller may be operating full time; the water truck only part time. The estimate should include standby time for the water truck to compensate for having it available on the job during the entire time of placing aggregate.

5. Support Equipment:.
Fuel trucks, pickups, crew transportation, etc.

6. Permits:
Even though permits are not a direct billed item, the cost of obtaining necessary permits is included in overhead.

D. Unit Costs.
The estimator should round off the unit price to avoid creating accounting errors when processing contract payments. For example, clearing costs generally should be rounded to the nearest $10 per acre, excavation costs should be rounded to the nearest $.10 per cy, and CMP costs are rounded to $.50/LF. Quantities should never be carried out further than the nearest one-hundredth (0.01), and generally no further than the nearest one-tenth (0.1), depending on accuracy of measurements and cost or value of the item.

E. Use of Average Cost in Project.
Use average cost for individual roads within the project whenever possible unless there are significant variations in the character of work from one road to another. Variations are sometimes appropriate for clearing, excavation, hauling, or other unique situations. In these situations, each road should have separate and distinct unit costs for those items; otherwise, the use of overall project unit costs may create problems with design changes, alternate facilities, etc.

F. Profit and Risk Factor.
The profit and risk factor used in this Cost Guide is 10%. All unit prices shown in the Guide include this allowance, including the wage and equipment rates.

G. Pay Item Number.
Pay item numbers and descriptions are found in the Spec Manager database in Lotus Notes rather than in the FP-03 book.

H. Public Works and Timber Sale Estimates.
All engineer's estimates for road construction are to be prepared as if construction is to be accomplished by a public works contract. Unit costs for work items listed in this cost guide utilize Davis-Bacon wages.

I. Davis-Bacon (D-B) /Purchaser Wage Rate Adjustments.
To arrive at Specified Road Construction Cost, the engineer's cost estimate shall be adjusted by the estimated cost difference between the applicable Davis-Bacon wage rates and the local prevailing wage rates using the appropriate labor factor given for the labor percentages shown for each work item. These adjustments are mandatory and will be used for all timber sale contracts having specified road construction. Note that some work items are not normally performed by a Timber Sale Purchaser but are subcontracted. No reduction should be made for these items, if the subcontractor is likely to pay Davis-Bacon wage rates. Reductions will be made for those situations where it is unlikely that D-B wages are paid. Refer to FSH 7709.56-7.54 (Preconstruction Handbook) for more information, and refer to Labor Rates in the

Engineer's Estimate section of this Guide for D-B wage information. An example of this may be dust palliative treatments. For additional information, see section entitled Timber Sale Wage Rate Adjustments.

Please note that the labor and equipment rates shown in the Cost Guide include applicable "payroll loading" and profit and overhead costs.

J. Fuel Prices.

Fuel costs can be quite variable over a period of time due to geopolitical conditions. Equipment Rates in Section 622 and elsewhere in this Guide may need to be adjusted by the estimator to compensate for these variations. Other machinery/equipment that uses fuel or propane such as asphalt plant dryers, generators, etc. may also cost more/less to operate. The overall effect on the typical road construction project is that 30-40% fuel price increases will increase the total cost of construction about 2-5%. The estimator should be aware of big (10% plus) fuel price increases/decreases that would affect the unit bid prices shown in this Guide. Fuel price variations will have more effect on items that are equipment oriented such as excavation, than those that are material and labor oriented such as signs.

K. Use of Costs Other Than Shown in the Cost Guide.

When local experience indicates unit costs are different than those shown in this Guide, local costs should be considered. Cost deviations from this Guide shall be documented and included in the project file.

L. Small Quantity Adjustments.

Estimates should consider all roads that are included in a contract package that are within a five mile radius as one project for the purposes of small quantity adjustments. Therefore, small quantity factors should not be applied to individual road costs when the individual roads are part of a larger group of road projects in the same vicinity and part of the same contract. On the other hand, where small quantities are involved, estimators should increase allowances due to the inefficiencies generally encountered in small projects. Of particular concern are projects where small quantities of aggregate are involved. Mobilization of equipment may outweigh the direct costs of the aggregate, short road construction projects also have a relatively high mobilization cost for transport of dozers and excavators.

M. Purchaser Engineering.

Recent changes in Forest Service FRP budgets have introduced or revised several concepts for timber sale roads: post-award engineering (PAE) including possible purchaser survey and/or design, restricted public use of haul routes, deposits for engineering work on road reconstruction, converting some planned short-term specified roads to temporary roads that remain open for a short period after purchasers use, and use of salvage sale funding for engineering work. Estimator should refer to specific C-provision requirements when estimating purchaser engineering costs.

N. Change Orders and Design Changes.

The principles, costs, etc. listed in this Guide can be used to assist in determining unit costs for contract design changes and change orders; however, site specific and project related information should be used to the maximum extent possible.

O. Electronic Copy of the Cost Guide.

The 2009 R2/R3/R4 Cost Guide is available for downloading by employees and the general public at http://www.fs.fed.us/r4/projects/roads/cost_est_guide.pdf.

P. Summary.

This is a guide and not a cookbook. Estimators need to use judgment and knowledge of the specific project and local conditions when preparing cost estimates.

Others sources for cost estimation procedures and data (use the most current version available):

RS Means Heavy Construction Cost Data
Equipment Watch Rental Rate Blue Book for Construction Equipment
Caterpillar Handbook - for production rates and equipment capabilities

End of General Information and Instructions

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ENGINEER'S ESTIMATE

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Determination of Wage Rate Area

The preliminary estimated unit costs published in this guide may need to be adjusted. Determine the area and/or zone and adjust the unit costs per instructions of this section. All unit costs in this guide were calculated using Idaho Area1 hourly wage rates and Idaho hourly equipment rates. Due to the differences in Davis-Bacon wage rates across the 3 Regions, and variances in equipment rates, cost adjustments may be needed.

Current Davis-Bacon wage rates may be downloaded at http://www.gpo.gov/davisbacon/ .

A. Arizona.

In Arizona, Davis-Bacon wage rates published in this guide apply to the entire state.

B. California.

In California, Davis-Bacon wage rates published in this guide apply to all the counties contained within Region 4.

C. Colorado.

In Colorado, Davis-Bacon wage rates published in this guide are divided into 2 Areas.

Area 1 includes the following counties: Alamosa, Archuleta, Baca, Bent, Chaffee, Cheyenne, Clear Creek, Conejos, Costilla, Crowley, Custer, Delta, Dolores, Eagle, Elbert, Fremont, Garfield, Gilpin, Grand, Gunnison, Hinsdale, Huerfano, Jackson, Kiowa, Kit Carson, La Plata, Lake, Las Animas, Lincoln, Logan, Mineral, Moffat, Montezuma, Montrose, Morgan, Otero, Ouray, Park, Phillips, Pitkin, Prowers, Rio Blanco, Rio Grande, Routt, Saguache, San Juan, San Miguel, Sedgwick, Summit, Teller, Washington and Yuma counties.

Area 2 includes the following counties: Adams, Arapahoe, Boulder, Denver, Douglas, El Paso, Jefferson, Larimer, Mesa, Pueblo and Weld counties.

D. Idaho.

In Idaho, Davis-Bacon wage rates published in this guide are divided into 2 Area within Region 4 as described below.

Area 1: That area within the State of Idaho located within 30 miles on either side of I-84 from the Oregon-Idaho State Line on the West to the Intersection of I-84 and I-86 in Cassia County, then following I-86 to Pocatello, then following I-15 to Idaho Falls, then following State Highway #20 - 10 miles north to the intersection with Moody Road then following I-15 south from the city of Pocatello to a point 10 miles South of the Southern Boundary of Bannock County extended to the West.

Area 2: The remaining area of that portion of the State of Idaho south of Parallel 46 (the Washington-Oregon State Line extended eastward to Montana) that is not included in Area 1 as described above. An additional $1.50 per hour was added to the Area 1 base wage rates, before adding in fringes and adjustments for overhead and profit and risk.

E. Kansas.

In Kansas, Davis-Bacon wage rates published in this guide apply to all the counties contained within Region 2 administered land.

F. Nebraska.

In Nebraska, Davis-Bacon wage rates published in this guide apply to all the counties contained within Region 2 administered land.

G. Nevada.

In Nevada, Davis-Bacon wage rates published in this guide are divided into 2 Areas, Las Vegas and Carson City. Special hourly rate adjustments apply depending upon the distance from the project to the reference point of the Area.

Las Vegas Area: Includes the following counties: Clark, Esmeralda, Lincoln, and Nye counties.

Carson City Area: Includes the following counties: Churchill, Douglas, Elko, Eureka, Humboldt, Lander, Lyon, Mineral, Pershing, Storey, Washoe, White Pine, and Carson City counties.

Nevada area pay applies to all three categories in Las Vegas area and in the Carson City area. Add the appropriate adjustments to wage rates when work falls within the listed areas. The rates adjustments required by the Nevada Wage Determination were modified to include overhead costs and profit and risk.

Table 15 - Zone Adjustments for Las Vegas Area

	City Hall, Las Vegas	Power Equip	City Hall, Las Vegas	Labor	City Hall, Las Vegas	Truck Driver
Zone 1	0 - 20 miles		0 - 30 miles		0 - 30 miles	
Zone 2	20 - 40 miles	$2.24	30-50 miles	$0.00	30-50 miles	$2.24
Zone 3	40 - 60 miles	$3.73	50 - 70 miles	$0.00	50 - 70 miles	$3.73
Zone 4	> 60 miles	$4.47	> 70 miles	$0.00	> 70 miles	$5.22

Mileage is road miles from City Hall, Las Vegas.

Table 16 - Zone Adjustments for Carson City Area

	Carson City	Power Equip/Truck Driver	Labor
Zone 1	0 - 50 miles		
Zone 2	50 - 150 miles	$2.98	$0.00
Zone 3	150 - 300 miles	$4.47	$0.00
Zone 4	> 300 miles	$5.96	$0.00

Mileage is road miles from the Washoe County Courthouse (Reno) or road miles from the Carson City Courthouse.

H. New Mexico.

In New Mexico, Davis-Bacon wage rates published in this guide are divided into 2 Areas.

Area 1 includes the following counties: Bernalillo, Los Alamos, Dona Ana, and Sante Fe counties

Area 2 includes the following counties: Catron, Hidalgo, San Juan, Chaves, Cibola, Colfax, Curry, De Baca, Eddy, Grant, Guadalupe, Harding, Lea, Lincoln, Luna, McKinley, Mora, Otero, Quay, Rio Arriba, Roosevelt, San Miguel, Sandoval, Sierra, Socorro, Taos, Torrance, Union, and Valencia counties.

I. South Dakota

In South Dakota, Davis-Bacon wage rates published in this guide are divided into 2 Areas.

Area 1 includes the following counties: Lincoln, Minnehaha and Pennington counties

Area 2 includes the following counties: Aurora, Beadle, Bennett, Bon Homme, Brookings, Brown, Brule, Buffalo, Butte, Campbell, Charles Mix, Clark, Clay, Codington, Corson, Custer, Davison, Day, Deuel, Dewey, Douglas, Edmunds, Fall River, Faulk, Grant, Gregory, Haakon, Hamlin, Hand, Hanson, Harding, Hughes, Hutchinson, Hyde, Jackson, Jerauld, Jones, Kingsbury, Lake, Lawrence, Lyman, Marshall, McCook, McPherson, Meade, Mellette, Miner, Moody, Perkins, Potter, Roberts, Sanborn, Shannon, Spink, Stanley, Sully, Todd, Tripp, Turner, Union, Walworth, Yankton and Ziebach counties.

J. Utah

In Utah, Davis-Bacon wage rates published in this guide are divided into 2 Areas.

Area 1 includes the following counties: Davis, Juab, Millard, Morgan, Salt Lake, Sanpete, Sevier, Summit, Utah, and Weber counties.

Area 2 includes the following counties: Beaver, Box Elder, Cache, Carbon, Daggett, Duchesne, Emery, Uintah, Garfield, Grand, Iron, Kane, Piute, Rich, San Juan, Tooele, Wasatch, Washington and Wayne counties.

K. Wyoming

In Wyoming, Davis-Bacon wage rates published in this guide are divided into 2 Areas.

Area 1 includes the following counties: Albany, Big Horn, Campbell, Carbon, Converse, Crook, Fremont, Goshen, Hot Springs, Johnson, Lincoln, Niobrara, Park, Platte, Sheridan, Sublette, Sweetwater, Teton, Uinta, Washakie and Weston counties.

Area 2 includes the following county: Natrona county.

Hourly Wage Rates per State

The wage rates shown in Table 17 and Table 19 below include basic hourly rates; fringe benefits; an overhead factor to cover Worker's Compensation and Unemployment Insurance costs which varies by state, Social Security Taxes (7.65%), Risk Insurance and Public Liability costs (2.02%), Overhead costs (16%); and 10% profit and risk. Wage rates are subject to change at any time. The area contracting specialists can provide the latest wage information.

All wage rates shown are from highway construction rates.

The Equipment Size Classification tables are used when certain wage areas within individual states require paying different wage rates based on size of equipment being operated. This only applies to dozers, front end loaders, and trucks. Where there is no difference in rates, "same" appears in the table.

Table 17 - Hourly Wage Rates

JOB CLASSIFICATION	AZ	CA	CO		ID		KS	NE	NV	
ZONE			1	2	1	2			LV	CARSON CITY
Foreman	49.47	108.86	45.99	57.92	51.13	53.31	23.86	24.35	78.65	78.65
General Laborer	25.79	52.36	22.21	21.57	37.53	39.70	13.74	12.95	53.07	53.07
Chainsaw Operator	29.45	53.82	21.49	21.57	41.36	43.53	15.18	17.48	60.31	60.31
Powderman	46.58	53.82	24.08	23.41	43.75	45.93	17.71	19.98	59.81	59.81
Wagon Drill Operator	42.21	68.68	28.54	43.21	46.49	48.67	18.43	18.10	73.49	73.49
Asphalt Spreader Operator	43.76	66.65	42.76	43.21	45.85	48.03	19.52	19.27	70.05	70.05
Backhoe Operator	42.99	70.63	29.08	29.08	46.29	48.46	18.07	15.37	73.16	73.16
Dozer Operator (1)	37.50	70.63	42.76	42.76	46.49	48.67	18.07	18.10	73.49	73.49
Dozer Operator (2)	42.21	70.63	42.76	42.76	46.49	48.67	18.07	19.98	73.49	73.49
Front End Loader Operator (1)	42.21	70.63	42.76	42.76	45.85	48.03	18.07	17.79	73.66	73.66
Front End Loader Operator (2)	43.76	72.75	42.99	42.99	46.08	48.26	18.07	18.88	73.83	73.83
Grader Operator	43.76	75.02	28.81	43.21	46.49	48.67	19.52	18.77	73.83	73.83
Heavy Duty Mechanic or Welder	43.76	70.63	29.34	42.99	46.40	48.58	20.96	20.21	73.80	73.80
Hydraulic Excavator Operator	43.76	75.08	42.99	42.99	46.88	49.06	19.52	21.23	74.09	74.09
Truck Driver (1)	41.92	59.08	25.08	27.69	44.69	46.87	17.35	15.06	56.58	56.58
Truck Driver (2)	42.81	59.54	27.19	28.20	44.85	47.03	18.07	16.93	57.16	57.16
Roller Operator Compaction	37.50	70.63	27.94	28.38	45.62	47.80	16.99	15.69	73.16	73.16

Table 18 - Equipment Size Classifications for Table 17

EQUIPMENT	AZ	CA	CO	ID	KS	NE	LV---- NV -----CC	
Dozer (1)	<D5	same	same	same	same	<D5	<D5	same
Dozer (2)	>=D5	same	same	same	same	>=D5	>=D5	same
Front End Loader (1)	3-6 cy	<= 4 cy	<= 6 cy	< 4 cy	same	<= 4 cy	< 1.5 cy	< 1.5 cy
Front End Loader (2)	7-10 cy	>4 cy	> 6 cy	4 - 7 cy	same	>4 cy	1.5 - 6 cy	1.5 - 6 cy
Truck (1)	<=4 axle	<= 8 cy	<= 14 cy	< 16 cy	<4 axle	<4 axle	< 12 cy	< 12 cy
Truck (2)	>5 axle	> 8 cy	>14 cy	16 - 30 cy	>3 axle	>3 axle	12 -16 cy	12 -16 cy

Table 19 - Hourly Wage Rates

JOB CLASSIFICATION	NM		SD		UT		WY	
ZONE	1	2	1	2	1	2	1	2
Foreman	16.58	16.82	34.72	34.78	49.23	49.23	41.62	34.34
General Laborer	10.20	10.11	21.53	21.42	22.29	32.36	25.86	24.34
Chainsaw Operator	10.20	10.11	23.96	23.90	25.64	32.89	27.70	22.17
Powderman	10.20	10.11	29.45	29.71	33.12	33.12	27.70	22.17
Wagon Drill Operator	10.20	10.11	25.16	25.14	47.10	47.10	32.28	29.95
Asphalt Spreader Operator	13.25	13.58	28.25	28.27	48.63	48.63	32.28	29.95
Backhoe Operator	13.25	13.58	27.45	27.58	50.16	50.16	32.28	29.95
Dozer Operator (1)	12.35	12.68	25.16	25.14	48.63	48.63	32.28	29.95
Dozer Operator (2)	13.27	13.58	27.45	27.58	48.63	48.63	36.28	31.73
Front End Loader Operator (1)	12.35	12.68	25.16	25.14	48.63	48.63	32.28	29.95
Front End Loader Operator (2)	13.25	13.58	27.45	27.58	50.16	50.16	36.28	31.73
Grader Operator	13.25	13.58	31.68	31.74	50.95	50.95	39.22	34.62
Heavy Duty Mechanic or Welder	13.48	13.81	31.68	31.74	53.49	53.49	39.22	34.62
Hydraulic Excavator Operator	13.48	13.81	31.68	31.74	50.16	50.16	36.28	31.73
Truck Driver (1)	10.41	10.71	22.38	22.11	36.38	36.38	33.00	27.15
Truck Driver (2)	10.71	11.01	26.13	26.02	36.61	36.61	29.84	27.77
Roller Operator Compaction	12.35	12.68	25.16	25.14	44.25	44.25	29.88	27.54

Table 20 - Equipment Size Classifications for Table 19

EQUIPMENT	NM	SD	UT	WY
Dozer (1)	< D4	< D4	<= D7	< D4
Dozer (2)	D4 and up	D4 and up	> D7	D4 and up
Front End Loader (1)	< 2 cy	< 1.25 cy	<= 10 cy	< 1.5 cy
Front End Loader (2)	2 -10 cy	>= 1.25cy	> 10 cy	1.5 - 3.5 cy
Truck (1)	8 - 16 cy	<4 axle	<= 8 cy	< 7 cy
Truck (2)	> 16 cy	>3 axle	8 -14 cy	7 - 13 cy

Adjustment Factors for the Unit Costs

Adjust the preliminary estimated unit prices in this guide by multiplying them by the appropriate factors in the following Table 21 and Table 22.

The wage rate adjustment factors in Table 21 are based on the appropriate Davis Bacon wage rates with fringes and overhead loading for a mixed work force of equipment operators, laborers, and truck drivers.

Table 21 - Davis-Bacon Adjustment Factors

LABOR %	ARIZONA - all	CALIFORNIA - all	COLORADO - Zone 1	COLORADO - Zone 2	IDAHO - Zone 2	KANSAS -all NEBRASKA - all	LAS VEGAS Area 0-30 miles LAUGHLIN Area MESQUITE Area	LAS VEGAS Area > 30 miles
5	1.00	1.03	0.99	0.99	1.00	0.97	1.03	1.03
10	0.99	1.05	0.97	0.98	1.00	0.94	1.05	1.06
15	0.99	1.08	0.96	0.97	1.01	0.91	1.08	1.09
20	0.98	1.10	0.95	0.96	1.01	0.88	1.10	1.11
25	0.98	1.13	0.93	0.95	1.01	0.85	1.13	1.14
30	0.97	1.15	0.92	0.94	1.01	0.82	1.16	1.17
35	0.97	1.18	0.91	0.93	1.02	0.79	1.18	1.20
40	0.96	1.21	0.89	0.92	1.02	0.76	1.21	1.23
45	0.96	1.23	0.88	0.91	1.02	0.73	1.24	1.26
50	0.95	1.26	0.87	0.90	1.02	0.70	1.26	1.28
55	0.95	1.28	0.85	0.89	1.03	0.67	1.29	1.31
60	0.94	1.31	0.84	0.89	1.03	0.64	1.31	1.34
65	0.94	1.33	0.83	0.88	1.03	0.61	1.34	1.37
70	0.93	1.36	0.81	0.87	1.03	0.58	1.37	1.40
75	0.93	1.39	0.80	0.86	1.04	0.55	1.39	1.43
80	0.92	1.41	0.79	0.85	1.04	0.52	1.42	1.45
85	0.92	1.44	0.77	0.84	1.04	0.49	1.45	1.48
90	0.92	1.46	0.76	0.83	1.04	0.46	1.47	1.51
95	0.91	1.49	0.75	0.82	1.05	0.43	1.50	1.54
100	0.91	1.51	0.73	0.81	1.05	0.40	1.52	1.57

Table 21 - Davis-Bacon Adjustment Factors, Continued

LABOR %	CARSON Area <50 miles	CARSON Area 50-300 miles	CARSON Area >300 miles	NEW MEXICO - all	SOUTH DAKOTA - all	UTAH - All	WYOMING - Zone 1	WYOMING - Zone 2
5	1.02	1.02	1.02	0.96	0.98	1.00	0.99	0.98
10	1.03	1.04	1.04	0.93	0.96	1.00	0.97	0.96
15	1.05	1.05	1.06	0.89	0.94	1.00	0.96	0.95
20	1.06	1.07	1.08	0.85	0.92	0.99	0.95	0.93
25	1.08	1.09	1.10	0.82	0.90	0.99	0.93	0.91
30	1.09	1.11	1.12	0.78	0.88	0.99	0.92	0.89
35	1.11	1.13	1.14	0.75	0.86	0.99	0.91	0.88
40	1.12	1.14	1.16	0.71	0.84	0.99	0.89	0.86
45	1.14	1.16	1.18	0.67	0.82	0.99	0.88	0.84
50	1.15	1.18	1.20	0.64	0.80	0.99	0.87	0.82
55	1.17	1.20	1.22	0.60	0.78	0.99	0.85	0.81
60	1.18	1.22	1.24	0.56	0.76	0.98	0.84	0.79
65	1.20	1.23	1.25	0.53	0.74	0.98	0.82	0.77
70	1.21	1.25	1.27	0.49	0.72	0.98	0.81	0.75
75	1.23	1.27	1.29	0.45	0.70	0.98	0.80	0.74
80	1.24	1.29	1.31	0.42	0.68	0.98	0.78	0.72
85	1.26	1.30	1.33	0.38	0.66	0.98	0.77	0.70
90	1.27	1.32	1.35	0.35	0.64	0.98	0.76	0.68
95	1.29	1.34	1.37	0.31	0.62	0.98	0.74	0.66
100	1.30	1.36	1.39	0.27	0.60	0.97	0.73	0.65

The equipment rate factors in Table 22 are used to adjust for regional cost differences listed in the Equipment Watch Rental Rate Blue Book.

Table 22 - Equipment Rate Adjustment Factors

% LABOR	AZ, NM, UT	CA, SD, WY
5	0.97	1.04
10	0.97	1.04
15	0.97	1.03
20	0.98	1.03
25	0.98	1.03
30	0.98	1.03
35	0.98	1.03
40	0.98	1.02
45	0.98	1.02
50	0.99	1.02
55	0.99	1.02
60	0.99	1.02
65	0.99	1.01
70	0.99	1.01
75	0.99	1.01
80	0.99	1.01
85	1	1.01
90	1	1
95	1	1
100	1	1

No adjustment is necessary for Colorado, Idaho, Kansas, Nebraska, or Nevada

Steps to Adjust Davis-Bacon Costs

Example 1 - New Mexico 18" Culvert
New Mexico
For Item 60250 - 18" culvert (new construction)
Percent labor = 25% (*reference Section 602*)
Cost Guide unit cost = $28.00/LF (*reference Section 602*)
Adjusted Davis-Bacon cost = Cost Guide unit cost x Davis-Bacon adjustment factor x equipment adjustment factor = $28.00 x 0.82 (*reference*

) x 0.98 (*reference Table 22*) = $22.50/LF

Example 2 - California 18" Culvert
California
For Item 60250 - 18" culvert
Percent Labor = 25% (*reference Section 602*)
Cost Guide unit cost = $28.00/LF (*reference Section 602*)
Adjusted Davis-Bacon cost = $28.00 x 1.13 (*reference*

) x 1.03 (*reference Table 22*) = $32.59/LF

End of Engineer's Estimate

TIMBER SALE WAGE RATE ADJUSTMENTS

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Davis-Bacon/Timber Sale Wage Rate Adjustments

All road construction projects must first be estimated as if being built by public works contracts using Davis-Bacon wage rates. For Timber Sale Contracts, the engineer's estimate must then be adjusted to take into account the difference between Davis-Bacon wage rates and the local wage rates paid by timber purchasers. This adjusted construction cost is called the "Total Estimated Road Construction Cost." The method to use for the cost adjustment is explained below.

The following labor percentage ranges shown in Table 23 are typical and include equipment operators, truck drivers and laborers. The actual percentage selected should be documented. Use of percentages different than those indicated and the reason for the selection should also be documented.

Table 23 - Labor Percentage Ranges

Work Item	Percent Labor	Low Percent Factors	High Percent Factors
151-Mobilization	30-60	Short travel distance with few pieces of equipment to dismantle and reassemble.	Long travel distance, many pieces of equipment to move, dismantling and assembly of equipment, semi-permanent structures, platforms, etc., to erect for project support
201-Clearing and Grubbing	40-55	Small timber, light ground cover, gentle terrain, good soils, scattering, accessible to equipment.	Large timber, heavy ground area, difficult terrain, poor soils and rock, pile and burn, inaccessible to equipment.
204-Excavation and Embankment This item may be broken down as follows: Earthmoving Slope, Rounding, and Benching Compaction Scarification Drill and Blast Traffic Control Station-Yard Overhaul Yd^3-mile Overhaul	20-45 24 25 30 45 86 90 23 37	Gentle terrain, good soils, wide poor soils and tolerances, no blasting	Difficult terrain, rock, close tolerance, blasting, and haul.
209-Structure Excavation and Backfill	35-45	Gentle terrain, good soils, easy equipment access, no dewatering.	Difficult terrain, poor soils and rock, equipment access difficult, dewatering required.
251-Riprap Hand-Placed Machine-Placed Sacked Wire-Enclosed	 75 35 60 75		
253-Gabions	30-40		
303-Road Reconditioning	40-60		
322-Minor Aggregate Course	30-50	Crushed pit rock, wide gradation tolerance	Crushed quarry rock, close gradation tolerance.

Work Item	Percent Labor	Low Percent Factors	High Percent Factors
400-Asphalt Pavement	20-30	Large project, road mix, wide tolerance	Small project, plant mix, close tolerance, labor intensive.
550-Bridge Construction	20-30	No reduction if purchaser is not equipped to perform. Requires analysis of equipment, labor, and materials	
602-Culverts and Drains	20-30	Gentle terrain, easily available bedding and backfill material.	Steep pipe grade, poor gradation for bedding and backfill material.
605-Underdrains (Installation Only) Backfill Filter Cloth Special Granular Backfill	 90 10 10 25		
606-Corrugated Spillways Installation Only	20 80		
619-Fences, Gates and Cattleguards Metal gates and cattlequards Fence and wire gates	 10 15 60-65		
625-Turf Establishment	30-50	Hydromulch, flat slopes, large project.	Hand-placed mulch, steep slopes, small project.

The amount of labor involved in work items not shown above must be determined by analysis of labor, materials, and equipment for the item.

See individual items in text of Cost Guide for other labor percentages. Note that contract items (items not normally accomplished by woods crews such as engineering and asphalt items) are not to be reduced, if the subcontractor is expected to pay Davis-Bacon wage rates. See Labor Rates in the Engineer's Estimate section of this Guide for Davis-Bacon wage rate information.

Table 24 below is just for reference and lists the reduction percentages to be applied to the labor costs for each work item based on the state where the project is located. Table 25 on the following page provides the unit costs adjustment factors to apply to the Engineer's Estimate (Davis-Bacon wages) unit costs based on the percent labor involved and the work zone.

Table 24 - State Labor Reduction Percentages

State	Reduction
Arizona	No Adjustment
California	No Adjustment
Colorado	25%
Idaho	27%

State	Reduction
Kansas	No Adjustment
Nebraska	No Adjustment
Nevada	No Adjustment
New Mexico	No Adjustment

State	Reduction
South Dakota	No Adjustment
Utah	63%
Wyoming	No Adjustment

Procedures to Determine Costs

To determine the Estimated Timber Sale Road Construction Cost for any item, use the following procedure.

1. Determine the Davis Bacon wage rate area and/or zone. For instructions, see the previous section of this guide, Engineer's Estimate.

2. Determine labor percentage for applicable item in the body of this Guide or from Table 23.

3. Select the appropriate unit cost adjustment factor from Table 25.

4. Determine the estimated Timber Sale Road Construction Cost for the applicable item by multiplying the public works cost by the labor factor determined in item 3.

Example 3 - Timber Sale Road Construction Cost

Public works excavation cost	=	$1.90/cy
Project location: Idaho		
Excavation: labor percentage (*from Table 23*)	=	25%
Unit cost adjustment factor (*from Table 25*)	=	0.93
Estimated road construction cost	=	$1.90/cy * 0.93 = $1.77/cy

Time Estimates For Road Construction Projects

Care must be exercised when determining time estimates. The final time estimate should not be made until all contract clauses are known, including applicable C provisions for timber sale contracts. Be sure to consider operating season limitations. Project access and sequencing must also be considered.

Except in unusual circumstances, the time estimate should not exceed two (2) full construction seasons. This may require increasing the size of the crew and the amount of equipment used in the estimate. In addition, this may require the adjustment of some cost items and contract clauses. For projects that will require more than one construction season to complete, be sure to allow for the cost of the mobilization of equipment and personnel for each operating season.

When the construction of specified roads in a timber sale contract can be turned back to the Forest Service, consider the effect on the road completion date. Allow sufficient time for the Forest Service to prepare a public works contract, receive a satisfactory bid, and have the road construction work completed by the “Road Completion Date” stated in the Timber Sale Contract. A minimum of 155 days should be allowed to prepare, solicit, and award a Public Works contract.

Whenever the Total Estimated Road Construction Cost for a timber sale is $50,000 or more, consider the possibility of a turnback. (*reference FSH 2409.18 43.5*) Use the following form to track the various time components associated with a turnback and to determine if the proposed road completion date to be included in the timber sale contract is attainable.

Table 25 - Timber Sale Unit Cost Adjustment Factor For Wage Differentials

LABOR %	AZ	CA	CO	ID	KS	NE	NV	NM	SD	UT	WY
5	1.00	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00	0.97	1.00
10	1.00	1.00	0.98	0.97	1.00	1.00	1.00	1.00	1.00	0.94	1.00
15	1.00	1.00	0.96	0.96	1.00	1.00	1.00	1.00	1.00	0.91	1.00
20	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.87	1.00
25	1.00	1.00	0.94	0.93	1.00	1.00	1.00	1.00	1.00	0.84	1.00
30	1.00	1.00	0.93	0.92	1.00	1.00	1.00	1.00	1.00	0.81	1.00
35	1.00	1.00	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.78	1.00
40	1.00	1.00	0.90	0.89	1.00	1.00	1.00	1.00	1.00	0.75	1.00
45	1.00	1.00	0.89	0.88	1.00	1.00	1.00	1.00	1.00	0.72	1.00
50	1.00	1.00	0.88	0.87	1.00	1.00	1.00	1.00	1.00	0.69	1.00
55	1.00	1.00	0.86	0.85	1.00	1.00	1.00	1.00	1.00	0.65	1.00
60	1.00	1.00	0.85	0.84	1.00	1.00	1.00	1.00	1.00	0.62	1.00
65	1.00	1.00	0.84	0.82	1.00	1.00	1.00	1.00	1.00	0.59	1.00
70	1.00	1.00	0.83	0.81	1.00	1.00	1.00	1.00	1.00	0.56	1.00
75	1.00	1.00	0.81	0.80	1.00	1.00	1.00	1.00	1.00	0.53	1.00
80	1.00	1.00	0.80	0.78	1.00	1.00	1.00	1.00	1.00	0.50	1.00
85	1.00	1.00	0.79	0.77	1.00	1.00	1.00	1.00	1.00	0.46	1.00
90	1.00	1.00	0.78	0.76	1.00	1.00	1.00	1.00	1.00	0.43	1.00
95	1.00	1.00	0.76	0.74	1.00	1.00	1.00	1.00	1.00	0.40	1.00
100	1.00	1.00	0.75	0.73	1.00	1.00	1.00	1.00	1.00	0.37	1.00

Form 1 - Time Estimating and Scheduling Form

Road completion date will be set by determining the timber sale advertisement date and adding the following:

	Timber Sale (T.S.) Advertisement Date	_____
1.	Sale Advertising Period	30 Days
	Timber Sale Bid Opening Date	_____
2.	Period specified in the T.S. advertisement to allow the F.S. to solicit and award a P.W. Contract for the road construction. (155 days minimum is recommended. See note below)	* 155 - 170 Days
	Public Works Construction Award Date	_____
3.	Additional time needed between P.W. contract award date and date construction could start.	10 Days
	Public Works Construction Start Date	_____
4.	Total calendar days elapsed time allowed for completion of road construction Public Works contract.	_____ Days
	Computed Construction Completion Date	_____
5.	Additional time for expected excusable delays for P.W. contracts. This time will only be added to determine the road completion date in a Timber Sale (C5.13#) not to determine contract time for a Public Works contract.	_____ Days
6.	W.O. approval for projects over $100,000. (see note below)	15 Days
	Final Road Completion Date	_____
	Planned Timber Sale Termination Date	_____

* The time permissible may vary by local policy. Check with the Timber staff to see if there are any Regional supplements that may dictate the maximum time period. The time period is comprised of the following items:

1. 80 days for Engineering to convert the timber sale road contract to Public Works format, including modification of supplemental specifications, development of contract documents, and to submit road package to Administrative Services. Additionally, Job Codes must be set up, Work Plan developed, and IAS data entry and approval process must be completed.
2. 5 days for AQM to prepare solicitation documents.
3. 15 days synopsis (Fedbizopps.gov) by AQM.
4. 15 days notice to public prior to solicitation..
5. 30 days advertising period.
6. 15 days to evaluate bids and make award.

7. If project is over $100,000 and will not be set aside as an 8a, HubZone or SDVOSB (Service Disabled Veteran Owned Small Business) contract add 15 days for W.O. approval.
8. Consider additional time if access to project for pre-bid tour is not available due to inclement weather or other restrictions.

End of Timber Sale Wage Rate Adjustments

PROJECT REQUIREMENTS

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Section 151 - Mobilization

(Labor 30-60%)

Mobilization costs are those for preparatory work and operation including bonding and tasks necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, and for all other work and operations which must be performed or costs incurred including obtaining permits.

Average bids reflect that mobilization costs are 6 percent to 10% of the total project cost. Smaller projects tend to show mobilization as a higher percentage of the total project cost. The number of move-ins and operating seasons will increase this percentage. Listed in Table 26 are normal percentages for mobilization.

Table 26 - Average Mobilization Percentages

Total Project Cost		Mobilization Costs of Project
Low	High	
$ 50,000	$ 600,000	9%
600,000	899,999	8%
900,000	1,999,999	7%
1,200,000	over	6%

These percentages consider a normal project to have two construction seasons. *If specialized pieces of equipment or machines are required, the percentage should be increased. If the time and equipment method is used calculate mobilization, make allowances for obtaining permits, insurance, bonds, and moving personnel and materials to the job site.*

A. Roading Costs.

Roading costs can be used for time and equipment jobs, particularly for reconstruction projects. The method for calculating these types of move-in costs would be to determine the time to move to the project site and begin productive operation, then affix proper standby rates, usually 45% to 55% of listed rental rates, plus wage rates. For projects of this type and others where mobilization can be readily figured in as an integral part of the listed pay item, it may be unnecessary to include a separate mobilization pay item in the contract. Average roading costs are listed below for some standard equipment:

Table 27 - Average Equipment Roading Costs per Mile

Equipment	Ave. Speed (Mi./Hr)	$ per mile
Grader, Motor Patrol (CAT 12H)	20	6.20
Loaders, CAT 950G	20	5.80
Dump Trucks, 10-12 cy	30	4.20
Water Trucks, 4000 gallon	30	3.50
Service Trucks, 1 ton	30	2.20
Lowboys		
35 ton	25	5.60
50 ton	25	5.70

Example 4 - Simple Mobilization
Total of all pay items without Section 151 = $110,000
Project Location: Wyoming

Mobilization Costs = $110,000 x .09 (*reference Table 26*) = $9,900

Example 5 - Rock Crusher Mobilization
Total of all pay items without Section 151 = $110,000
Project Location: Wyoming
A rock crusher (jaw style) is required.

Mobilization Cost = $110,000 x .09 (*reference Table 26*) = $9,900

Crusher Movein/Moveout (*reference Section 322*) = $12,000
Total Costs = $9,900 + $12,000 = $21,900
Total Engineer's Estimate = $110,000 + $21,900 = $131,900

Mobilization should not exceed 10% of contract ($131,900) or $13,200 (rounded), so place $13,200 under Section 151 and the remainder,$8,700, under Section 322.

Section 152 - Construction Survey And Staking
(Contract Item)

A. Road Location.
There are no recent costs for this item at the present time.

B. Construction Surveys.
Detailed surveys of existing roads generally run higher than new construction due to the presence of cut/fill slopes, culverts, and other features.

Survey costs for A/E negotiated survey and design contracts should be estimated using the recent contract costs if known. Additional fieldwork may include items such as material and clearing classification, special site investigation, and stream flow estimates. The engineering firm will normally have a higher overhead cost because a business engaged in survey and design work usually has more office equipment, computers, etc. than a firm specializing in only survey work.

Hourly crew costs below are from RS Means Crew Cost Data Table for Crew A-7. The two-person field party consists of an instrument person and rod person, and is suitable for level loop surveys. The three-person field party consists of a party chief along with an instrument person and rod person, and is suitable for construction surveys and slope staking.

Table 28 - RS Means Survey Crew Cost Data

Crew/Expense	Cost
Two-person field party field work	$122 per hour
Three-person field party field work	$180 per hour
Supervision person	$ 77 per hour
Per diem	$ 60 per person per day
Transportation	$0.55 per mile
Motel, camp expenses	Variable, depends on project location (approximately $50/day)

The following production rates should be used as a guide in estimating fieldwork:

1. Brushing:
Three-person crew. The production for brushing is dependent upon density of stems and will vary with the requirements of the contract:

Table 29 - Survey Crew Production Rates

Density of stems	Miles per day
Extra heavy	0.35
Heavy	0.5
Medium	0.7
Light	1.0
Extra light	1.5

2. P-Line Survey:
Estimate P-Line survey costs in Section 183.

3. Traverse:
Three-person crew. The production for traverse is dependent upon the precision of survey and number of points of intersection (PI's) per mile. This cost estimate is broken down according to the precision desired. It is, therefore, mandatory for the estimator to know the precision required before making the estimate. The chaining difficulty is constant with the number of PI's per mile on which this cost guide will be based. For average conditions consider a production rate of a half mile per day of completed work.

For survey precision standards see the Survey Accuracy Standard, FSH 7709.56, pg 3.9-2.

Table 30 - PI Survey Crew Production Rates

PI's per mile	Precision A,B Miles per Day	Precision C,D Miles per Day	Precision E,F Miles per Day
60 to 70		0.5	0.6
50 to 60		0.6	0.7
40 to 50	0.3	0.7	0.8
30 to 40	0.5	0.8	0.9
20 to 30	0.6	0.9	1.0
10 to 20	0.9	1.0	1.1
5 to 10	1.0		

4. Levels:
Two-person crew. The production for levels is mainly dependent upon the precision of survey. Therefore, this cost guide is based on average production figures for a given precision. The estimator should use his/her own judgment and adjust these figures if they do not fit the individual project.

Table 31 - Level Survey Crew Production Rates

Accuracy Standard	Miles per day
A, B	0.5
C,D	0.7
E, F	1.0

5. Cross Sections:
Three-person crew. Cross sections are generally constant in production between 0.4 mile to 0.7 mile per day. The brushing for extra heavy and heavy brush are figured in the brushing estimate. Therefore, this item will consider the slope only. If the estimator has unusual circumstances, he/she should adjust the production figures accordingly.

Table 32 - Cross Section Survey Crew Production Rates

Slope	Miles per day
50% +	0.4
30 to 50%	0.6
0 to 30%	0.7

6. Supervision:
Allow 1 day per week of survey crew time for supervisory engineer at $620 per day.

7. Mobilization:
Allow move-in/move-out costs, supplies, transportation at $0.55 per mile.

8. Checking Notes-Office Work:
All notes need to be office checked for completeness. Traverse and level notes need office work in recording and computation for angles and elevation. There is no per diem allowance for this work. Allow 1 to 2 hours per mile for one person at a rate of $63 per hour.

9. Materials Investigation and Testing:
See Section 153 or 154 for unit costs.

C. Site Surveys.
Cost per site of $3,900 to $7,650 per site. Includes setting control, topographic data collection, and plotting site plan.

D. Corner Search, Monumenting, and Boundary Marking and Posting.
Contact the Forest Land Survey staff for costs associated with this type of work.

E. Construction Staking.

Construction staking us usually accomplished by either Method I - Computed Method or Method II - Catchpoint Measurement Method.

1. Method I - Computed Method.

With this method the surveyors use the template information shown in the slope stake notes to calculate the actual location of the catchpoint. The slope stake "catchpoint distance" shown in the stake notes may be used as a trial location to initiate slope staking.

Add $92.00 per culvert for culvert staking using the computed Method I. This is based on an allowance of 30 minutes per culvert.

2. Method II - Catchpoint Measurement Method.

With this method the surveyors locate slope stake catchpoints and clearing limits by measuring the "catchpoint distance" shown in the slope stake notes.

The base cost for Method II - Catchpoint Measurement Method is $3,450 per mile. This is based on using a 3 person crew, completing 0.5 miles per day, 120 points per mile, staking cut and fill catchpoints, and setting one RP stake per side. Includes costs for stakes, paint, markers, flagging, travel, and per diem. For an average project assume camp is within 10 miles of project and access is at the beginning of each job and each job is two miles in length.

3. Calculating Unit Costs:

Average base prices should be multiplied by the following factors to determine final unit cost.

Method I: Computed Method x 1.5
Slope Staking - one side: 0.85
Slope Staking - both sides: 1.0
Side Slopes - 0 to 30%: 1.0
Side Slopes - 50% and over: 1.25
Brush Density - light: 1.0
Brush Density - heavy: 1.33

Section 153 - Contractor Quality Control

These costs are to be included as subsidiary to the respective pay item in capital investment and 14i (turnback) estimates. DO NOT HAVE QUALITY CONTROL AS A SEPARATE PAY ITEM!

Section 154 - Contractor Sampling And Testing

There are four aspects of contractor sampling and testing:

1. Certificates of compliance
2. Field and laboratory sampling and testing

3. Field measurements
4. Records of sampling, testing, and measuring

A. Project Records.

Projects that include controlled compaction for excavation, graded aggregate (not pit run), concrete, asphalt, major drainage structures, and similar work requiring specific sampling and testing (Included in FSSS 153 or FSSS 154) have quality control record keeping costs of approximately $25/day while the above-noted work is in progress. These costs decrease to approximately $15/day while the above-noted work is not in progress but work requiring contractor quantity measurements is in progress.

Projects that basically consist of clearing, excavation (Placement Methods 1 and 2), and minor culvert installation have quality control record keeping costs of approximately $15/day while work requiring contractor quantity measurements is in progress.

B. Sampling and Testing

The following testing costs are from Materials Testing and Inspection, Boise, Idaho as of February 2009.

Table 33 - Materials Testing and Inspection Costs

Item	Units	Rate
---SOILS INSPECTION and TESTING		
Field Density Testing D2922	hours	$45.00
Proctor D698, D1557/T99, T180	each	$140.00
Sieve Analysis- Coarse and Fine C117, C136/T11, T27	each	$75.00
Atterberg Limits D4318/T89, T90	each	$90.00
Sample Pick Up	hours	$42.00
Subgrade Inspector/Geologist	hours	$80.00
---CONCRETE INSPECTION and TESTING		
Concrete Inspector	hours	$42.00
Epoxy Bolt/Dowel Inspector	hours	$42.00
Concrete Cylinders C39/T22	each	$15.00
Cylinders Pick Up	hours	$42.00
---MASONRY INSPECTION and TESTING		
Masonry Inspector	hours	$42.00
Mortar Cylinders Strength C109/T106	set of 3	$45.00
Grout Prisms C1019	set of 4	$60.00
CMU Compressive Strength (Prisms) (Grouted) C1314	set of 3	$225.00
CMU Compressive Strength (Block Only) C140	set of 3	$75.00
CMU Absorption, Density and Moisture C140	set of 3	$90.00
---ASPHALT INSPECTION and TESTING		
Asphalt Field Density Testing D2922	hours	$45.00
Asphalt Coring D979	hours	$125.00
Asphalt Core Specific Gravity, Height, Diameter, Weight	each	$50.00
Asphalt Content-by Ignition Method D6307/T308	each	$125.00
Mechanical Analysis D5444	each	$75.00
---MISCELLANEOUS ITEMS		
Professional Engineer	hours	$100.00
Per Diem	day	$100.00
Mobile Laboratory	month	$1,500.00

Item	Units	Rate
Mileage	miles	$0.65
Letter of Affidavit	hours	$85.00

Overall costs for contractor sampling and testing, not including costs for individual tests, should range from $500/week for relatively simple projects to $1,400/week for more complex projects if only one technician is required. Add up to $1,000/week for each additional technician required.

The cost of a mobile lab may be required for more complex projects.

When more than one road project is included in a contract, the costs for Section 153 should be prorated among the individual roads or road segments based on project size and the type of work included in each individual road project.

For those contracts or projects having a small amount of contractor QC per the FSSS's (no specific field tests), all costs are incidental to other items and should not exceed $50-$100/week. This cost is primarily associated with any contractor measurement that is required. For simplicity, it may be advisable to add this cost to Mobilization rather than spread it over several items.

Section 156 - Public Traffic

The cost of opening a road under reconstruction to traffic several times during the day can add as much as 50% to the normal cost of excavation, culverts, clearing, etc. This is due to the decrease in work efficiency and production on the part of the contractor and increased liabilities for public safety. Traffic volumes normally found on most Forest Service roads generally do not justify opening the road more than once during the work shift, and only if the road has significant traffic. If difficult construction work such as rock blasting or large culvert replacement is anticipated on existing roads, total road closure should be considered in the interest of public safety and cost savings. All too often road openings are for the convenience of the Forest Service and have little bearing on public use, particularly during weekdays.

A. Construction Induced Maintenance (CIM).

Payment for construction induced maintenance can be made in several ways, depending on the situation. CIM should be included in and made a requirement of the contract, public works or timber sale.

When CIM is required to support a specific construction activity, payment and the cost estimate should be subsidiary to that item. Hauling of aggregate or borrow are examples of this. Maintenance associated with transport of right-of-way timber will be included in construction cost only for capital investment projects and only when timber becomes property of the contractor.

If the CIM is required to support general construction access and traffic, CIM can be a subsidiary item to mobilization.

If the amount of CIM is uncertain or likely to be variable, it may be advisable to estimate and make payment based on actual quantities under Section 622, Rental Equipment.

In all cases, appropriate Forest Service Supplemental Specifications to Section 156 are required to define the work and indicate how payment will be included in the contract. Due to the possibility of 14i turnbacks, C5.312 shall not be used to cover CIM under timber sales. Be sure to follow directions regarding commensurate shares when estimating and specifying this work.

Section 157 - Soil Erosion Control

This work consists of temporary and permanent measures incorporated into the project to reduce and control soil erosion and water pollution. The estimator should consider all measures used to provide this protection. Measures taken may be in areas that in the past have been considered "normal practice", i.e., waterbars constructed on roads during construction, or they may be items that have been designed specifically for erosion control. Timing may impact costs, i.e., if rock blankets are required prior to constructing a road to a pit run borrow source, an alternate source which may be more costly is necessary.

Costs may be estimated directly under Section 157 and shown on the Schedule of Items or may be subsidiary to other pay items (the parent section). Some examples of cost item determination are:

Section 157.09 Diversions, Earth Berms. The purpose of the berm is for a reduction of erosion. Payment for this item may be subsidiary to other items or paid for under Section 157.

Section 157.05 Filter Barriers, Silt Fence. This is a specialized pay item and would not fall under other items of work. It should be used in the contract specifically as a soil erosion item, under Section 157.

Section 157.11 Temporary Turf Establishment. This work is accomplished solely for the purpose of erosion control. The cost of this work is directly related to Section 157. This cost should not be considered under Section 625.

If the primary purpose of the windrow is slash disposal, this work should be priced under Section 201 and/or 203. When all or part of this cost is exclusively for erosion control, it should be shown as a cost under Section 157.

A. Cost Estimating Guidelines

For items not listed here or covered under other items, estimate by time, material and equipment. After calculating cost, determine labor percentage and make appropriate reductions for timber sales.

Table 34 - Soil Erosion and Water Pollution Control Costs

Description of Work	Pay Unit	Estimated Cost	Percent Labor
Temp Seeding and Fertilizing Seed at 30 lb/acre, seed and fertilizer in one application Fertilizer at 200 lb/acre	acre	$400-$610	20-40%
Dry Mulching (Weed Free Straw) Seed at 30 lb/acre Fertilizer at 200 lb/acre Straw at 2 tons/acre	acre	$1500-$1900	30-40%
Hydromulching Seed at 40 lb/acre Fertilizer at 200 lb/acre J-TACK H-S at 120-160 lb/acr Wood Cellulose Fiber at 150-300 lb/acre Hay or Straw at 2 tons/acre Water as Necessary	acre	$2000-$4000	20-50%
Temporary Netting Should price using specific Material / Labor, etc	SY	$4.50-$6.40	60-70%
Straw/Hay Bales (Weed free required) Bales placed by hand below CMP's prior to installation at live water; also used below outlet of cross-drains in highly erosive soil areas and in ditches.	each	$23-$32	35-50%
Gravel Blanket Sheathing	cy	Materials, Time and Equipment	
Silt Fence 3 ft. high, includes wood stakes	LF	$7-$12	50-60%
Earth Berm	LF	$0.18-$0.23 Cost from Section 204	30%
Dam	each	Materials, Time and Equipment	
Temporary Water Bars Constructed very shallow upgrade, but near CMPs and also midway between CMPs. Should be constructed just prior to compaction. Aggregate may be placed over temp waterbars, w/o removal. Temp waterbars will not provide adequate protection when installed with soil in overly saturated state. Not intended for permanent use. Equipment - Cat 12H w/ operator, rate of production is 15-20 bars/hr. Estimate construction just prior to compaction, no additional allowance made for compaction.	each	$7-$9	30%-40%
Permanent Water Bars Constructed to design depth and location. Equipment - Cat D7 w/ operator rate of production is 5-10 bars/ hour	each	$20-$40	20%
Drain Dips Equipment - D7 w/ operator and Cat 12H w/ operator	each	$105-$145 Cost from Section 204	25%

Section 170 - Develop Water Supply and Watering
(Labor 50-70%)

A. Estimated Quantity.
For embankment construction, estimate 5-10 gallons/cy. For base and surface courses, estimate 35-44 gallons/cy or 20-25 gallons/ton.

B. Total Cost.
Watering cost includes installing either a pump or gravity system to fill the tanker, filling time, and haul. Unit costs range from $31 to $38 per thousand gallons, including haul (assuming 5 -10 mile round trip from water source).

If any other work is required such as digging a basin, constructing a large check dam or constructing a spur road, compute these costs by using time and equipment methods.

C. Haul Costs.
Haul costs include truck and driver time. Calculate haul costs from the source to the center of project. Center of project is the center of embankment mass for excavation and linear center of project for base and surfacing.

D. General.
Estimator is cautioned that designs including this section as a separate pay item require *additional inspection and control* by FS contract administration personnel during construction, coordinate with them when costing for this item.

Normally, watering costs are estimated using time and equipment and the cost is considered subsidiary and included in the unit costs of other items such as excavation and aggregate.

Section 183 - P Line Survey

P-Line costs are generally dependent on survey standards, project access (drive, walk, camp, etc), terrain, vegetation density and time schedule. Establishment of spike camps can add costs to a project, long walks or difficult vehicle access can also increase the survey costs. Reestablishment of old P-Line can be estimated to cost about $870/mile, based on using a 2 person crew and a production rate of 1.5 miles per day.

Survey costs for A/E negotiated survey and design contracts should be estimated using the recent contract costs if known. Additional fieldwork may include items such as material and clearing classification, special site investigation, and stream flow estimates. The engineering firm will normally have a higher overhead cost because a business engaged in survey and design work usually has more office equipment, computers, etc. than a firm specializing in only survey work.

Hourly survey crew costs are available in Table 28. Use the following production rates as a guide in estimating fieldwork:

A. P-Line Survey.

Three-person crew. This work includes collection of traverse and cross section data needed for low volume road design. The production for P-line survey is dependent upon the precision of survey and number of points of intersection (PI's) per mile, and the width of the cross-section swath. For average conditions consider a production rate of a half mile per day of completed work. Costs for completed surveys range from $2490 - $4280 per mile, including supplies(stakes, paint, flagging, etc.), and travel expenses(per diem, mileage, etc.) based on easy terrain and minimal brush.

Table 35 - P-Line Survey Production Rates

PI's per mile	Average P-Line Spacing (ft)	Miles per Day
176	30	0.35
132	40	0.45
106	50	0.55
88	60	0.68

B. Other Types of Surveying.

All types of construction surveying except for P-Line surveys should be estimated in Section 152.

C. Supervision.

See Section 152 for unit costs.

D. Mobilization.

See Section 152 for unit costs.

E. Checking Notes-Office Work.

See Section 152 for unit costs.

F. Materials Investigation and Testing.

See Section 153 or 154 for unit costs.

Section 185 - Low Volume Road Design

Road design includes classification, plan and profile, cross sections, and plan-in-hand reviews. Ranges from $2,800 to 3,500 per mile for new construction.

End of Project Requirements

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CLEARING AND EARTHWORK

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Section 201 - Clearing And Grubbing
(Labor 40-55%) and
Section 202 - Additional Clearing And Grubbing

A. General.
There are too many variables reflected in the bids to use them solely as a basis for costs. Therefore Figure 1 is given as a starting point for an "average" new construction project. The designer will need to consider the uniqueness of the project and estimate accordingly. Also consider the amount of vacant (no clearing) area in relation to the acreage being cleared. The factors used are based on the use of the hydraulic excavator for clearing/pioneering.

B. Clearing Classification.

1. Classification by volume per acre of timber within clearing limits:
The classification of clearing by volume per acre is shown on Figure 1, this section. It is essential that timber volumes be estimated within accuracy standards. Estimators should request gross volume figures from Vegetation Management for estimating use.

Clearing cost estimates should compensate for down material as well as that which is standing. In some cases the down volume is insignificant while in others it may be more difficult to handle than standing volume. Therefore, an adjustment factor for down material of 0 to 1.2 is appropriate.

Example 6 - Clearing Amount Estimate

Gross volume from timber cruise:	12 Mbf/Acre
Gross down volume:	6 Mbf/Acre
Factor for down material:	0.5
Volume for classification: 12 + (6 x 0.5) =	15 Mbf/Acre

C. Classification by Stand Description.
Clearing classification by stand description is based on a uniform mixture of large and small trees. The classification can be based on the stem spacing and average diameter as shown on Figure 2, this section, or by the guidelines below. Additional items to be considered are the amount and size of down material and the size of stumps and limbs.

- *EXTRA LIGHT:* Few tops and limbs. Few, if any, cull logs. Low scattered brush. Little or no falling or yarding of unmerchantable timber required.

- *LIGHT:* Light to moderate amount of tops and limbs. Few cull logs. Light brush. Little to moderate falling or skidding of unmerchantable required.

- *MEDIUM:* Light to moderate amount of cull logs. Many tops and limbs. Tall brush or dense unmerchantable trees requiring falling. Some unmerchantable material requiring skidding.

- *HEAVY:* Many tops and limbs from dense stand of unmerchantable timber. Tall, heavy brush or dense unmerchantable pole stand requiring falling and bucking numerous cull logs. Yarding of unmerchantable necessary.

- *EXTRA HEAVY:* Much cull material requiring falling. Many large, downed cull trees. Area may be swampy or wet. Closely spaced extra large stumps. Thick duff and other organic material.

D. Topographic Factor.

The cost-per-acre figures should be adjusted by the following topographic factors.

Table 36 - Clearing and Grubbing Topographic Factors

Ground Slope	Factor
Gentle (under 20%)	0.8
Moderate (20 to 45%)	1.0
Steep (over 45%)	1.1-1.3
Areas that require more than one pioneer or a long boom machine due to high cut/fill	1.4-2.0

E. Slash/Cleanup Factor.

The cost-per-acre figures must also be adjusted by the slash cleanup factor if the required treatment method is other than windrowing. Care must be exercised in applying this factor, however. For example, "scattering" in steep terrain or in areas of dense undergrowth can result in significantly higher costs than windrowing. The adjustment factor 1.15 for scattering would apply for average side slopes and open understory. If stumps are to be split or partially buried, the factor used for them may need to be adjusted.

Table 37 - Clearing and Grubbing Slash/Cleanup Factors

Treatment Method	Factor
Windrow	1.0 - 1.1
Windrow and Cover	1.25
Scattering	1.15 - 1.35
Burying	1.6 - 2.0
Chipping	1.75
Pile and Burn	1.6 - 2.0
Deck Unmerchantable Material	1.1
Disposal in Cutting Units	1.2
Removal	2.0
Piling	1.3
Placing slash on embankment slopes	1.4

Different treatment methods may be specified for Tops and Limbs, Logs, and Stumps. When this occurs, the following slash treatment combinations should be used to prorate costs based on the treatment method specified for each type of slash. Adjustments can be made to meet local project conditions.

Table 38 - Slash Treatment Combinations

Clearing Classification	Tops and Limbs (%)	Logs (%)	Stumps (%)
X-Light	30	10	60
Light	30	20	50
Medium	35	35	30
Heavy	40	30	30
X-Heavy	20	40	40

Example 7 - Slash/Clean Up Factor

Treatment Methods: Tops and Limbs - Pile and Burn
Logs - Windrow
Stumps - Scatter

Adjusted Slash Treatment Factor =

Tops and Limbs		Logs		Stumps
(0.35)(1.6)	+	(0.35)(1.00)	+	(0.30)(1.15) = 1.26

Other: Additional areas and/or strips may need to be cleared, but not grubbed, for burning bays, decking areas, and for windrowing right-of-way slash in dense lodgepole pine stands. The cost allowances for these situations should consider the treatment of tops and limbs, and logs, but not stumps. Clearing costs associated with campgrounds will normally be higher.

Cost allowance for painting and branding of logs, where required, is considered incidental to the clearing cost estimate, no separate allowance is generally required.

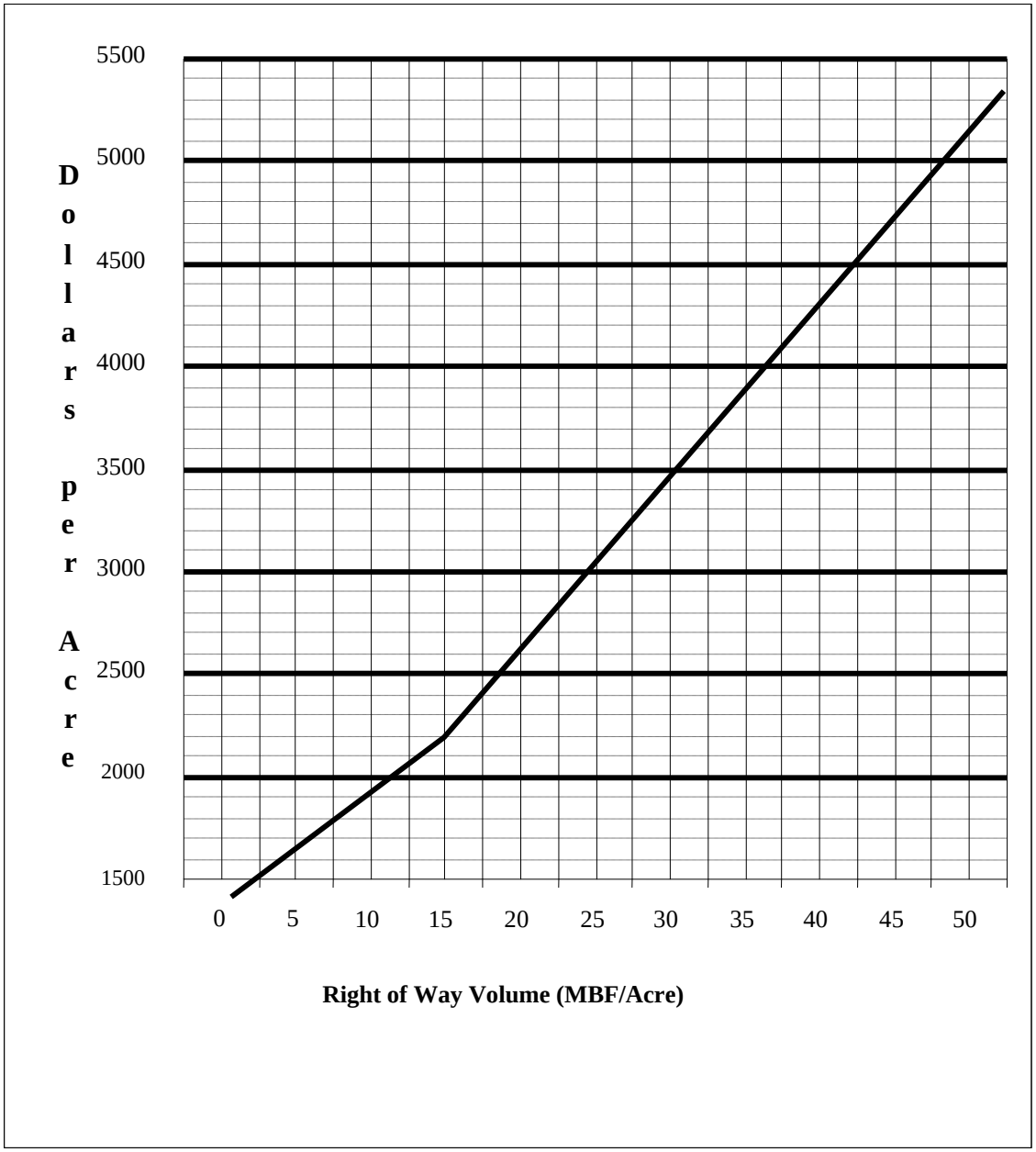
Section 202 - Individual Removal of Trees

(Labor 45-60%)

This includes falling and windrowing the slash of hazard trees that lie outside of the clearing limits. Average cost: $160 per tree.

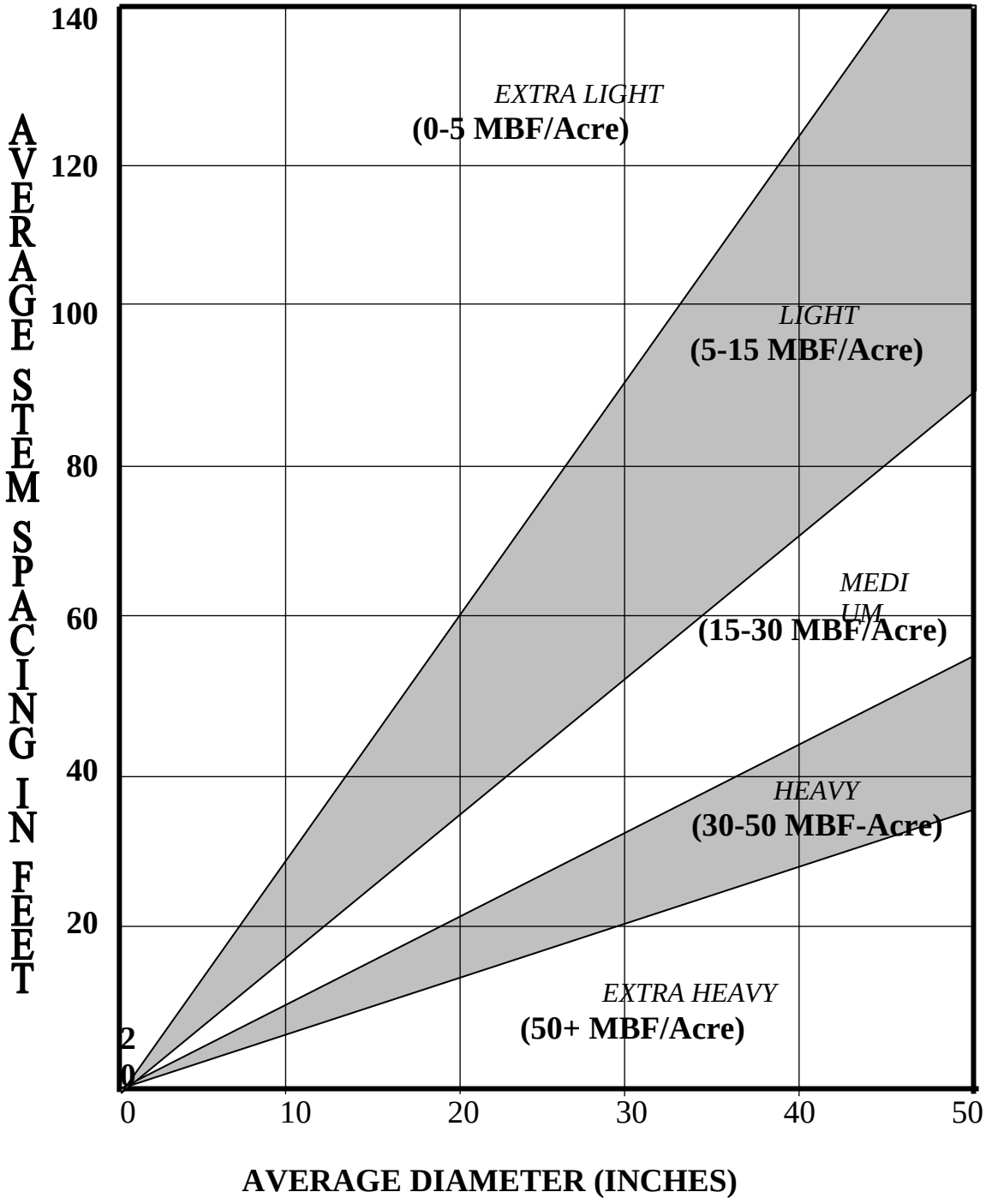
Cost to fall and leave snags outside of clearing limits equals $23 each.

Figure 1 - Clearing and Grubbing (Costs Based on Windrowing)



	Right of Way Volume (MBF/Acre)										
	0	5	10	15	20	25	30	35	40	45	50
Dollars per Acre	1300	1630	1910	2170	2600	3050	3450	3900	4300	4740	5150

Figure 2 - Equivalent Volume using Average Diameters and Stem Spacing



Clearing And Grubbing for Existing Roadbeds
(Labor 40-60)

A. *General.*
The designer will need to consider the uniqueness of the project and estimate accordingly. Consider the spacing as well as the diameter of the trees and brush to be cleared when classifying the material.

B. Clearing Classification By Stand Description.
Clearing classification by stand description is based on an average mixture of size, spacing, and density of the trees and brush on the roadbed. Disposal method by scatter.

- *Light* ($600-$1,000/mile,)
  Few trees and low brush scattered along the shoulders of the roadway. Production rate approximately 3 - 5 hours per mile.

- *Medium* ($1,000-$1,700/mile)
  Trees and brush along the entire length of the shoulders of the roadway. Production rate approximately 5 - 7 hours per mile.

- *Heavy* ($1,700-$3,260/mile)
  Trees and brush scattered throughout the entire roadway. This cost range considers the grubbing of the roadbed. Production rate approximately 7 -11 hours per mile.

- *Extra Heavy* ($3,260-$6,300/mile)
  Trees and brush densely spaced along the entire roadway. This cost range considers the grubbing of the roadbed. Production rate approximately 11 -20 hours per mile.

Section 203 - Removal Of Structures and Obstructions
(Labor 50-60%)

A. Removal of Existing Bridges.
This item should be estimated on an individual basis. Use the equipment and labor costs in computing the cost. Typical prices are:

1. Treated Timber Bridges:
$5,300 - $8,300, depending on abutment height and span. Disposal by hauling away treated timbers.

2. Native Log Bridge:
Disposal of timbers adjacent to site $1,900 - $2,800.

If a replacement structure will not be installed in the vacated crossing, allow for the cost of the appropriate road closure method and appropriate warning signs if needed.

B. *Removal and Stockpiling/Disposing of Cattleguards.*

This item must be estimated on an individual basis. Cost of equipment, labor, disposal, move-in and move-out of any special equipment, etc., needs to be considered. Use the equipment and labor costs in computing the cost (see Section 622 and Labor Rates). Make allowance for filling in the hole resulting from the removal.

C. Removal and Disposal of Pipe Culverts.

This should be estimated using time and equipment. Consideration should be given to the salvage value and disposal method of the culvert. Also consider if the culvert is being replaced at the same location.

Note: In addition to the above costs for removal of bridges, pipes, etc.; additional allowances may be necessary for removal of approach fills, reclamation and rehabilitation work, and for disposal of hazardous and toxic materials such as creosoted beams.

Section 204 - Excavation and Embankment

(Labor 20-45%)

Bid history shows little fluctuations in unit prices due to project size. Localized conditions (slope, classification, etc.) have more impact on costs for small jobs because a full range of conditions may not exist as in a larger job.

Excavation for constructing catch basins on reconstruction projects which add drainage should have the same unit cost as the culvert excavation. Both jobs will be done using the same equipment; therefore, costs should be similar. This should be a separate pay item.

The average base cost of common excavation in Idaho Area 1 is $1.66/cy. This is based upon an effective hourly production rate for a CAT D7H of 120 cy/hour.

Table 39 - Excavation and Embankment Adjustment Factors

Type	Factor
Common	1.0
Loose rock	1.5-1.75
Talus rock	1.5
Small glacial Boulders	1.75
Rippable rock	3.0
Large glacial boulders	5.0
Solid/Shot rock	5.0-8.0

A. Base costs are to be adjusted by adding the following if required.

1. Base Cost:

The average base cost of common excavation $1.66/cy. Use the material adjustment factor to change the base cost for each type of excavation.

2. Compaction Method:

Compaction does not include water. Make an allowance for water and include cost in Section 204.

Compaction Methods from complete WO FSSS 204	$/cy
Method A(1) - More than 80% retained on a No.4 Sieve	$1.03
Method A(2) - 50% to 80% retained on a No.4 Sieve	$1.20
Method A(3) - Less than 50% retained on a No. 4 Sieve	$1.50
Method B - Roller Compaction - min. 3 passes	$0.38
Method C - Compaction by Hauling and Spreading Equipment	$0.65

3. Benching Fill Slopes:

Assuming work is performed with a D-7 dozer

30-50% slope: $1.19/LF
> 50 percent slope: $1.99/LF

Note: If hydraulic excavators are used, there will be no additional cost for benching fill slopes as work will be done during clearing/pioneering.

4. Finishing:

a. Scarifying:

Costs include motor patrol, laborer, and pickup.

Type	Rate	$/Mile
Light	3 hours/mile	$570
Average	4 hours/mile	$750
Heavy	6 hours/mile	$1,130

b. Shaping and Finishing:

Make additional allowance for watering if needed.

Table 40 - Shaping and Finishing Costs per Mile of Single Lane Roads with Ditch

Tolerance Class	A	B/C	D/E	F/G/H	I/J/K/L/M
Rate (hrs/mi)	28	18	8	6	4
Cost	$5,280	$3,400	$1,500	$1,130	$750

Table 41 - Shaping and Finishing Costs per Mile of Single Lane Roads without Ditch

Tolerance Class	A	B/C	D/E	F/G/H	I/J/K/L/M
Rate (hrs/mi)	16	10	6	4	2
Cost	$3,020	$1,890	$1,130	$760	$380

For Double Lane, multiply single lane cost by 1.35.

5. Loading Material into Trucks:

	$/cy
Common and loose rock	$0.71
Stockpiles	$0.71
Ripped rock	$1.00
Blasted rock and large boulders	$3.70

6. Conservation of Rock:

For use when excavating with a dozer and excavator and placing in small stockpile within 300 ft. When excavating and hauling to central stockpile or use point beyond 300 feet, the added cost of loading and hauling should be calculated.

Push Distance →	150 Feet	300 Feet
	$7.75/cy	$8.51/cy

7. Haul:

Haul should be calculated by Time and Equipment methods.

8. Conservation of Topsoil:

Assume 3" layer of topsoil, 14 feet wide

a. Stripping topsoil and windrowing with grader, relatively flat ground: $0.88/cy or $595/mile
b. Stripping topsoil with tracked loader and placing in stockpile within 300 ft.: $2.37/cy or $1,620/mile

9. Traffic Control:

a. Open to traffic twice during shift:

Sum excavation costs.
Base cost plus options and add 30%.

Example: Summed cost for 204 = $5,700. Adjusted cost with traffic control = $5,700 x 1.3 = $7,410

b. Open to traffic once during work shift:

Sum excavation costs
Base cost plus options and add 15%.

c. Open to traffic at end of work shift:

Sum excavation costs
Base cost plus options and add 5%.

10. Water:

Estimate under Section 170 (see Complete WO FSSS 170), or include an allowance under this item.

11. Pit Development:
Estimate under Section 651 (see Complete WO FSSS 651).

B. Rounding Cut Slopes.
This work, if specified, applies to sophisticated "rounding" after initial pioneering and excavation, and not to blending of the cutslope with the natural ground during initial excavation which is done by a hydraulic excavator. Estimate by time and equipment, costs range from $0.77 to $1.15/LF.

C. Drainage Excavation and Furrow Ditches.
Drainage excavation can be estimated most easily by the lineal foot. The same piece of equipment is required for small quantities or larger amounts; but one may use something less efficient for very small amounts. Site conditions govern more than size considerations; estimate by time and equipment procedures.

D. Drainage Dips.
Drainage dips on reconstruction can be estimated at $105 to $143 each depending on difficulty of excavation. If armoring of dips is desired, make an allowance for the work incidental to the installation of the dip or include the appropriate aggregate item.

E. Earth Berms.
Continuous Berms cost about $1,200 per mile or $.23/LF

Example 8 - Sample Earthwork Calculations

Given: 4.96 miles of single lane, native surfaced road with ditch, Compaction Method C, Tolerance Class G, 30% labor. Design is self-balanced, no allowance for haul is needed. Location is Utah Area 2

80,000 cy excavation
- 70% common
- 15% rippable rock
- 15% blasting rock

Benching: 30-50% slope - 1500 LF
>50% - 2500 LF

Finishing:
a. Scarification: light -2.18 miles
average -1.36 miles
heavy - 0.28 miles
b. Shaping and Finishing: 4.96 miles

Traffic Control - N/A.

Solution:

Step 1 - Base Cost		
Common: 80,000 cy * 0.70 * $1.66	cy * base cost * material factor	$92,960.00
Rippable: 80,000 cy * 0.15 * 3.0 * $1.66	cy * base cost * material factor	59,760.00
Blast: 80,000 cy * 0.15 * 5.0 * $1.66	cy * base cost * material factor	99,600.00
Step 2 - Compaction Method		
Compaction Method C: 80,000 cy * $0.65	cy * compaction cost	52,000.00
Step 3 - Benching		
Benching (30-50%): $1.19 * 1,500	LF * benching cost	1,785.00
Benching (> 50%): $1.99 * 2,500	LF * benching cost	4,975.00
Step 4 - Finishing		
Scarifying:		
Light: 2.18 mi * $570	mile * scarifying cost	1,242.60
Average: 1.36 mi * $750	mile * scarifying cost	1,020.00
Heavy: 0.28 mi * $1,130	mile * scarifying cost	316.40
Shaping and Finishing:		
Tolerance Class G: 4.96 mi * $1,130	mile * tolerance class	5,604.80
Total Engineer's Estimate		$319,263.80

Unit Cost = $\frac{\$319,263.80}{80,000 \text{ cy}}$ = $3.99/cy

For Utah Area 2, the Adjustment Factor for Public Works Davis-Bacon Areas is 0.99 for 30% labor. (The adjustment factor comes from Table 21 in the Engineer's Estimate section of this guide.)

For all Areas in Utah , the Adjustment Factor for Equipment Differences is 0.98 for 30% labor. (Note: The adjustment factor comes from Table 22 in the Engineer's Estimate section of this guide)

Adjusted Unit Cost for Engineer's Estimate = $3.99 * 0.99 * 0.98 = $3.87/cy

Haul

(30-40% labor)

This is not a pay item, costs are incidental to and included in other items of work.

Labor: Cu Yd Mile, 35%. Note, the haul of asphalt and aggregate may be a contract item. If so, do not reduce, if the subcontractor is expected to pay Davis-Bacon wages.

Cost for cubic yard-mile haul of excavation, aggregate, riprap, borrow excavation, etc., should be derived with the use of the following procedure.

Haul of material includes the fixed costs (for the truck only) of spotting, loading, dumping, and turnaround in addition to the variable "underway" cost while hauling equipment is moving. Loading costs for the loading labor and equipment should be included under the parent specification for that work.

Haul of excavated material is to be measured (for payment) in terms of excavated cubic yards in the original position (in place). Costs shown below are based on loose cubic yards; therefore, a compaction factor adjustment (CF) must be made to provide costs based on excavated cubic yards.

$$CF = \frac{\text{in place density}}{\text{loose density}}$$

To compute haul of aggregate, borrow, riprap, etc., the compaction factor, CF, must be adjusted to fit the method of measurement; i.e., in place, vehicle quantity, compacted in place, etc.

When computing variable haul cost, the estimator should consider all the factors that effect the haul over each segment of the haul route. These factors include grade, alignment, road width, type of surface, road condition, sight distance, turnout spacing, and other traffic using the road. Use the correct truck for the type of road on the haul route (belly dumps are inappropriate for crooked narrow roads).

Variable costs should be increased if load limits (bridges, city streets, etc) on the route preclude loading trucks to rated capacity. The average distance from the point of dumping to the turn-around should be included in the variable cost haul distance. On single-lane roads this may range up to 2-3 miles additional length, on two-lane roads no addition is usually necessary since the trucks can turnaround nearby. Also, if there are similar conditions at the material source which affect travel distance, make allowance.

The following are general guidelines the estimator should use in determining average round-trip travel speeds for haul computations.

Average Travel Speed	Road Characteristics
5-15 mph	Narrow dirt road, steep grades, numerous sharp curves, poor sight distances and few turnouts
10-30 mph	Dirt or gravel surface, single lane, grades to 8%, fair to good alignment, adequate turnouts, and good sight distance
25-50 mph	Gravel or paved surface, double lane, moderate grades to 6%, good to excellent alignment, excellent sight distance

1. Fixed Cost:
Increase fixed costs to reflect difficult or unique situations in loading or dumping material, such as asphalt or riprap.

12 cy End Dump	$1.78/cy
18 to 20 cy Bottom/Belly Dump	$1.74/cy

2. Variable Cost:
Cost per cy-Mile computed based on round trip distance.

mph	12 cy End Dump ($/cy-Mile)	20 cy Bottom Dump ($/cy-Mile)
10	$2.09	$1.51
15	$1.41	$1.01
20	$1.05	$0.76
25	$0.84	$0.60
30	$0.69	$0.50
40	$0.52	$0.38
50	$0.42	$0.30

Example 9 - Example Haul Costs

Road Segment or Number	Avg. Speed Roundtrip	Length in Miles (one way)	Variable Cost ($/cy - Mile)	Cubic Yards Hauled	Total Variable Cost($)
333	25	10.5	$0.84	550	$

Calculate the Variable Cost in dollars for each segment by multiplying the one way haul distance in miles by the Cubic Yards Hauled over that segment times the Variable Cost Rate($/cy-Mile) which is based on the average speed and type of truck used.

Example: Using 12 cy End Dumps; 10.5 miles x $0.84/cy-Mile x 550 cy = $4,851

Calculate the Fixed Cost by multiplying the Fixed Unit Cost for the type of truck hauling by the number of Cubic Yards hauled.

Example: Using 12 cy End Dumps; $1.78/cy x 550 cy = $979

The *total haul* cost is the sum of the variable costs and fixed cost = $4,851 + $979 = $5,830

Section 208 - Structure Excavation And Backfill For Selected Major Structures

(Labor 40%)

B. Typical Costs.

$17 to $36 cy . More if large boulders are present or if there are excessive dewatering problems. Make allowances for sampling and testing if required by the specification used. The work includes excavation required to get down to foundation elevation and sufficient trench width to install the structure, backfilling, and compaction with a roller. If excavated material cannot be placed adjacent to the site on the roadway, make an allowance for haul to a temporary stockpile site. The haul allowance should also include the cost for loading trucks at the temporary stockpile site for return haul to the structure, and the cost of the return haul.

Higher prices can be expected for excavation of large boulders, solid rock, etc.

Section 211 - Roadway Obliteration

(Labor 20-35%)

Obliteration may range from merely blocking access to a road to allow natural vegetation to become re-established, to ripping and scarifying the road surface, removing culverts, and rounding off the cutslope to complete removal of the road template and recontouring to the original natural profile. A laborer should be included to saw replacement slash and seed/fertilize behind the equipment, if required. The costs below are for reference, using the assumptions shown. Due to the variance in complexity to obliterate a road, time and equipment methods should be used, and production rates should be site specific to the roadway to be obliterated.

For roadbeds where just outsloping the template is required, costs range from $900 - $1,350 per mile. This cost is based on production rates from 4-6 hours per mile with a D-7 dozer.

For light scarifying with a grader, $450 - $600 per mile. These costs are based on production rates of 3-4 hours per mile.

For ripping 6 - 12 inches with a dozer (one complete pass out and back), $450 - $900 per mile. These costs are based on production rates of 3-4 hours per mile.

For removal of shallow installed cross drain culverts, allow 1-2 hours per removal with an excavator, depending upon fill height. Cost ranges from $155 - $310 each.

For culverts with higher fills, or culverts in live streams, cost out by time and equipment methods, taking into account the quantity of excavation required, and whether or not haul to a disposal site is needed. In addition, make cost allowances for stream diversions, additional clearing required to remove culvert, and slash disposal.

For all culvert removals, make allowance for disposal of the culverts; typically this is removal from National Forest land. If the culverts are to be salvaged and stockpiled, allow additional time for removal, as more care will be required during excavation to avoid damaging the pipe.

For non-drivable water bars, use a rate of 10 per hour with a D-7. Cost is $23 each.

For roads requiring full re-contour, a dozer and excavator working together is typically used. Typical production rates range from 200 LF per hour for low to moderate sideslopes (10-30%) to 100 LF per hour for steeper sideslopes (>30%). In order to recover the entire fill embankment additional clearing may be required to reach the toe of fill. Costs range from $9,320 - $18,700 per mile.

Blocking access to a road may be accomplished by a gate, Jersey Barriers, boulders, or other means. Follow the Forest policy for blocking access and consider signs if appropriate. Cost out the work by time and equipment methods. Also consider signs if appropriate.

Other requirements may include seed, mulch, and fertilizer. Contact your local Botanist to determine appropriate seed mix, mulch type, and fertilizer to apply, as well as the recommended application rates. Also, consider appropriate seeding season to optimize successful seed catch. On roads with culvert removals or re-contouring, the seeding must be done as the work progresses from the end toward the beginning as access will be cut off.

Section 212 - Linear Grading

(Labor 40%)

This section is intended for use on single purpose roads in relatively gentle/moderate and uniform terrain. It can be used in conjunction with most construction control methods. The specification combines clearing and grubbing, excavation, and erosion control. Use of this specification is NOT appropriate for roads with complex horizontal alignments, numerous culvert installations, or over dissected topography where non-self balanced sections prevail.

The entire preconstruction effort including location, survey, design, and cost estimating should be consistent with the road standard, desired end product, and risk factor. A high degree of sophistication is not warranted when developing the cost estimate for this work.

Use of Table 36 through Table 45 on the following pages is quite appropriate and fits the intent of the specification. The tables are for roads without a ditch. The assumptions listed below were used in preparing the tables:

Excavation	Based on self-balanced sections. Use appropriate compaction factor column for your soil type. No allowance is included for drain dips, finishing and/or shaping, slough widening, curve widening, turnouts, turnarounds, or haul.
Clearing and Grubbing:	Clearing limits (3 ft beyond top of cut - 10 feet beyond toe of fill to allow for slash windrow construction) - minimum 24' width Topographic factor - see Section 201.
Seeding	Seed cut and fill slopes only that are 1:1 or flatter

Note: To ensure that your slopes are never misunderstood, insert a "V" and an "H" in the ratio. For example: 1V:3H.

To determine costs, use the procedure outlined below. Be sure to use the correct table for the appropriate road backslope and road template.

Step 1 Determine which quantity table to use based on road width and backslopes.

Step 2 Determine excavation quantity in cubic yards per mile using the existing average sideslope and applicable compaction factor. Multiply the cy per mile by the length of the road segment in miles to get the total excavation. Obtain the base excavation cost from Section 204. Adjust the excavation cost for materials, topography, and additional widening by multiplying the base excavation cost by the respective adjustment factors. Add additional cost for scarifying (if necessary), drainage dips, haul, etc.

Material Factor = (% Common)(1.0) + (%Loose Rock)(1.5 to 1.75) + (% Rip)(3.0) + (% Blast and Boulders)(5.0)

Topography Factor = Self balanced sections = 1.0
Some through fills and free haul = 1.25

Widening Factor = No additional widening = 1.0

For slough widening, turnouts every 1,000 ft, log truck curve widening, turnarounds one per mile use a factor of 1.15, or add cost using 204 for turnouts as follows. For turnarounds, double the cubic yards.

	Cubic Yards	
Sideslopes	Turnouts	Turnarounds
20%	31	62
40%	86	172
60%	223	446

Drainage Dips: See Section 204 for costs

Total Excavation Cost = (Base Cost) x (Material Factor) x (Topography Factor) x (Widening Factor) + (Drainage Dips) + (Haul)

Step 3 Determine Clearing and Grubbing quantity in acres per mile by using the existing average sideslope. (Note: the minimum clearing width is 24 feet or 3 acres per mile.) Multiply the Acres per mile by the length of the road segment in miles to get the total clearing acres. The acres per mile in the tables are based upon a clearing limit of 10 feet beyond the toe of fill to allow room for windrow construction. If the additional clearing area is NOT required, reduce the clearing acres by 10 ft x 5280 / 43560 = 1.2 Acres per mile for sideslopes above 30%. Obtain the base clearing cost per acre from Section 201 for the applicable clearing classification. Adjust the clearing cost by multiplying the base clearing and grubbing cost by the slash disposal adjustment and the widening factors.

Slash Disposals Factors:	
Windrowing	1.0-1.1
Scattering	1.15-1.35
Piling	1.3

Widening Factors:	
No additional widening	1.0
Slough widening, turnouts, log truck curve widening, turnarounds	1.2

Step 4 Determine the Seeding quantity in acres per mile by estimating using the existing average sideslope. Multiply the Acres per mile by the length of the road segment in miles to get the total seeding acres. No seeding is applied to 1.33V:1H (¾:1) slopes as seed and mulch will not stay in place. Obtain the costs for the seed/mulch/fertilizer application from Section 625.

Step 5 Total results from steps 2, 3, and 4 to determine unit cost.

Example 10 - Linear Grading Construction

Linear Grading Cost	
Location:	Wyoming Area 1
Length:	1.7 miles
Average side slope:	30%
Compaction factor:	25%
Clearing classification:	Medium (25Mbf/Acre)
Windrow construction slash	
Excavation classification:	85% common
	15% rip
	0% blast

Template: 14 ft w/o ditch, 1.33V:1H (3/4:1) backslope, self balanced sections, no through fills or free haul. Allow for turnouts every 1,000 feet, normal curve widening, one turnaround per mile, and 4 drainage dips. Seed, dry method, without mulch.

Step 1: Base excavation cost = $1.66 per cy (*from Section 204*)
Cubic Yards = 2353 cy/mile(*from Table 45)* x 1.7 miles = 4,000 cy
Adjusted excavation cost:
Material Factor = (0.85 *1.0) + (0.15 *3.0) + (0 *5.0) = 1.3
Topography Factor = 1.0
Widening Factor = 1.15
Drainage Dips = 4 at $105 each = $420
Cost = (4,000 cy * $1.66 * 1.3 *1.0 *1.15) + $420 = $10,347

Step 2: Base Clearing Cost = $3,050 per Acre (*from Section 201*)
Clearing Acres = 4.0 Acres/mile x 1.7 miles = 6.8 Acres
Adjusted Clearing Cost:
Slash Disposal Factor = 1.0
Widening Factor = 1.2
Cost = $3,050 per acre * 4 Acres *1.0 *1.2 = $14,640

Step 3: Seeding Cost = $500 per mile (*from Section 625*)
Seeding Acres = 0.6 Acres/mile x 1.7 miles = 1.02 Acres
Cost = $500 per Acre x 1.02 Acres = $510

Step 4: Total Cost = $10,347 + $14,640 + $510 = $25,497

Unit Cost per mile = $25,497/1.7 miles = $14,998 / mile

For Wyoming Area 1, the Adjustment Factor for Public Works Davis-Bacon Areas is 0.89 for 40% labor. **(The adjustment factor comes from Table 21**

in the Engineer's Estimate section of this guide and the labor percentage comes from Section 212.)

For all Areas in Wyoming, the Adjustment Factor for Equipment Differences is 1.02 for 40% labor. (The adjustment factor comes from Table 22 in the Engineer's Estimate section of this guide and the labor percentage comes from Section 212.)

Adjust for Wyoming Area 1 (labor, 40%): $14,998 per mile *0.89 * 1.02 = $13,615 per mile

Table 42 - Section 212 12 ft Wide Template 1V:1.5H

Average Sideslope (%)	20 % Comp. Excavation per mile (cy)	25 % Comp. Excavation per mile (cy)	30 % Comp. Excavation per mile (cy)	Clearing per mile (Acre)	Seeding per mile (Acre)
10	413	413	413	3.2	0.3
20	1044	1087	1130	3.5	0.6
30	1889	1932	2021	3.9	1.1
40	3121	3210	3301	4.5	1.9
50	5258	5352	5495	5.6	3.3
60	10206	10423	10639	8.5	6.9

Construction Quantities for Specification 212 - 12 foot wide template, no ditch, backslope 1V:1H, fill slope 1V:1.5H

Table 43 - Section 212 14 ft Wide Template 1V:1.5H

Average Sideslope (%)	20 % Comp. Excavation per mile (cy)	25 % Comp. Excavation per mile (cy)	30 % Comp. Excavation per mile (cy)	Clearing per mile (Acre)	Seeding per mile (Acre)
10	636	636	636	3.5	0.3
20	1406	1456	1505	3.8	0.7
30	2540	2590	2692	4.3	1.3
40	4277	4382	4541	5	2.2
50	7198	7362	7587	6.2	3.8
60	13795	14109	14360	9.7	8.1

Construction Quantities for Specification 212 - 14 foot wide template, no ditch, backslope 1V:1H. fill slope 1V:1.5H

Table 44 - Section 212 12 ft Wide Template 1V:1.33H

Average Sideslope (%)	20 % Comp. Excavation per mile (cy)	25 % Comp. Excavation per mile (cy)	30 % Comp. Excavation per mile (cy)	Clearing per mile (Acre)	Seeding per mile (Acre)
10	386	386	496	3.2	0.1
20	965	1012	1022	3.4	0.3
30	1670	1726	1785	3.7	0.5
40	2693	2753	2875	4.1	0.9
50	4113	4239	4366	4.7	1.4
60	6493	6626	6830	5.8	2.5

Construction Quantities for Specification 212 - 12 foot wide template, no ditch, backslope 1.33V:1H, fill slope 1V:1.33H

Table 45 - Section 212 14 ft Wide Template 1V:1.33H

Average Sideslope (%)	20 % Comp. Excavation per mile (cy)	25 % Comp. Excavation per mile (cy)	30 % Comp. Excavation per mile (cy)	Clearing per mile (Acre)	Seeding per mile (Acre)
10	556	556	620	3.5	0.2
20	1328	1393	1460	3.7	0.4
30	2286	2353	2421	4	0.6
40	3658	3798	3869	4.5	1
50	5520	5665	5811	5.2	1.7
60	8802	9038	9076	6.5	2.9

Construction Quantities for Specification 212 - 14 foot wide template, no ditch, backslope1.33V:1H, fill slope 1V:1.33H

End of Clearing and Earthwork

SLOPE REINFORCEMENT AND RETAINING WALLS

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Section 251 - Riprap

(See individual items for labor reduction)

A. Range of Costs.

Range of costs per cubic yard including haul for bridges and culverts (includes manufacturing, furnishing, and placing):

1. Hand-Placed Riprap:
(Labor 75%) Ranges from $78 - $131 per cy depending upon difficulty of gathering rock.

2. Dumped Riprap:
(Labor 40%) Ranges from $20 - $40 per cy depending upon difficulty of sorting, loading rock, and the haul distance from the source.

3. Machine-Placed Riprap:
(Labor 35%) Ranges from $57 - $77 per cy depending upon difficulty of sorting, loading rock, haul distance from the source, and difficulty of placing with an excavator.

4. Sacked Soil Cement:
(Labor 60%) Estimate by time, materials and equipment

5. Sacked Concrete:
(Labor 60%) Estimate by time, materials, and equipment

6. Wire-Enclosed Riprap:
(Labor 75%) Estimate by time, materials, and equipment

Riprap must be estimated on an individual basis due to such a variety in size, shape, and difficulty of installations. Unit costs are to include furnishing, placing, and haul of riprap. Also includes cost of woven wire, lacing or tie wires, stakes, and labor to place and enclose riprap.

B. Haul.

Calculate haul cost using prices listed in the haul section of this cost guide.

C. Pit or Source.

Development of the pit or source if required should be calculated using time and equipment.

D. Royalty.

Royalty charge in private pits obtained from pit owner - see Section 301 or 641.

E. Drilling and Blasting.

Drilling and blasting cost of quarries, if required - see Section 301 or 641.

F. Access Roads.

Access road development, if required - use time, and equipment.

G. Geotextile.

If used - estimate material prices and pay under Section 207.

Section 253 - Gabions And Revet Mattresses

(Labor 30-40%)

General cost range is $150 to $180/cy. Cost varies by materials, installation and site.

Approx Cost of Gabion baskets:	6 Ft Long	Cost/cy	12 Ft Long	Cost/cy
3 ft x 3ft	$90.00	$45.00	$150.00	$37.50
3 ft x 1.5 ft	$65.00	$65.00	$120.00	$60.00

Gabion material costs includes all hardware. It does NOT include shipping to job site.

The installation cost must be estimated on an individual basis. The variety of sizes available and design needed can change costs. Equipment needed and cost of rock must be considered. Use time, material, and equipment to determine cost and percent labor for this item.

Section 255 - Mechanically-Stabilized Earth Walls

(Labor 40%)

General cost range is $25.00 - $50.00/S.F. of frontal face.

Each project is unique and must be estimated on material, labor, and equipment basis.

Section 257 - Alternate Retaining Walls

This item must be estimated on an individual basis. The variety of types and the site conditions can affect the unit costs. Use time, material, and equipment to determine cost and % labor for this item.

Types available include:

- Steel Bin Retaining Wall
- Treated Timber Bins
- Culvert Retaining Wall
- CRIBLOCK (Concrete bins)
- Reinforced Concrete (tie-back/cantilever)
- Chain Link
- Gabion
- HILFIKER (Welded Wire)
- Treated Timber Lag Wall
- Treated Timber-Faced Wall
- Fabric Wall

Section 262 - Reinforced Soil Embankment

This item must be estimated on an individual basis. The variety of types and the site conditions can affect the unit costs. Use time, material, and equipment to determine cost and percent labor for this item

A. Geocell Material.

Geocell materials are porous and non-porous as well as manufactured in widths and lengths other than those shown here. Call a local supplier to get the correct material and size for your application.

Standard Cell Sizes: 3" x 8' x 20', 4" x 8' x 20', 6" x 8' x 20', 8" x 8' x 20'
Large Cell Sizes: 3" x 8' x 40', 4" x 8' x 40', 6" x 8' x 40', 8" x 8' x 40'

B. Select Granular Backfill.

Calculate haul using instructions in section 204.

C. Placement

Use Time and Equipment Method. Call supplier for support.

End of Slope Reinforcement and Retaining Walls

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AGGREGATE COURSES

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Section 303 - Road Reconditioning

(Labor 40-60%)

Normally, the majority of "reconditioning" work should be done with a grader with some minor blasting and/or tractor work for localized rock problems. More extensive work should be covered in the appropriate sections. *Good* field classification and design will usually avoid the problem of calling for use of this specification when more appropriate work items may be needed. Other examples can be traced to situations where, through years of maintenance a roadway has been widened and shifted slightly away from the original alignment. Trees that used to be outside the shoulder by 5-10 feet, were eventually cut down for safety reasons, *but the stumps remain* in what now is the shoulder. Estimator should also watch out for *subgrade boulders* which were originally well covered by native subgrade material, but the covering is now thin or absent.

A. Removing Slides.

Use time and equipment costs. (Estimate all slides in excess of l0 cubic yards per station under Section 204).

B. Pull Ditches with Grader.

$380/Mile. Assumes 2 hours/mile production rate with grader, laborer, and pickup

C. Clean Catch Basins with Backhoe.

$39 each. Assumes 15 minutes per catchbasin to clean, reshape, and dispose of material on roadbed if suitable, or on fill slope.

D. Scarifying and Shaping.

Costs in $/mile, use grader, laborer, and pickup.

Average production rate equals 4 hours/mile.
Heavy equals 6 hours/mile.
Rate for double lane road equals single lane x 1.35

	Single Lane	**Double Lane**
Average	$ 755	$1,020
Heavy	$1,130	$1,530

E. Finish Grading with Blade.

Costs in $/mile. Assumes all oversize has been removed, hence no laborer required. Production rate equals 3 hours/mile. Rate for double lane road equals single lane x 1.35 .

Single Lane	$370
Double Lane	$500

F. Compaction.
Costs in $/mile. Using roller until visible displacement ceases, minimum 3 complete passes. Double lane cost equals single lane cost x 1.35

Single Lane	Double Lane
$1030	$1370

G. Water.
Estimate under Section 170 (see Complete WO FSSS 170), can be included in Section 303 if specified as indirect.

H. Constructing New Ditch.
Include under Section 204

I. Erosion Control Measures.
Include under Section 157

J. Clearing and Grubbing.
Include under Section 20l

K. Reconditioning Asphalt or Aggregate Surfaces.
Costs for reconditioning of asphalt and aggregate surfaces should be estimated using Sections 204, 301, 404, 414, and 430.

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

Section 306 - Dust Palliative
(Contract Item)

Refer to current dust palliative manufacturer and geotechnical engineering information for detailed information on product characteristics, application rates, estimating procedure, conversion factors and calculations. The following is a summary of essential information.

A. Application Rates.
See application rate below. Rates for lignin sulfonate and chloride products are based on the solid contents shown under C, "Approximate Weight-Volume Factors at 60°F," this Section. These products may be furnished with varying amounts of water and if so, adjustments based upon the weight of solids may be necessary on the application rates and payment. Rates will vary depending on the type and condition of the surface and the amount of residual dust abatement material present. For example, more dust abatement material will be required for loose pit-run gravel and less for unsurfaced roads in clay material. Due to leaching of the chloride products, it is recommended that the product be applied slightly narrower in width than the surfacing, particularly along riparian areas.

B. Unit Material Cost.

Prices can be extremely variable, particularly for dust oils. Up-to-date quotes should be obtained from local suppliers for each project.

Table 46 - Approximate Weight-Volume Factors at 60°F

Material	Gallons/Ton	Pounds/Gallon
Lignin Sulfonate (50% solids, Specific Gravity = 1.26.)	190	10.51
Magnesium Chloride (32 percent solids, Specific Gravity =1.317)	182	10.98
Calcium Chloride (38 percent solids)	171	11.69

C. Shipping Costs.

Shipping costs are variable and should be verified for each project by contacting suppliers.

D. Road Preparation.

Road preparation costs will depend on the existing surface condition, requirements in other sections such as 322 or 303, and the method specified. See Section 303 for grading costs and Section 170 for watering.

E. Application Cost.

Contact supplier for information regarding the cost of application. Supplier will need to know the project location, length of project, width of application, and application rate.

Table 47 - Typical Dust Palliative Application Rates

Type	Initial Application	Subsequent Application
Lignin Sulfonate	0.50 gallons/yd²	0.25 gallons/yd²
Magnesium Chloride Brine	0.35-0.50 gallons/yd²	0.20 gallons/yd²
Calcium Chloride Brine	0.28-0.40 gallons/yd²	0.16 gallons/yd²
Calcium Chloride Flake@77%	1.30-1.90 lbs/yd²	0.75 lbs/yd²

Section 322 - Minor Aggregate Courses

Note: *If local conditions indicate that aggregate production will be subcontracted, and that aggregate producers will likely pay Davis-Bacon wage rates, no reduction for labor should be made to the basic rock cost. Also, not all contracts require Davis Bacon rates in basic rock and hauling costs. Check with your Contracting Officer.*

The costs shown herein are applicable only for situations closely fitting the stated assumptions. However, the procedure and work items should be considered and estimated for all projects where that type of work is involved. On larger base and surfacing projects of 25,000 cy or more, consideration should be made for additional economies due to the large quantities. Total in place cost for these large jobs will average about 10% less. On the other hand, for small projects of 5,000 cy or less, costs will be at least *20% higher*.

Aggregate costs are estimated in the following three categories:

A. Basic Rock Cost
B. Load and Apply
C. Haul

A. Basic Rock Cost (Labor: 45%).

The following costs assume a production rate of l50 tons per hour (TPH). Material weighs 2,800 to 3,000 lbs/cy loose. Costs shown are in tons and loose cubic yards. Material Grading C, 1-1/2 inch minus is the basis for rock costs.

1. Move-in/Move-out Costs (approximate):

Includes cost to set up and take down equipment. Does not include movement of equipment commonly used on other parts of job. Make cost allowance per instructions under Section 151 (Mobilization).

Table 48 - Crusher and Rock Screen Typical Costs for Move-In and Set-Up

Jaw Crusher or Screen	$12,000 - $13,000
Two-Stage Crusher	$18,750 - $23,600
Three-Stage Crusher	$20,300 - $26,500
Changing Pit Sites	$1,700 - $2,600
Changing Screens	$190 - $1,000
Setup Belt-Scale Operation	$625 - $1,250
Platform Scale (move-in, setup, ramps, and certification)	$2,500 - $3,250

These are approximate ranges of typical costs only. Verify costs with producers

2. Pit Development:

Estimate pit or quarry development under FSSS Section 651, cost may be included in basic rock cost or as a separate pay item. Costs should include:

l. Clearing, grubbing, and slash cleanup
2. Access roads
3. Conserving topsoil
4. Removal of overburden
5. Ground control and traffic control
6. Restoration
7. Seeding

3. Royalty charge for private pits:

These are highly variable, costs range from $.50/cy to $1.00/cy or higher.

4. Drilling and shooting cost:

Normal drilling and shooting:	$1.63/cy loose
(includes tractor for moving material)	$1.13/ton

Breaking oversize	$5.65/cy loose $3.930/ton

5. Ripping:

$1.25/cy
$0.87/ton

6. Crushing:

For grading other than Grading C, the following multipliers should be applied to crushing costs shown in (a) and (b) below. Grading in Table 49 and Table 50 is based on Complete WO FSSS 322 and 703.05, Tables 703-2, 703-3

a. Crushed pit rock (drilling and shooting and/or ripping generally not required)	$6.51/cy loose $4.48/ton
or	
b. Crushed quarry rock (includes loading into crusher)	$7.79/cy loose $5.34/ton

If size-ratio requirements are included in the grading, increase crushing costs approximately 10%. If bentonite binder is specified at 2% of aggregate quantity, add $2.00 per ton to rock cost for projects over 10,000 tons and $3.00 per ton for smaller projects.

Table 49 - FSSS Crushed Aggregate Grading Multipliers

Max Size (in)	2-1/2"	2"	l -1/2"	1"	3/4"	1-1/2"	1"	3/4"
Grading	A	B	C	D	E	F	G	H
Multiplier	0.9	0.95	1.00	1.10	1.25	0.80	0.9	0.95

Table 50 - FSSS Screened Aggregate Grading Multipliers

Max Size (in)	6"	6"	4"	4"
Grading	L	M	N	O
Multiplier Size Ratio 1.10	0.6	0.7	0.7	0.7

7. Screening only.

$4.80/cy loose
$3.31/ton

8. Pit run.

Costs include no crushing but do include dozer loader, and operators.

$4.27/cy loose
$2.93/ton

9. Stockpiling.

Use only where required by contract or job conditions.

$0.85/cy loose
$0.59/ton

10. Weighting.

Platform Scales $0.35/ton

11. Contractor Quality Control.

If required by contract, add the cost of contract or sampling and testing. Otherwise for general contractor QA/QC see Section 153.

Production Losses.

In computing aggregate costs, one should calculate the total cost of producing the final quantity of aggregate desired. To determine unit costs, the total costs of each major subdivision (basic rock cost, load and apply, and haul) should then be divided by the final desired quantity. By following this procedure, the cost of normal production losses can be included in the unit cost of the final quantity.

The following production losses should be considered:

1. Ongrade process and haul losses - essentially negligible for conscientious operator.
2. Stockpiling losses: Approximately 5%; use only if stockpiling required by contract, physical arrangement of pit, or work schedule imposed by contract.
3. Crushing/screening/blasting.
    a. Quarry operation approximately: 5-10%.
    b. Gravel or rock pit: 20-30%

These seemingly high losses result from a high percentage of fines found in such pits. Technically, it is not "lost" material, but "reject" necessitated by gradation requirements. Actual estimate of losses should be based on field tests or experience.

Small Quantities.

Increase costs for small projects as calculated above by about 20% for jobs where the quantities are less than 5,000 tons or 3,500 cy.

Example 11 - Basic Rock Cost Example

Grading D
Compact by hauling equipment
Quantity required on the road: 10,000 tons
Location: Colorado Area 1
Assume hard rock quarry with stockpiling and weighing required.
Stockpiling loss: 5%
Crushing loss: 10%

To obtain 10,000 tons for the road, the contractor will have to drill, shoot, and process approximately 10,000 tons + 5% (*stockpiling loss*) + 10% (*crushing loss*) = 11,500 tons.

Contractor will stockpile 10,000 tons + 5% (*stockpiling loss*) = 10,500 tons.

Move in/Move-out including platform scale
Two stage crusher $18,750 (*reference Table 48*)
Scales $2,500 (*reference Table 48*)
$18,750 + $2,500 = $21,250
Include costs under Section 151 - Mobilization.

Drilling and Shooting: $1.13*11,500	$12,995
Crushing: $5.34 * 11,500 * 1.1 (*reference Table 49*)	$67,551
Stockpiling: $0.59 * 10,500	$ 6,195
Weighing: $0.35 * 10,000	$ 3,500
Contractor sampling and testing (lump sum estimate)	$ 3,500
Total Cost	$93,741

$$\text{Unit basic rock cost} = \frac{\$93{,}741}{10{,}000 \text{ tons}} = \$9.37/\text{ton}$$

For Colorado Area 1, the Adjustment Factor for Public Works Davis-Bacon Areas is 0.92 for 45 % labor. **(The adjustment factor comes from Table 21**

in the Engineer's Estimate section of this guide and the labor percentage comes from Section 212.)

For all Areas in Colorado, no Adjustment Factor for Equipment Differences is necessary. (The adjustment factor comes from Table 22 in the Engineer's Estimate section of this guide and the labor percentage comes from Section 212.)

Adjust for Colorado Area 1, 45% labor; $9.37 x 0.92 = $8.62/ton

B. Load And Apply
(Labor: 40%)

1. Loading Costs:
Loading costs are variable depending on procedures at pit. These vary depending on loading method, i.e.,

a. From belt - included in basic rock cost.	$0
b. From hopper - included in basic rock cost.	$0
c. Pit run - included in basic rock cost.	$0
d. From stockpile.	$0.71/cy loose(*from Section 204*) $0.49/ton

2. Processing with grader.
Depends on aggregate depth and width of road.
$0.91-$1.21/cy loose
$0.63-$0.83/ton

3. Compaction (approximate).

a. With hauling equipment. Compaction with hauling equipment is not recommended except for very small jobs where roller mobilization is not warranted.	$0
b. With rollers - minimum 3 complete passes	$1.12-$1.39/cy loose $0.77-$0.96/ton

4. Watering.
Estimate under FSSS Section 170; water should be indirect to Section 322. Consider allowing for water truck to be available throughout the entire aggregate placing process.

C. Aggregate Haul
(Labor: 30-50%)

Calculate haul according to the instructions in haul section in Section 204 of this cost guide. These costs are based on loose cubic yards. Use appropriate weight conversion factor to convert to $/ton-mile. If measurement for payment or credit is on another basis, appropriate adjustment factors must be made.

Haul cost = fixed cost for the truck plus variable haul costs. If Construction Induced Maintenance is needed, it should be included in aggregate haul costs.

Equation 12 - Haul Cost Example

Variable costs of haul based on road characteristics and average round trip travel speed

3.0 miles, 30 mph
6.0 miles, 15 mph
2.5 miles, 10 mph (include distance to turnaround)

Belly dump trucks (20 cy)
Location: Colorado Area 1
Basis of payment: cy

Haul Cost = Fixed cost + Variable haul cost x Haul distances (*reference Haul section*)
Fixed Cost = $1.74/cy
Variable Costs = $0.50/cy x 3.0 + $1.01/cy x 6.0 + $1.51/cy x 2.5 = $11.34/cy
Haul Cost = $1.74/cy + $11.34/cy = $13.08/cy

For Colorado Area 1, the Adjustment Factor for Public Works Davis-Bacon Areas is 0.91 for 35 % labor. **(The adjustment factor comes from Table 21**

in the Engineer's Estimate section of this guide and the labor percentage comes from Section 212.)

For all Areas in Colorado, no Adjustment Factor for Equipment Differences is necessary. (The adjustment factor comes from Table 22 in the Engineer's Estimate section of this guide and the labor percentage comes from Section 212.)

Adjust for Colorado Area 1 (35% Labor): $13.08 x 0.91 = $11.90/ton

End of Aggregate Courses

ASPHALT PAVEMENTS AND SURFACE TREATMENTS

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Section 400 - Asphalt Pavement General

Contractor Quality Control and Testing - All allowances shall be subsidiary to other pay items. Generally contractor quality control is applicable for Items 403 through 406, 409, 410, and 412. Contractor sampling is applicable for Items 407, 408, and 413. Refer to Asphalt Products Suppliers (Table 67).

Section 403 - Hot Asphalt Concrete Pavement

Estimates should be based upon current local prices, remoteness and size of project, haul distance of materials, adequacy of worksite, etc.

Compare the cost of on-site production with feasible commercial sources in the area. Move-in and move-out costs of a portable plant will often control prices on small projects.

The in-place compacted density and asphalt content used for calculating quantities should be based on a preliminary mix design. In lieu of other information, use 150 pounds per cubic foot for in-place compacted density and 6.5% asphalt cement based on weight of total mix.

Contact local State DOT for available mix designs in your area.

Add $11 to $16 per ton of asphalt if antistriping additive is required.

Section 409 - Asphalt Surface Treatment

A. Aggregate.

Costs are dependent upon quantity and location. Include the following:

1. Crush and Stockpile:
(FSSS Sections 320 and 322). Crushing costs can vary widely depending on the gradation selected, whether aggregates are produced as a by-product of other crushing operations or produced separately, and availability of commercial sources. Chips average weight is 2300 lbs/cy (loose).

2. Loading Aggregate:
Use costs from Section 322.

3. Weighing:
Use costs from Section 322. If bin or belt scales are used, allow $530-$1050 for certification. For small projects consider using lump sum or cubic yard measurement.

4. Hauling:
Develop haul cost from Haul Section in this cost guide

5. Road Surface Preparation, Brooming and Other Prep Work:
Estimate the number of passes for power broom. Travel speed of 5-7 miles per hour. Rough cost $0.0069/sq. yd.

6. Aggregate Application:
Include cost of self-propelled aggregate spreader and truck time while waiting and spreading.

7. Rolling:
Immediately after application of aggregate. Estimate using pneumatic-tired, self-propelled roller.

8. Traffic control:
Determine if traffic count and type of traffic warrant the need for pilot car and/or flag persons. Special or unusual construction signing should also be considered.

9. Surface Maintenance:
Determine maintenance and brooming during and at the end of the curing period.

10. Temporary Centerline Marking:
Price range is $265.00 to $375.00 per mile.

B. Bituminous Material.

Obtain current quotes from local suppliers (Table 67). Asphalt costs are dependent upon quantity and location. Application rates for emulsified and liquid asphalts may be determined by two methods, depending on the type of table used for estimating:

1. Total Quantities:
Application rates for total quantities are given under Section 409 in the Application Rate Tables (Table 51) included in this Guide, and no adjustment is necessary, if asphalt emulsions are specified.

2. Residual Quantities:
Application rates for residual quantities are given in Tables 409-1. 409-2 and 409-3 of the FP-03, Section 403, and actual application rates for cutback and emulsified asphalts are determined by dividing the asphalt residual rates by the percent asphalt from the applicable AASHTO materials specification for the selected type and grade.

Include:

1. Application cost of $11 to $16 per ton of bituminous materials for uninterrupted work. Consider location of tanker trucks or temporary storage tank and time to re-fill distributor. Small, irregular areas such as in campgrounds or parking areas should be estimated using hourly rates for a distributor and hand spraying.

2. Add $11 to $16 per ton of liquid asphalt for antistriping additive, if required for cut-back asphalts.

Table 51 - Bituminous Coat Application Rates

Item	Rate	Remarks
412	0.03 - 0.15 gallon/yd²	Typical rate for tack coat using 1:1 diluted CSS-1 emulsion
411	0.10 - 0.50 gallon/yd²	Typical rate for prime coat using MC-70

C. Bituminous Surface Treatments and Seal Coats Using Emulsified Asphalts.

For estimating use the highest rates for aggregate and asphalt emulsion shown for the type of treatment desired. Final rates should be determined by testing the aggregate after contract award. Use rock size (gradation) that is similar to local State requirements to obtain more competitive bids. For campgrounds and administrative sites that have a buildup of soil and pine needles along the shoulder, increase the costs for cleanup.

Table 52 - Emulsified Asphalt Application Rates

Number and Type of Treatment	Course	Aggregate Grading	Aggregate (lb/yd^2)	Asphalt Emulsion (gallon/yd^2)
No. 1 Single	1	NA	None	0.10 - 0.15
No. 2 Single	1	D	18 - 23	0.25 - 0.30
No. 3 Single	1	C	23 - 28	0.35 - 0.40
No. 4 Single	1	B	28 - 33	0.40 - 0.50
No. 5 Double	1	A	40 - 50	0.55 - 0.65
No. 5 Double	2	D	15 - 20	0.25 - 0.30

Section 410 - Slurry Seal

Obtain costs from supplier.

Section 411 - Prime Coat

Obtain current quotes from local suppliers. Asphalt costs dependent upon quantity and location. Costs will vary widely with crude oil supplies and prices, but should be in the area of ±$750/ton .

Application costs are about $20 to $25 per ton of asphalt.

For application rates see Table 51. For price data see Table 67.

Section 412 - Tack Coat

Costs dependent upon quantity and location. Application, exclusive of materials, is about $0.25/gallon. Include surface preparation and brooming cost. Commonly an SS-1 is used for tack coat. Remember that most tack oils are commonly sold 50% dilute in emulsion form, ready for application. When gathering price information ask whether the price quoted for the oil is "neat" (non-diluted) or diluted in emulsion form.

For application rates see Table 51. For price data see Table 67.

Section 414 - Asphalt Pavement Crack & Joint Sealing

Obtain costs from supplier. If applicable, make allowance for routing/blowing out the cracks prior to the application of crack sealer.

Section 415 - Paving Geotextiles

Obtain costs from supplier.

Section 430 - Asphalt Pavement Patching

Obtain costs from supplier.

End of Asphalt Pavements and Surface Treatments

BRIDGE CONSTRUCTION

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Contact the Bridge Design Group in the Regional Office to estimate costs in Section 550. At the present time, historical costs are not adequate for estimating the cost of new bridges.

Region 2: Structural Engineer	Scott Mitchell	303-275-5196
Region 3: Structural Engineer for Region 2	Scott Mitchell	303-275-5196
Region 4: Structural/Bridge Engineer	Tom Gillins	801-625-5236

End of Bridge Construction

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INCIDENTAL CONSTRUCTION

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Section 601 - Minor Concrete Structures
(Labor 40%)

WO FSSS 601 deletes the entire FP-03 specification, and replaces it with new wording.

A. Method A or B:
Concrete for minor structures (about 30 cy or less). Unit price may vary from $300 to $400 per cy, depending upon quantity, distance from concrete source, forming difficulty, etc. Verify costs with local suppliers.

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

B. Method C:
Very small quantities of concrete for fence posts, gate post, etc. (no forms required). Cost will be about $100 - $200/cy or greater, depending on number of sites, access, etc.

Section 602 - Culverts And Drains
(Labor 20-30%)

Labor for culverts up to and including 36 inches in diameter and CMPA's up 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.

Compaction Methods A, B, and C are from WO FSSS 209.11. The unit prices shown in this Section need to be adjusted for the compaction method and quality control as follows:

A. Compaction Method:
Method A. No adjustment.
Method B. Add in additional $5/LF. Uses roller until visual displacement ceases
Method C. Add in additional $16/LF. Uses roller and requires compaction testing T310

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

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 installed culvert prices are based on a 40 LF pipe which includes one band and should be used for the condition indicated:

Table 53 - Installation Costs for Culverts

Pipe Size	New Construction $/ft	"After Grade" and Reconstruction (Shallow Installation) $/ft
18"	$30.50	$36.50
24"	$35.70	$41.50
30"	$47.70	$53.50
36"	$59.80	$65.60

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:

If installation is in a live stream, allow for stream diversion costs under Section 157. Consider diversion pipe, plastic sheeting, sandbags, Sedimats, turbidity curtains, pumps, and potential fish removal. Allow for installation and removal of diversions. If instream work restrictions exist for fish bearing streams, such as work windows relating to migration and spawning, be sure to include the appropriate wording in the contract.

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.

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.

The following materials and shop prices are provided as a guide for use in estimating culvert prices. The prices do not include delivery to the job site. Price information is from Contech Construction Products in Boise, Idaho; current as of February 2009. Always check current prices with your local supplier when putting together a cost estimate, especially if there is a large quantity of culvert involved. Metal culvert prices listed are for galvanized steel only, as aluminum and aluminized steel culvert is significantly more expensive.

C. Culvert Material Base Prices.

Polyethylene pipe may be suitable for some applications, but shouldn't be used in a forest setting where fire danger may exist, as the pipe will be easily consumed. Typically it is used for stream diversions due to its lighter weight per foot, or in campgrounds where metal pipe is not desired. The cost for polyethylene pipe is usually higher than for galvanized steel.

Table 54 - Polyethylene Corrugated Pipe Costs

Polyethylene Corrugated Pipe 20 Foot Sections	
Double Wall Rigid	
Size inches	Material Cost/ft
12	$8.54
15	$16.32
18	$19.62
24	$33.58
30	$53.50
36	$62.32
42	$91.02
48	$115.80

The plastic pipe supplier list is located in Table 70 on page 147 while the metal pipe supplier list is in Table 71 on page 148.

Table 55 - Galvanized Steel Pipe - 2.66"x1/2" Corrugations

Thickness	Pipe Arch	Size inches	Material Cost/ft	Wt/ft (lbs)	Thickness	Pipe Arch	Size inches	Material Cost/ft	Wt/ft (lbs)
0.064		12	$9.80	10	0.079	21x15	18	$19.80	18
(16ga)	17x13	15	$12.10	12	(14ga)	24x18	24	$26.15	24
	21x15	18	$14.40	15		28x20	30	$32.55	30
	24x18	24	$19.00	19		42x29	36	$39.00	36
	28x20	30	$23.65	24		49x33	42	$45.40	42
	42x29	36	$28.40	29		57x38	48	$51.75	48
	49x33	42	$33.00	34		64x43	54	$58.10	54
	57x38	48	$37.65	38					
0.109	28x20	24	$36.40	33	0.138	71x47	60	$115.95	103
(12ga)	35x24	30	$42.25	41	(10ga)	77x52	66	$127.45	113
	42x29	36	$54.15	49			72	$138.85	123
	49x33	42	$63.00	57					
	57x38	48	$72.00	65					
	64x43	54	$80.75	73					
	71x47	60	$89.65	81					
	77x52	66	$98.55	89					

Table 56 - Galvanized Steel Pipe - 3"x1" and 5"x1" Corrugations

Thickness	Pipe Arch	Size inches	Material Cost/ft	Wt/ft (lbs)	Thick ness	Pipe Arch	Size inches	Material Cost/ft	Wt/ft (lbs)
0.064	60x46	54	$77.70	50	0.109	60x46	54	$135.98	83
(16ga)	66x51	60	$86.10	55	(12ga)	66x51	60	$150.68	92
	73x55	66	$94.50	60		73x55	66	$165.38	101
	81x59	72	$103.08	66		81x59	72	$180.25	110
	87x63	78	$111.48	71		87x63	78	$195.13	119
	95x67	84	$119.88	77		95x67	84	$209.83	128
						103x71	90	$224.53	137
						112x75	96	$239.40	147
	60x46	54	$97.83	61		128x83	108	$268.98	165
0.109	66x51	60	$108.50	67		142x91	120	$298.55	183
(14ga)	73x55	66	$119.00	74					
	81x59	72	$129.68	81					
	87x63	78	$140.35	87					
	95x67	84	$151.03	94	0.138	128x83	108	$347.90	211
	103x71	90	$161.70	100	(10ga)	142x91	120	$386.06	234
	112x75	96	$172.38	107					
	117x79	102	$183.05	114					
	128x83	108	$193.55	120					

Table Note: Prices listed in the 2 tables above are for helical pipe with locked seams. For annular ring pipe with riveted seams increase the cost per LF by 20%.

1. Coupling Bands:
Equivalent material cost:

For 16, 14, or 12ga. pipe (can all use 16ga band)	Up to and including 48" diameter = 2 LF of 16ga pipe Greater than 48" diameter = 1 LF of 16ga pipe
For 10ga. pipe (need to use at least 14ga band)	Up to and including 48" diameter = 2 LF of 14ga pipe Greater than 48" diameter = 1 LF of 14ga pipe

2. Watertight gaskets and O-rings:
For 1 watertight gasket or a set of O-rings the additional cost is equal to the cost of the band.

3. Arched pipe:
Add 20% to round culvert prices shown in the table above for forming pipe arch. Pipe arches are available only for the culvert with the prices in BOLD print in the table.

D. Culvert Pipe End Treatment.
Call for quotes as cost depends upon the angle of the cut and the gage of material.

E. Five percent Shop Ellipse.
Call for quotes.

F. Special Coatings.
Call culvert distributor for quotes.

G. Flared End Sections.

These end sections are available with a trash rack as well if desired to catch debris. End sections can also be acquired for pipe arches, call for material pricing.

Table 57 - Pipe Flared End Section Prices

Diameter of pipe	Price w/o Rack	Price w/ rack
12	$85.97	$114.77
15	$107.28	$143.28
18	$136.58	$186.96
24	$196.06	$282.48
30	$373.54	$517.56
36	$493.78	$665.28
42	$823.68	$1039.68
48	$1020.82	$1336.32

Section 603 - Structural Plate Structures

(Labor 20%)

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%)

Call culvert manufacturer for prices. Use time and equipment for installation. Supplier list is located in Table 72 on page 148.

Section 605 - Underdrains, Sheet Drains, And Pavement Edge Drains

(See items below for labor and reductions)

Supplier list is located in Table 73 on page 149.

A. Perforated pipe cost per lineal foot.

(Labor 40%) Add 12 percent to standard culvert price.

B. Special Sections.
Elbows, Wyes, and Tees. Call supplier for current prices.

C. Porous Backfill or Filter Material.
(Labor 10%) Develop price from rock costs plus the haul cost as determined from Section 204 of the cost guide. Haul cost to be estimated from the nearest point of manufacture.

D. Geotextiles.
(Labor 10%) When using geotextiles, the pipe must be placed in freely draining porous material.

E. Granular underdrain.
(Labor 25%) 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).

F. Sheet Drains.
(Labor 30%) 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%)

Use time, material, and equipment.

A. Round Pipe.
If round pipe is used, the unit cost should be about 70% of the installed unit cost for the same diameter listed in Section 602 for New Construction, unless difficult slope conditions are encountered.

B. Elbows.
Include two connecting bands.

C. Anchors.
Estimate by material and time.

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

E. *Flexible Downdrain:*
Lowest price for larger quantity of 200 or more lineal feet.

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

G. Downpipe:
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.

H. Anchors:
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 60%)

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 using time and equipment. Removing, cleaning, and relaying of pipe should cost approximately 66 - 81% of the in place price per foot for reconstruction for a given size of pipe as listed in Section 602.

For repairs where a damaged portion of a culvert will be removed and replaced, be sure to match up corrugations, and the type of culvert metal to avoid electrolysis problems. Also include cost for band(s) to join up sections.

Section 609 - Curb And Gutter
(Labor 40-50%)

Use time, materials, and equipment estimate.

Section 615 - Sidewalks, Drive Pads, And Paved Medians
(Labor 40-50%)

Use time, materials, and equipment estimate.

Section 617 - Guardrail

Call manufacturer for price quotes on material prices. Supplier list is located in Table 74 on page 150. Contact local State DOT for more information.

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

Concrete barriers (Jersey) will cost about $50-$70 per lineal foot installed.

Call manufacturer for price quotes on material prices. Supplier list is located in Table 75 on page 150.

Section 619 - Fences, Gates And Cattleguards

Use this specification only for facilities being built for campgrounds and rights-of-way. Use FSSS 650 for Road closure Devices. Supplier list is located in Table 76 on page 151.

A. Fences.

(Labor 60%) Four strand barbed wire
Estimate by time, equipment and material. Costs average about $4.00/LF ($13.12/m) for fencing.

B. Gates.

(Labor 15% metal gates, 65% wire gates) Costs range from $1,500 to $3,500 each for double-lane metal gates, and $1,200 to $1,700 each for single-lane metal gates. Wire gates cost about $100 to $200 each. Powder River type gates cost from $300 to $500 each.

C. Cattleguard.

(Labor 10%) Prices include wings and base. Costs range from $3,500 to $5,000 for 16'-0 width HS20-44 cattleguard.

Table 58 - Cattleguard Cost Adjustment Factors

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 approximately 5,250 pounds/side (2,381 kg/side).

Section 621 - Monuments And Markers

(Labor 25%)

Estimate by time, equipment, and material. See Section 634 for more information.

Section 622 - Rental Equipment

Total equipment rental cost includes the equipment rate and the operator rate. The figures shown in this section are for equipment rates only. Operator rates are not included but can be found in the labor rates section. The equipment rates include fuel, oil, lubrication, repairs, maintenance, and insurance. The cost of moving most equipment to the job is included in Section 151 - Mobilization. *Profit and overhead charged to equipment are included herein (10%).*

The rates shown herein were derived from the *Rental Rate Blue Book For Construction Equipment*. The models shown should be considered typical and their rates can be applied to similar equipment. Local rates should be used if local equipment is generally available at a rate different than those shown herein. Table 59 includes the hourly rental equipment costs from the 2009 Blue Book without an operator but with 10% profit included.

For rates not shown in Table 59, estimator should refer to Blue Book equipment rates and correct procedures for location factors. For work lasting 40 hours or less, the base rate is determined by dividing the Blue Book daily rate by eight. For work lasting over 40 hours, the base rate is determined by dividing the Blue Book monthly rate by 176. The rates shown herein (Table 59) are for work in excess of 40 hours.

Location factors from the Blue Book have been applied to the rates in Table 59. They reflect the variations between National averages and local conditions caused by the differences in topography, construction seasons, and the costs of labor, freight, taxes, etc. The location factors vary hence the Estimator needs to select the rate under the state where the project resides.

The use of brand names is for the ease of identification of the type and size of equipment and does not constitute an endorsement of any product. Some models listed are no longer manufactured or were not manufactured during the time period under which they are classified.

Table 59 - Hourly Rental Rates from 2009 Blue Book

AIR COMPRESSORS, PORTABLE, RECIPROCATING: Includes hose and fittings, diesel powered					
CUBIC FEET PER MINUTE	HOURLY RATE ($)				
	AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
100	10.83	10.97	11.24	10.83	11.24
185	20.35	20.53	20.85	20.35	20.85
300	34.96	35.33	36.00	34.96	36.00
600	68.42	68.99	70.06	68.42	70.06
900	77.28	78.05	79.48	77.28	79.48
1300	116.94	118.00	120.00	116.94	120.00

Table 59 - Hourly Rental Rates from 2009 Blue Book, Continued

ASPHALT PAVER: Diesel powered						
MODEL		HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Blaw-Knox diesel 8' Wheel PF-161		153.49	162.63	171.63	171.63	162.63
Blaw-Knox diesel 10' Wheel PF-3172		183.79	194.42	204.88	204.88	194.42
Barber-Greene diesel 8' Crawler BG-225C		193.70	204.61	215.35	215.35	204.61
Barber-Greene diesel 10' Crawler BG-245C		218.37	230.58	242.60	242.60	230.58
ASPHALT PRESSURE DISTRIBUTOR: Includes diesel powered truck with full circulating spray bar, heater, insulation, power takeoff unit, and tachometer.						
TRUCK MODEL	CAPACITY (gallons)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
4x2 - 200 HP	1600	61.27	63.85	66.30	66.30	63.85
6x4 - 280 HP	3100	79.05	82.09	84.96	84.96	82.09
6x4 - 380HP	4,000	97.02	100.53	103.83	103.83	100.53
BACKHOE: Diesel powered, standard 24" bucket, EROPS, Extend-a-Hoe						
MODEL	DIGGING DEPTH (ft)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Deere 310G -2WD	14' - 5"	35.99	37.19	38.74	35.99	37.19
Case 580 Super M -4WD	17' - 6"	44.23	45.68	47.56	44.23	45.68
Deere 410G - 2WD	16' - 1"	46.96	48.54	50.58	46.96	48.54
Cat 430D IT - 4WD	19' - 6"	48.86	50.50	52.63	48.86	50.50
Cat 446B - 4WD	21' - 2"	62.55	64.73	67.55	62.55	64.73
Deere 710G - 4WD	17' - 10"	79.20	82.23	86.17	79.20	82.23
BROOMS AND SWEEPERS: (Truck costs not included with pull types)						
TYPE	WIDTH (ft)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Pull type - traction driven	7	8.82	9.13	9.68	9.13	9.68
Pull type - gas engine driven	7	15.01	15.39	16.05	15.39	16.05
Self propelled - diesel RC-350	8	28.96	29.46	30.31	29.46	30.31
Self propelled - diesel RJ-350	8	29.68	30.17	31.03	30.17	31.03
BRUSH CHIPPERS: Trailer mounted						
MODEL	MAX LOG DIA (in)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Mitts & Merrill K12F6 125 HP - gas	8	41.16	41.76	42.78	41.76	42.78
Bandit 150XP 119 HP - gas	12	40.43	41.06	42.13	41.06	42.13
Bandit 280 119 HP - gas	18	43.44	44.19	45.49	44.19	45.49
Bandit 150XP 110 HP - diesel	12	38.86	39.57	40.80	39.57	40.80
Bandit 280 125 HP - diesel	18	43.28	46.21	47.70	46.21	47.70
BRUSH CUTTERS: Rubber tired, diesel						
MODEL	CUTTER WIDTH (ft)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Kershaw 800-2 185 HP	8	147.16	150.95	157.44	150.95	157.44
Kershaw 1200 225 HP	10	164.47	168.67	175.86	168.67	175.86

Table 59 - Hourly Rental Rates from 2009 Blue Book, Continued

CLAMSHELL: Crawler mounted, Diesel Powered - Without Bucket							
MODEL	HP	BUCKET SIZE (cy)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
American 5220	125	2	130.76	134.51	140.69	130.76	134.51
Northwest 70-D/7060	232	3	182.92	188.03	196.47	182.92	188.03
CLAMSHELL: Crawler mounted, Diesel Powered - with HD Square Nose Bucket							
MODEL	HP	BUCKET SIZE (cy)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
American 5220	125	2	139.43	143.50	150.23	139.43	143.50
Northwest 70-D/7060	232	3	193.76	199.29	208.40	193.76	199.29
CRANES: Rough Terrain, Hydraulic, self-propelled, diesel powered							
MODEL	CAPACITY (ton)	MAX REACH (ft)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Bronerson RT300-2B 4x4x4	15	60	81.74	83.49	86.04	83.49	86.04
Grove RT525E 4x4x4	25	75	89.08	91.12	94.09	91.12	94.09
Grove RT530E 4x4x4	30	95	91.76	91.76	96.96	91.76	96.96
Grove RT700E 4x4x4	55	110	143.84	146.95	151.49	146.95	151.49
COMPACTORS: Static, self-propelled, diesel powered, tandem							
MODEL		CAPACITY (tons)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Bomag BW5AS		6	31.36	32.32	33.83	31.36	32.32
Ferguson 5-8B		9	33.28	34.09	35.34	33.28	34.09
Ferguson 8-12B		12.5	36.09	37.01	38.43	36.09	37.01
Ferguson 10-14B		14	36.67	37.61	39.08	36.67	37.61
COMPACTORS: Vibratory, self propelled, diesel powered, tandem							
MODEL		DRUM WIDTH (in)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Bomag BW100AD-3		39	23.57	24.31	25.45	23.57	24.31
Bomag BW161AD-2		66	71.77	74.06	77.64	71.77	74.06
Dynapac CC622		84	79.17	81.71	85.66	79.17	81.71
COMPACTORS: Rubber tired, pull type, static							
MODEL	WHEELS	CAPACITY (tons)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Hercules PT-9	9	9.6	14.86	15.39	16.23	14.86	15.39
Hercules PT-11	11	13	15.57	16.14	17.02	15.57	16.14
Hercules PT-13	13	17	17.08	17.71	18.69	17.08	17.71

Table 59 - Hourly Rental Rates from 2009 Blue Book, Continued

COMPACTORS: Rubber-tired, self propelled, diesel powered, static						
MODEL	WHEELS	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Ferguson SP912	9	38.24	39.42	41.26	38.24	39.42
Ferguson SP1118	11	42.06	43.45	45.62	42.06	43.45
Caterpillar PS200B	9	50.86	52.51	55.09	50.86	52.51
Ferguson SP1130	11	62.69	64.77	68.01	62.69	64.77
Sakai TS200	9	50.64	52.32	54.94	50.64	52.32
COMPACTORS: Sheepsfoot, self propelled, single drum, vibratory						
MODEL	DRUM WIDTH (in)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Bomag BW166PDH-3	66	45.11	46.23	47.98	45.11	46.23
Bomag BW213PDBH-3	84	75.48	77.28	80.09	75.48	77.28
COMPACTORS: Handheld, vibratory plate compactors						
MODEL	HP	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
21", Gas, reversible	6	7.34	7.54	7.85	7.34	7.54
25", Gas, reversible	9	11.25	11.56	12.04	11.25	11.56
13.5"x17" Gas Rammer	4.5	6.00	6.16	6.42	6.00	6.16
DRILLS: Mobile air track with drill and feed						
MODEL	MAX HOLE SIZE (in)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Ingersoll-Rand Rotary CM345/EVL130	4	47.17	48.38	50.65	47.17	50.65
Sullivan-Palatek Pneumatic VCR-360	4	53.14	54.54	57.14	53.14	57.14
GRADERS, Motor: Basic machine plus EROPS and rear scarifiers						
MODEL	ENGINE (HP)	MOLDBOARD SIZE (ft)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Caterpillar 120H	125	12	67.81	70.25	73.41	70.25	70.25
Caterpillar 12H	145	12	77.50	80.29	83.90	80.29	80.29
Deere 770C II	155	12	80.41	83.15	86.70	83.15	83.15
Caterpillar 14H	220	14	130.64	135.92	142.76	135.92	135.92
Caterpillar 16H	285	16	168.68	175.57	184.50	175.57	175.57
HYDRAULIC EXCAVATORS: Crawler mounted tractor, with thumb, diesel powered							
MODEL	CAPACITY (cy)	WEIGHT (tons)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Caterpillar 312CL	0.68	14	73.66	75.83	79.42	73.66	75.83
Caterpillar 315CL	0.77	18	85.44	87.89	91.93	85.44	87.89
Caterpillar 320CL	1.25	23	115.27	118.60	124.11	115.27	118.60
Caterpillar 325BL	1.25	30	128.80	132.31	138.11	128.80	132.31
Caterpillar 330BL	2.25	38	152.67	156.67	163.28	152.67	156.67
Caterpillar 345BL II	2.50	49	210.07	215.57	224.65	210.07	215.57
Caterpillar 365BL	3.60	75	291.33	298.81	311.13	291.33	298.81
Caterpillar 385L	6.00	94	351.46	360.43	375.24	351.46	360.43

Table 59 - Hourly Rental Rates from 2009 Blue Book, Continued

MINI - HYDRAULIC EXCAVATORS: Crawler mounted tractor, diesel powered							
MODEL	CAPACITY (cy)	HOURLY RATE ($)					
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV	
Deere 17ZTS(ROPS)	0.05	11.80	12.11	12.63	11.80	12.11	
CAT 302.5(EROPS)	0.07	17.16	17.62	18.37	17.16	17.62	
LOADERS: Crawler type, diesel powered, with EROPS							
MODEL	BUCKET SIZE (cy)	HOURLY RATE ($)					
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV	
Caterpillar 933C	1.30	46.34	47.96	50.06	47.96	47.96	
Deere 555G	1.50	56.97	58.99	61.62	58.99	58.99	
Caterpillar 953C	2.42	94.27	98.18	103.24	98.18	98.18	
Caterpillar 963C	3.20	121.69	126.56	132.87	126.56	126.56	
Caterpillar 973C	4.19	174.99	181.99	191.06	181.99	181.99	
LOADERS: Wheel type, diesel powered, articulated, 4-wd, with EROPS							
MODEL	MAX LOG DIA (in)	HOURLY RATE ($)					
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV	
Caterpillar 906	1.00	31.81	32.79	34.06	32.79	32.79	
Caterpillar IT14G	1.70	44.05	45.47	47.32	45.47	45.47	
Case 621E	2.50	60.06	61.98	64.47	61.98	61.98	
Caterpillar 950G Series II	4.00	70.45	72.76	75.76	72.76	72.76	
Caterpillar 966G Series II	5.00	96.61	99.92	104.22	99.92	99.92	
Caterpillar 980G Series II	7.00	129.15	133.47	139.07	133.47	133.47	
Caterpillar 988G Series II	8.20	192.35	198.73	207.00	198.73	198.73	
LOADERS: Skid steer type, diesel powered							
MODEL		HOURLY RATE ($)					
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV	
Bobcat 753 - 43.5 HP		24.31	25.13	26.19	25.13	25.13	
CASE 435 - 72 HP		33.83	34.93	36.35	34.93	34.93	
PUMPING UNITS (Trash): Portable, self priming							
PUMP SIZE	ENGINE TYPE	PUMP CAPACITY (gallons/hr)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
2	Gas	10,000	6.79	6.91	7.14	6.79	7.14
3	Gas	18,000	10.55	10.72	11.06	10.55	11.06
4	Gas	36,000	13.71	13.95	14.42	13.71	14.42
6	Gas	90,000	57.54	58.30	59.76	57.54	59.76
8	Diesel	125,000	41.02	41.77	43.22	41.02	43.22
10	Diesel	160,000	47.97	48.81	50.44	47.97	50.44
Note: Unit costs for 2"-6" pumps include 25' of suction and 200' of discharge hose with couplings.							
SAWS - Chainsaw:							
BAR SIZE	ENGINE (in^3)	HOURLY RATE ($)					
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV	
14 inch	2	1.89	1.91	1.96	1.89	1.96	
16 inch	4	2.86	2.90	2.96	2.86	2.96	
20 inch	6	3.97	4.03	4.12	3.97	4.12	
25 inch	8	5.03	5.11	5.24	5.03	5.24	

Table 59 - Hourly Rental Rates from 2009 Blue Book, Continued

SCRAPERS: Single engine conventional, diesel powered with EROPS						
MODEL	CAPACITY (cy)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Caterpillar 621G	16-22	198.70	205.60	214.54	205.60	205.60
Caterpillar 631G	24-34	286.14	296.10	309.02	296.10	296.10
Caterpillar 651E	32-44	333.28	345.07	360.37	345.07	345.07
SCRAPERS: Dual engine conventional, diesel powered with EROPS						
MODEL	CAPACITY (cy)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Caterpillar 637G	24-34	377.23	389.30	404.96	389.30	389.30
SIGNS, Message: trailer mounted, changeable, DOT Type						
MODEL		HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Solar		7.66	8.05	8.73	8.05	8.73
Diesel 5 hp		11.60	12.05	12.84	12.05	12.84
SKIDDERS: Cable						
MODEL	ENGINE (HP)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Caterpillar 525B	160	103.02	105.75	110.43	105.75	110.43
Deere 540G III	117	76.32	78.46	82.12	78.46	82.12
Caterpillar 535B	180	114.31	117.36	122.58	117.36	122.58
Deere 640G III	185	110.71	113.61	118.58	113.61	118.58
SKIDDERS: Grapple						
MODEL	GRAPPLE OPEN (in)	ENGINE (HP)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Timberjack 360D SA	85	119	73.86	75.83	79.20	75.83	79.20
Caterpillar 525B	120	160	109.85	112.83	117.93	112.83	117.93
Deere 648G III	115	160	110.12	113.12	118.26	113.12	118.26
Deere 748G III	125	171	126.24	129.59	135.33	129.59	135.33
SPREADERS: Aggregate							
MODEL	WIDTH (ft)	ENGINE (HP)	HOURLY RATE ($)				
			AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Etnyre Chip Spreader	10	152	83.09	84.86	87.88	84.86	87.88
Rosco Spreadpro	16.5	205	137.99	141.75	148.20	141.75	148.20
Tail gate w\auger, gas powered	8	18	7.42	7.51	7.65	7.51	7.65
Towed w\auger, gas powered	7	7	4.53	4.61	4.75	4.61	4.75

Table 59 - Hourly Rental Rates from 2009 Blue Book, Continued

TRACTORS, CRAWLER: Power shift/torque converter, Blade, EROPS - without Rippers						
MODEL	ENGINE (HP)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Caterpillar D3G XL	70	50.55	52.31	54.58	52.31	52.31
Caterpillar D4G XL	80	57.08	59.11	61.74	59.11	59.11
Caterpillar D5G XL	90	62.50	64.74	67.64	64.74	64.74
Caterpillar D5N XL	120	76.16	78.85	82.35	78.85	78.85
Caterpillar D6R Series II	165	96.42	99.80	104.17	99.80	99.80
Caterpillar D7H DS	240	136.40	141.28	147.61	141.28	141.28
Caterpillar D8R Series II	307	177.33	183.88	192.37	183.88	183.88
Caterpillar D9R	410	230.77	239.14	249.99	239.14	239.14
Caterpillar D10R	574	307.12	318.12	332.39	318.12	318.12
Caterpillar D11R	850	521.07	541.59	568.21	541.59	541.59
TRACTORS, CRAWLER: Power shift/torque converter, Blade, EROPS - with Rippers						
MODEL	ENGINE (HP)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Caterpillar D3G XL	70	56.24	58.23	60.82	58.23	58.23
Caterpillar D4G XL	80	62.76	65.03	67.98	65.03	65.03
Caterpillar D5G XL	90	68.75	71.26	74.51	71.26	71.26
Caterpillar D5N XL	120	82.41	85.37	89.21	85.37	85.37
Caterpillar D6R Series II	165	105.40	109.18	114.09	109.18	109.18
Caterpillar D7H DS	240	150.07	155.60	162.78	155.60	155.60
Caterpillar D8R Series II	307	199.59	207.21	217.10	207.21	207.21
Caterpillar D9R	410	255.56	265.15	277.58	265.15	265.15
Caterpillar D10R	574	336.22	348.68	364.85	348.68	348.68
Caterpillar D11R	850	566.11	589.00	618.69	589.00	589.00
TRUCKS: Pickups and flatbeds						
AXLE CONFIGURATION	GVW (lbs)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
4x4 gasoline 3/4 Ton PU		19.17	19.42	19.79	19.17	19.42
4x4 gasoline 3/4 Ton Crew Rig PU		19.36	19.62	20.00	19.36	19.62
4x4 gasoline 1 Ton PU		25.11	25.38	25.78	25.11	25.38
4x2 diesel flatbed	15,000	29.32	29.69	30.24	29.32	29.69
4x2 diesel flatbed	25,000	32.34	32.84	33.57	32.34	32.84
6x4 diesel flatbed	40,000	46.66	47.40	48.47	46.66	47.40
TRUCKS: Rear dump, highway type, diesel powered						
AXLE CONFIGURATION	CAPACITY (cy)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
4x2	5-6	43.18	43.80	44.71	43.18	43.80
6x4	8-10	67.57	68.46	69.76	67.57	68.46
6x4	10-12	84.51	85.63	87.26	84.51	85.63
6x4	12-18	91.13	92.49	94.47	91.13	92.49
TRUCKS: Articulated Rear dump, diesel powered						
MODEL	CAPACITY (cy)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Caterpillar 725	14.5-18.8	111.07	114.42	119.30	111.07	114.42
Caterpillar 730	17.1-22.1	120.08	123.65	128.86	120.08	123.65
Caterpillar 735	19.3-25.8	143.06	147.21	153.25	143.06	147.21
Caterpillar 740	22.8-30.0	152.42	156.99	163.65	152.42	156.99

Table 59 - Hourly Rental Rates from 2009 Blue Book, Continued

TRUCKS: Water tankers, highway						
FUEL	CAPACITY (gallons)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Gasoline	1500	42.99	43.53	44.31	42.99	43.53
Gasoline	2500	44.07	44.66	45.50	44.07	44.66
Diesel	2500	35.20	35.81	36.71	35.20	35.81
Diesel	3000	42.65	43.39	44.46	42.65	43.39
Diesel	3500	55.78	56.68	57.99	55.78	56.68
Diesel	4000	63.55	64.79	66.60	63.55	64.79
TRUCKS: Water tankers, off highway						
FUELD	CAPACITY (gallons)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
Diesel	5000	82.18	83.95	86.54	82.18	83.95
Diesel	6000	141.31	144.12	148.22	141.31	144.12
Diesel	8000	209.38	213.82	220.31	209.38	213.82
TRUCKS: Truck tractor with hydraulic gooseneck lowboy trailer, tandem axle						
AXLE CONFIGURATION	CAPACITY (tons)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
75,000 GVW Truck	35	95.64	97.44	100.15	97.44	100.15
75,000 GVW Truck	50	99.51	101.49	104.47	101.49	104.47
TRUCKS: Truck tractor with single-gate belly dump trailer, tandem axle						
CAPACITY (cy)	CAPACITY (tons)	HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
18	27	93.24	94.98	97.58	94.98	97.58
WELDERS: Portable, diesel, mounted on skid						
MODEL		HOURLY RATE ($)				
		AZ, NM, UT	CO, KS, NE	CA, SD, WY	ID	NV
DC-CC 300		8.90	8.97	9.08	8.90	9.08
DC-CC 400		12.37	12.47	12.61	12.37	12.61

Section 624 - Top Soiling

(Labor 50%)

Topsoil needed on disturbed areas of back slopes and fill slopes 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 651.

The cost of pit development must be included if Section 651 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 with 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 $400 to $600 per acre. The cost for Hydraulic Method (hydroseeding) is about $2,000 to $4,000 per 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.

See Section 157 for more seeding options.

Section 629 - Rolled Erosion Control Products And Cellular Confinement Systems

Costs for erosion control blankets and netting range from $2 to $4 per SY installed. Supplier list is located in
Table 77 on page 152.

Section 633 - Permanent Traffic Control

(Labor 60%)

Costs below are for planning purposes only. Call suppliers for current pricing. Supplier list is located in Table 78 on page 153.

Table 60 - Traffic Control Material Prices

Materials	Price
Wood Post	$6 to $8/Lineal Ft
Steel Post	$2.00/Lineal Ft
Signs	$60 to $110/Ea
Route Markers	$15 to $25/Ea
Aluminum Sign Panels	$16/Sq Ft
Fiberglass Sign Panels	$17/Sq Ft
Wood Sign Panels	$16/Sq Ft
Regulatory/Warning Signs	$50 to $140/Ea
Sign and Post(s)	$75 to $175/Ea
Delineators w/ posts	$20 to $35/Ea
Delineator only Double Sided	$15 EA

Table 61 - Traffic Control Installation Costs

Install Only	Price
Sign and Post (one)	$30-$50/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. 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.

See FSSS Section 634 for application rates for paint and beads.

Contact suppliers for current costs. Supplier list is located in Table 79 on page 154. Contact local State DOT for contractors:

Section 650 - Road Closure Devices

Labor: Metal Gates - 15%
Concrete Barriers - 10% ----- Call for quotes.
Guardrail Barriers - 30%

Costs range from $1,500 to $3,500 each for double-lane metal gates, and $1,200 to $1,700 each for single-lane metal gates.

Estimate by time, equipment and material. Supplier list is located in Table 80 on page 155.

Section 651 - Development Of Pits And Quarries
(Labor percent and reduction as per sections used in estimating)

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

B. 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.

C. 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.

D. Turf establishment may be estimated per instructions in Section 625.

E. Ground and traffic control estimated per requirements in Section 635.

If Section 651 is not included in the contract, development costs should be included in the items requiring the pit or quarry. Estimator should pay close attention to requirements shown on the pit development plan.

End of Incidental Construction

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TEMPORARY ROAD COST ESTIMATING

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Cost Estimating For Temporary Roads

The decision to construct temporary roads for a timber sale or other activity is based on transportation planning and resource objectives that are documented in a NEPA decision. Temporary roads generally are built for one or two seasons of use for limited traffic. The National Forest Management Act (NFMA) requires that any temporary road built as part of a timber sale or other permit/lease shall be designed with the goal of reestablishing vegetative cover on the roadway and adjacent disturbed area within ten years after the termination of the contract, permit, or lease. In addition to this NFMA requirement, the timber sale contract requires outsloping, removal of culverts and ditches, and building water bars or cross ditches after the road is no longer needed.

Per FSH 2409.18 - Timber Sale Preparation Handbook, under Chapter 45.36d: "Coordinate closely with the local engineering staff to develop the cost of temporary roads or other temporary development identified in the timber sale contract. Estimate the costs of all temporary roads, using cost data contained in Area or regional cost guides and schedules."

The responsibility for the accuracy of temporary road cost estimates in some Regions may rest with the Forest Engineer. Check for additional guidance contained in regional supplements, if any. Following the example estimate in this section is one way to document temporary road costs estimates.

The following procedure, or an estimate by time and equipment, should be used to develop temporary road costs that will be included in the timber sale appraisal. If time and equipment methods are used, the estimator should use the labor rates and equipment rental rates contained in this Cost Guide. The labor rates need to be adjusted per section entitled Timber Sale Wage Rate Adjustments which appear earlier in this publication.

Step 1: Using Table T-1, determine the quantity in acres for clearing and grubbing based on the average sideslope of the temporary road. Calculate the cost per mile by multiplying the quantity by the clearing unit cost per acre from Figure 1. Select the unit cost based on the average timber volume per acre (MBF/Acre). Apply the appropriate topographic factors from Section 201. Make adjustment for the method of slash disposal used.

Adjust the cost per mile for Davis-Bacon work Areas using Table 21 in the Engineer's Estimate section. Adjust for Purchaser wage rate, if applicable, using the - Timber Sale Unit Cost Adjustment Factor For Wage Differentials, Table 25, in the Timber Sale Wage Rate Adjustments section of this guide.

Step 1a: The timber sale appraisal makes cost allowances for felling, bucking, and skidding for temporary roads so these costs must be removed from the clearing cost calculated here. Contact the Timber staff responsible for the timber sale to obtain the appropriate costs to remove. Also, the timber staff should have the volume per acre data as well. If additional clearing width is desired for windrow placement, etc., make necessary cost allowances.

Step 2: Using Table T-1, determine excavation quantity per mile based on the average side slope for the temporary road. Calculate the cost per mile by multiplying the quantity by the base cost per cy for excavation from Section 204. Make adjustments for type of excavation material, if any. If turnouts or turn-arounds are desired, adjust excavation costs accordingly (See Section 212).

Step 3: Using Table T-1, determine seeding quantity per mile based on the average side slope for the temporary road. Calculate the cost per mile by multiplying the quantity by the unit cost per acre of the turf establishment method used (See Sections 157 and 625). The quantities listed for seeding includes the roadbed and all slopes.

Step 4: Determine the cost of obliteration using Section 211. This item should be included in every temporary road.

Step 5: Total the unit per mile costs determined in Steps 1 through 4.

Step 6: Multiply unit cost from Step 5 by the length of the temporary road(s).

Step 7: Determine the total cost of drainage structures from the appropriate sections of this guide:

Step 8: Add the costs determined in Steps 6 and 7. Add an allowance of 7% for Mobilization.

Step 9: Remove Profit allowance by dividing the total in Step 8 by 1.10.

Example 13 - Temporary Road Construction

Location:	Idaho Area 2
Average side slope:	30%
Estimated length:	1.5 miles
Timber volume:	20 MBF/acre
Slash:	Disposal on site
Drainage structures:	3 drain dips
	1 - 18" x 40’ culvert
	1 - 24" x 36’ culvert
Obliteration:	Outslope and rip roadbed

Step 1:

- Clearing and grubbing = 2.11 acres/mile (*from Table T-1*)
- Unit cost for 20 MBF/acre = $2,600/acre (*from Section 201, Figure 1*)
- Percent labor = 40% (*reference labor percent given in Section 201*)

- Adjustment factor for Davis-Bacon wages for Idaho Area 2 = 1.02 (*from Table 21*)
- Adjustment factor for Timber Sale wage rate = 0.88 (*from Table 25*)
- Topographic factor for 30% side slope = 1.0 (*from Section 201, Table 36*)
- Slash/Clean Up factor for disposal on site = 1.2 (*from Section 201, Table 37*)

Cost = 2.11 acres/mile * $2,600/acre * 1.02 * 0.88 * 1.0 * 1.2 = $5,909/mile

Step 1a:

- Cost allowance for felling, bucking, and skidding = $78.03/MBF (*from the Timber staff*)

Cost = 20 MBF/acre * $78.03/MBF * 2.11 acres/mile = $3,293/mile

Final Step 1 Cost = $5,909/mile - $3,293/mile = $2,616/mile

Step 2:

- Excavation = 1,726 cy/mile (*from Table T-1*)
- Base cost for excavation from Section 204 = $1.66/cy (*Section 204*)
- Adjustment factor for common excavation materials = 1.0 (*from Section, Table 39*)
- Percent labor = 30% (*reference labor percent given in Section 204*)
- Adjustment factor for Davis-Bacon wages for Idaho Area 2 = 1.02 (*from Table 21*)
- Adjustment factor for Timber Sale wage rate = 0.92 (*from Table 25*)

Cost = 1,726 cy/Mile * $1.66/cy * 1.0 * 1.02 * 0.92 = $2,689/mile

Step 3:

- Seeding = 2.38 acres/mile (*from Table T-1*)
- Unit cost for seeding with fertilizer, no mulch = $500/acre (*from Section 625*)
- Percent labor = 50% (*reference labor percent given in Section 625*)
- Adjustment factor for Davis-Bacon wages for Idaho Area 2 = 1.02 (*from Table 21*)
- Adjustment factor for Timber Sale wage rate = 0.87 (*from Table 25*)

Cost = 2.38 acres/mile * $500/acre * 1.03 * 0.87 = $1,066/mile

Step 4:

- Outslope road = $1,125/mile (*from Section 211*)
- Rip roadbed= $750/mile (*from Section 211*)
- Percent labor = 40% (*reference labor percent given in Section 211*)
- Adjustment factor for Davis-Bacon wages for Idaho Area 2 = 1.02 (*from Table 21*)
- Adjustment factor for Timber Sale wage rate = 0.88 (*from Table 25*)

Cost = ($1,125/mile + $750/mile) * 1.02 * 0.88 = $1,683/mile

Step 5: (Step 1) - (Step 1a) + (Step 2) + (Step 3) + (Step 4) =
$2,616/mile + $2,689/mile + $1,066/mile + $1,683/mile = $8,054/mile

Step 6: $8,054/mile x 1.5 miles = $12,081

Step 7:

- 3 Drain Dips at $125 each = $375 (*from Section 204*)
- 1 - 18" x 40' CMP at $30.50/LF = 40 x $30.50 = $1,220 (*from Section 602, Table 53*)
- 1 - 24" x 36' CMP at $35.70/LF = 36 x $35.70 = $1,285 (*from Section 602, Table 53*)
- Total drainage structure cost = $330 + $1,120 + $1,188 = $2,638
- Percent labor = 30%.
- Adjustment factor for Davis-Bacon wages for Idaho Area 2 = 1.02 (*from Table 21*)
- Adjustment factor for Timber Sale wage rate = 0.92 (*from Table 25*)

Cost = ($375 + $1,220 + $1,285) * 1.02 * 0.92 = $2,703

Step 8: (Step 6) + (Step 7) = $12,081 + $2,703 = $14,784
Mobilization = $14,784 x 0.07 = $1,035
Total Cost = $14,784 + $1,035 = $15,819

Step 9: $15,819/1.10 (profit) = $14,380 (rounded)

Note: Temporary erosion control measures are not included in above example, refer to Section 157 for additional information. Also, this example did not include truck turnouts or turn-arounds or additional clearing for windrows.

Table T-1

Summary of quantities for a 12 foot wide road template w/o ditch, with 3/4:1 cut slopes and 1.33:1 fill slopes

No Minimum clearing width, seeding applied to ALL slopes and roadbed.

Clearing limits are 0 feet beyond top of cut, 0 feet beyond toe of fill.

Excavation is based on self-balanced sections, compaction factor of 25% was used.

Average Side slope (%)	25 % Comp. Excavation per mile (cy)	Clearing per mile (acre)	Seeding per mile (acre)
10	386	1.63	1.69
20	1023	1.83	1.99
30	1726	2.11	2.38
40	2753	2.51	2.92
50	4239	3.11	3.74

Form 2 - Cost Estimate for Temporary Roads

Sale Name _____ Made by _____
Unit or Road No. _____ Checked by _____
Reference: Cost estimating procedures for temporary roads from
Cost Guide - pages _____

Average Side Slope: _____
Length: _____ ft. = _____ Miles
Timber Volume: _____ MBF/Acre
Drainage Structures: _____ Dips
_____ 18" CMP, _____" CMP

(1) Clearing and Grubbing = _____/Mile

(2) Excavation = _____/Mile

(3) Seeding = _____/Mile

(4) Obliteration = _____/Mile

(5) Total Unit Cost (1)+(2)+(3)+(4) = _____/Mile

(6) Basic Cost Total (5) x Length = _____/Mile x _____ Mile(s) = _____

(7) Drainage Structures
Drainage Cost Total =
_____

(8) Basic Cost (5) + Drainage Cost (6) = _____(a)
Mobilization = (a)_____ x _____ % = _____(b)

Subtotal = Mobilization (b) + (a) =_____ (c)

(9) TOTAL COST = (c)_____ / 1.10 (Profit) = _____*

End of Temporary Road Cost Estimating

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ABBREVIATIONS

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Abbreviations

°F	Degrees Fahrenheit
A/E	Architectural and Engineering
AQM	Acquisition Management
C	Cut
CIM	Construction induced maintenance
CL	Centerline
CMP	Corrugated metal pipe
CPI	Consumer Price Index
cy	Cubic yard
D	Ditch
D-B	Davis-Bacon wage rates
DD	Drain dip
DIA	Diameter
Ea	Each
F	Fill
FP-03	Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects
FSSS	Forest Service Supplemental Specifications
ft	Foot
gal	Gallon
GVW	Gross vehicular weight
H	Horizontal
in	Inch
L	L-line (final location line)
lb	Pound
lbs	Pounds
LF	Linear foot
NFMA	National Forest Management Act
P	P-line (preliminary location line)
PAE	Post award engineering
PC	Point of curvature
PI	Point of intersect
PT	Point of tangency
QA	Quality assurance
QC	Quality control
RP	Reference point
SY	Square yard
TPH	Tons per hour
V	Vertical
W	Width
yd	Yard
yd^2	Square yard
yd^3	Cubic yard

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SUPPLIERS

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Lists of suppliers are provided for a starting reference only. Companies may not use this list for advertising or promotional purposes. These lists are not an endorsement of any product or firm by the USDA or Forest Service. Companies are listed in alphabetical order.

Table 62 - Slope Reinforcement and Retaining Wall Suppliers

Name	Address	Phone	Website	Contact
Buildology	3601 Pan American NE Albuquerque, NM 87107	505-344-6626	www.materialsinc.com	
Contech Construction Products	9025 Centre Pointe Drive, Suite 400 West Chester, OH 45069	1-800-338-1122 check online for your state's office	www.contech-cpi.com	
Geo Products	8615 Goldon Spike Ln Houston, TX 77086	281-820-5493	www.geoproducts.org	Al Florez
GeoCell Systems, Inc.	Suite 202 Pier 54, Terry Francois Blvd. San Francisco, CA 94158	415 541-5300	www.geocell-systems.com	
GSI/SNL GeoStabilization, Inc.	955 Malachite Dr. Fruita, CO 81521	970-210-6170	www.geostabilization.com	Cameron Lobato Colby Barrett
Hilfiker Retaining Walls (ArtWeld Gabions)	3900 Broadway PO Box 2012 Eureka, CA 95502 PO Box 39 Levan, UT 84639	707-443-5093 800-762-8962 435 623-1433	www.hilfiker.com	Suzane Brent Taylor
J-H Supply, Inc.	2132 Osuna Rd. NE #A Albuquerque, NM 87113	505-344-6006		

Name	Address	Phone	Website	Contact
Maccaferri Gabions	3650 Seaport Blvd. West Sacramento, CA 95691	916-371-5892 800-328-5805 PHX 602-246-9071	www.maccaferri-usa.com	Jeff
Modular Gabion Systems (Distributed locally by Contech)	MGS Corp Office: 2221 Canada Dry St. Houston, TX	800-324-8282	www.gabions.net	Grant Detro
Soil Stabilization Products Co.	PO Box 2779 Merced, CA 95340	209-383-3296 800-523-9992	www.sspco.org	Samuel Randolph
Terra Aqua Inc.	PO Box 7546 Reno, NV 89510	775-828-1390 800 -736-9089	www.terraaqua.com	Noel Cline
US Fabrics Inc.	3904 Virginia Ave. Cincinatti, OH 45227	800-518-2290	www.usfabricsinc.com	
Vance Bros., Inc.	PO Box 369 Aurora, CO 80040	303-341-2604 800-228-3671	www.vancebrothers.com	Chance Foreman

See Slope Reinforcement and Retaining Walls (page 77) for details.

Table 63 - Magnesium Chloride Suppliers

Name	Address	Phone	Website	Contact
Atlas Sand and Rock	4341 Snake River Ave. Lewiston, ID 83501	208-743-5596		
Desert Mountain Corporation	P.O. Box 1633 Kirtland, NM. 87417	800-375-9264		
Envirotech	910 54th Avenue, Suite 230 Greeley, CO 80634	800-369-3878 970-346-3900	www.envirotechservices.com	
Hill Brothers Chemical Co.	75 N. 640 W. N. Salt Lake, UT 84054 Plant - Rowley, UT	801-936-4100 800-336-3911	www.hillbrothers.com	Jeff Greenburg
Lyman Dust Control	P.O. Box 243 Spokane, WA 99210	509-999-2000 800-952-6457	www.lymandustcontrol.com	Jerry Lyman
North American Salt	Ogden, UT	913-344-9390	www.nasalt.com	Jason Bagely

See Section 306 (page 86) for details.

Table 64 - Lignin Sulfonate Suppliers

Name	Address	Phone	Website	Contact
Desert Mountain Corporation	P.O. Box 1633 Kirtland, NM. 87417	800-375-9264		Emil Mead
Georgia-Pacific West, Inc.	P.O. Box 1236 Bellingham, WA 98227	360-733-4410 800-365-4348	www.gp.com	

See Section 306 (page 86) for details.

Table 65 - Calcium Chloride Suppliers

Name	Address	Phone	Website	Contact
Cargill Salt	Farmington, UT	801-557-9967	www.cargillsalt.com	Steve Cheuvront
Desert Mountain Corporation	P.O. Box 1633 Kirtland, NM. 87417	800-375-9264		Emil Mead
Dow Chemical		800-447-4369	www.dow.com	Greg MacDonnel
Hill Brothers Chemical Co.	75 N. 640 W. N. Salt Lake, UT 84054 Plant - Rowley, UT	801-936-4100 800-336-3911	www.hillbrothers.com	Jeff Greenburg
Hyland Enterprises, Inc.	P.O. Box 2377 Rawlins, WY 82301	307-328-0668 800-651-5263	www.hylandenterprisesinc.com	Doug Dowlin
Tetra Technologies		800-327-7817 x350	www.tetratec.com	John May
Tiger Calcium Services, Inc.	BC, Canada	780-955-5004 800-661-4298	www.tigercalcium.com	Clark Sazwan
Vitro Chemical	Humble, TX	281-852-4754		Chuck Hodgdon
Ward Chemical	BC, Canada	780-436-4832	www.wardchem.com	Al Korchinski

See Section 306 (page 86) for details.

Table 66 - Bentonite Suppliers

Name	Address	Phone	Website	Contact
American Colloid	Lovell, WY	800-322-1159	www.americancolloid.com	
Bentonite Performance Minerals, Inc.	410 17th Street, Suite 800 Denver, CO 80202	281-871-7900 303-571-8240		Charles McAughan
Black Hills Bentonite	Box 9 Mills, WY 82644	800-7889443	www.bhbentonite.com	
Central Oregon Bentontite	50500 SE Camp Creek Rdprineville, OR 97754	541-477-3351	www.angelfire.com/bug/tdarby	
M-1 Bentontite (Usnewco)	PO Box 832 Greybull, WY 82426	307-765-9583 866-299-1464		John Livezey
Teague Mineral Products	1925 Highway 201 Adrian, OR	541-339-3940		
Wyo-Ben, Inc.	Billings, MT	800-548-7055	www.wyoben.com	Rick Zavitz

See Section 303 (page 85) for details.

There is also the USGS publication "Directory Of Companies Mining Specialty Clays In The United States In 2000" located at:
http://minerals.usgs.gov/minerals/pubs/commodity/clays/190200.pdf

Table 67 - Asphalt Suppliers

Name	Address	Phone	Website	Contact
Golden Bear Oil Specialties	P.O. Box 5446 Oakdale, CA 93388 6400 Richmar Ave. Las Vegas, NV 89139	661 393-7110 702 361-3700	www.goldenbearoil.com	John Petrilli
Hills Materials Company	3330 Sturgis Road Rapid City, SD 57702	605 394-3300	www.hillsmaterials.com/	
Holly Asphalt	Albuquerque, NM Glendale, AZ	623 385-3657	http://www.hollycorp.com/	
Idaho Asphalt Supply	Idaho Falls, ID Salt Lake City, UT California	208 524-5871	www.idahoasphalt.com	
Montana Refining	1900 10th Street N.E. Great Falls, MT 59404	406 761-4100	www.connacheroil.com/operations/montana.php	
SemMaterials	Grand Junction, CO Woods Cross, UT Boise, ID Spokane, WA	970 241-1135 801 295-3489 208 345-2538 509 487-4560	www.semmaterials.com/asphaltpostings.aspx	

See Asphalt Pavements and Surface Treatments (page 95) for details.

Table 68 - Clarified Dust Oil D0-4 Suppliers

Name	Address	Phone	Website	Contact
Idaho Asphalt Supply Inc.	P.O. Box 50538 Idaho Falls, ID 83405-0538	208 524-5871 800 524-1679	www.idahoasphalt.com	I

See Asphalt Pavements and Surface Treatments (page 95) for details.

Table 69 - Enzyme and Resin Suppliers

Name	Address	Phone	Website	Contact
Idaho Enzymes, Inc.	1010 West Main Jerome, ID 83338	208 324-3642		
Soil Stabilization Products Company	P.O. Box 2779 Merced, CA 95340	209 383-3296 800 523-9992	www.sspco.com	

See Asphalt Pavements and Surface Treatments (page 95) for details.

Table 70 - Plastic Pipe Suppliers

Name	Address	Phone	Website	Contact
Advanced Drainage Systems	240 N. 400 W. PO Box 540356 North Salt Lake City 84054	800-821-6710 801-296-2055	www.**ads-pipe.com**	
Contractor's Supply, Inc	PO Box 1655, Gillette, WY 82717	307-682-5153 800-284-8182		
Field Lining Systems	439 S. 3rd Ave. Avondale, Az. 85323	888-382-930 623-842-1255	www.**fieldliningsystems.com**	
GJ Pipe & Supply	2868 I-70 Business Loop Grand Junction, CO	970-243-4604 800-748-1564	www.gjpipe.com	
Northwest Pipe Fittings, Inc	PO Box 920 Rapid City, SD 57702	605-342-5587	www.**northwestpipe.net**	Terry Weber

See Section 602 (page 109) for details.

Table 71 - Metal Pipe Suppliers

Name	Address	Phone	Website	Contact
Big "R" Manufacturing & Distribution, Inc	PO Box 1290 Greeley, CO 80632	303 893-8480 800 234-0734	www.bigrmfg.com/products/steel pipe/	
Central Culvert Supply	3150 Airport Road, PO Box 103 Pierre, SD 57501	605 224-5222		
Contech Const. Products, Inc	Salt Lake City, UT Eagle, ID (Boise area) Twin Falls, ID Wheatridge, CO Albuquerque, NM	801 363-3873 208 939-3505 208 733-4188 303 431-8999 800 777-7972 505 842-8282 800 522-5237	www.contech-cpi.com/drainage/products_materials/128	
GJ Pipe & Supply	2868 I-70 Business Loop Grand Junction, CO	970-243-4604 800-748-1564	www.gjpipe.com	
Roscoe Steel & Culvert	Billings, MT Missoula, MT Casper, WY	406 656-2253 307 472-7121	www.roscoesteel.com/contact.html	

See Section 602 (page 109) for details.

Table 72 - Manholes, Inlets, And Catch Basin Suppliers

Name	Address	Phone	Website	Contact
GJ Pipe & Supply	2868 I-70 Business Loop Grand Junction, CO	970-243-4604 800-748-1564	www.gjpipe.com	

See Section 604 (page 111) for details.

Table 73 - Underdrains, Sheet Drains, And Pavement Edge Drain Suppliers

Name	Address	Phone	Website	Contact
Advanced Drainage Systems	240 N. 400 W. PO Box 540356 N. Salt Lake City, UT 84054	303 766-2000	www.**ads-pipe.com**	
Contech Construction Products	N. Salt Lake City, UT 84116 Twin Falls, ID Boise, ID Phoenix, AZ	801 363-3873 208 733-4188 208 344-2570 800 999-8399	www.contech-cpi.com/drainage/products_materials/128	
Master Distributors	1600 W. 13th Ave. Denver, CO 80204	303 595-8722	www.**drainage-eljen.com**	Rich Minteer
Nilex Corporation	15171 E. Fremont Dr. Englewood, CO 80112	303 766-2000	www.**nilex.com**	
US Fabrics	3904 Virginia Ave Cincinatti, OH 45227	800 518-2290	www.**usfabricsinc.com**	

See Section 605 (page 111) for details.

Table 74 - Guardrail Suppliers

Name	Address	Phone	Website	Contact
Coral Sales Company	PO Box 22385 Milwaukee, OR 97269	800 538-7245	www.**coralsales.com**	
J-H Supply, Inc.	2132 Osuna Rd. NE #A Albuquerque, NM 87113	505-344-6006		
SAN BAR Constuction Corp	9101 Broadway Albuquerque, NM 87105	505 452-8000	www.**sanbarcc.com**	
Trinity Highway Products	P.O. Box 99 Centerville, UT 84014	801-292-4461 800-772-7976	www.**highwayguardrail.com**	

See Section 617 (page 114) for details.

Table 75 - Concrete Barrier Suppliers

Name	Address	Phone	Website	Contact
Beauregards, LLC	Boise, ID	208-860-5626		
CRETEX Concrete Products	2046 Samco Rd. Ste. 2 Rapid City, SD 57702	605-718-4111 605-343-1450	www.**cretexwest.com**	
Discount Crowd Control	803 E. Park St. Olathe, KS 66061	866-755-3325	www.discountcrowdcontrol.com	
Materials, Inc.	318 South Hill Rd. Bernalillo, NM 87004	505-867-9035 866-867-9035	www.materialsinc.com	

See Section 618 (page 114) for details.

Table 76 - Fencing, Gates And Cattleguard Suppliers

Name	Address	Phone	Website	Contact
Big "R" Manufacturing and Distribution, Inc	PO Box 1290 Greeley, CO 80632	970-356-9600 800-234-0734	www.bigrmfg.com	
Colorado Correctional Industries (Dept. of Corrections)	P.O. Box 1600 Cañon Complex Cañon City, CO 81215	719-269-4540		
Cow Country Equipment	4501 S. Interstate 90 Service Rapid City, SD 57703	605-342-8258		
Hueys Metal Service Center	P.O. Box 377 Corona, NM 88318	505-849-8446		
Pavement Markings Northwest	4850 Henry St. Boise, ID	208-388-8858		
Powder River	388 E. 900 S. P.O. Box 50758 Provo, UT 84605	801-374-2983 800-453-5318	www.**powderriver.com**	
WW Cattle Guards and Precast	5742 Webb Dr. Lakeside, AZ 85929	928-537-3125		

See Section 619 (page 114) for details.

Table 77 - Rolled Erosion Control Products And Cellular Confinement System Suppliers

Name	Address	Phone	Website	Contact
Geo Products	8615 Goldon Spike Ln Houston, TX 77086	281 820-5493	www.**geoproducts.org**	Al Florez
North American Green	14649 Highway 41 North, Evansville, IN 47725	1-800-722-2040	www.**nagreen.com**	
RoLanka	155 Andrew Drive, Stockbridge, GA 30281	1 800 760 3215	www.rolanka.com	
Soil Stabilization Products Co.	PO Box 2779 Merced, CA 95340	209-383-3296 800-523-9992	www.**sspco.org**	Samuel Randolph
Terra Tech, LLC	2635 W. 7th Place, Eugene, OR. 97402	1-800-321-1037	www.**terratech.net**	

See Section 629 (page 124) for details.

Table 78 - Permanent Traffic Control Material Suppliers

Name	Address	Phone	Website	Contact
Action Safety Supply	700 Haines Ave NW Albuquerque, NM	505-878-9690		
J-H Supply, Inc.	2132 Osuna Rd. NE #A Albuquerque, NM 87113	505-344-6006		
Newman Signs	1606 6th Ave SW Jamestown, ND 58402	800 437-9770		
P and M Signs Inc (GSA contract)	Mountainarir, NM	505 847-2850		
Perma Letter Sign Co.	1105 4th Ave. N. Billings, MT 59101	406 252-1102		Ronald A. Bachman
Signs of Orion	Bozeman, MT	406 599-0382		Chris
Stonehouse Signs (GSA: GS-07F-5550P)		800 525-0456 Ext. 205		Patty Preston
Summit Signs and Supplies	2340 Deadwood Ave Rapid City, SD 57702	605 342-8303		
UNICOR Sign Factory	9595 W. Quincy Ave Littleton, CO 80123	303 763-2588		Karla Kunsemiller

See Section 633 (page 123) for details.

Table 79 - Permanent Pavement Marking Suppliers

Name	Address	Phone	Website	Contact
Emery Brothers	21357 Highway 30 Filer, ID	208 733-3951		
Idaho Traffic Safety	3400 E. Sunnyside St. Ammon, ID 83406	208 522-4470		
J-H Supply, Inc.	2132 Osuna Rd. NE #A Albuquerque, NM 87113	505-344-6006		
Pavement Markings Northwest	4850 Henry St. Boise, ID	208 388-8858		
TAPCO	800 Wall St. Elm Grove, WI 53122	800 236-0112		

See Section 634 (page 124) for details.

Table 80 - Road Closure Device Suppliers

Name	Address	Phone	Website	Contact
Big "R" Manufacturing and Distribution, Inc	PO Box 1290 Greeley, Colorado 80632	970 356-9600 800 234-0734	www.bigrmfg.com	
Cow Country Equipment	4501 S. Interstate 90 Service Rapid City, SD 57703	605 342-8258		
Hueys Metal Service Center	P.O. Box 377 Corona, NM 88318	505 849-8446		
Powder River Co.	388 E. 900 S., P.O. Box 50758 Provo, Utah 84605	801 374-2983 800 453-5318	www.**powderriver.com**	Ross Gull
WW Cattle Guards and Precast	Route 4, Box 1756 Lakeside, AZ 85929	520 537-3125 800 845-3234		Bob Sebring

See Section 650 (page 124) for details.