

### **Appendix 3. Costs Related to Road Construction/Improvement**

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## APPRAISAL POLICY STATEMENT

The cost appraisal policy in this section shall be concerned only with road construction items.

The appraisals shall be made as fairly and impartially as possible with due consideration for prevailing rates for equipment and labor; size and quantity of equipment available; terrain and material types in which equipment will be working.

Unless otherwise stated, all costs and factors include 17% for profit, risk, overhead, and bonding; and 18% for the labor surcharge.

### Cost Establishment Procedure

Direct cost items are provided which are up to date as nearly as practicable. Because of outdating and possible wide variation of conditions from the average, basic rates of time and quantity are supplied which will enable said cost items to be updated or modified with a minimum of effort.

Instructions on the use of tables and cost rate items are included with said tables and rates to facilitate their use.

Where the appraiser needs to know the cost of ownership of equipment or structures he/she should refer to textbooks on computation of Average Annual Investment.

No attempt has been made at this time to break down certain contract items, such as fencing, into detailed unit costs.

For the purposes of estimating costs, the appraiser must assume an operation of average efficiency undertaken by a prudent contractor who operates in the following manner:

1. Understands the project(s) prior to signing the contract.
2. Hires trained, competent persons.
3. Supervises and communicates with his crew closely.
2. Plans seasonal operations to take advantage of weather conditions.
3. Plans to have the road construction equipment and supplies necessary for forest road construction which are of correct size to do the job efficiently, and are maintained properly to minimize time lost for repair.
4. Proceeds with various phases of road construction in a safe and workmanlike manner.
5. Allows sufficient time to do the job.

## CLEARING AND GRUBBING COSTS

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### Base Costs/Acre In Dollars For Clearing And Grubbing

<u>Method</u>		<u>Tops &amp; Limbs</u>	<u>Logs</u>	<u>Stumps</u>	<u>Total</u>
1. Side cast	273	30		210	564
2. Scattering	419	48		323	869
3. Piling	465	54		358	965
4. Pile & Burn	671	77		710	1604

Load and Haul to the designated waste area shall be appraised on an individual basis using time and equipment estimates.

$$\frac{\text{Base cost}}{\text{Adjustment factor}} \times \text{X} = \$ \text{Cost per acre}$$

For explanation of Adjustment factor see "Clear And Grub" section and photos series.

<b>Terrain</b>	<u>Adjustment Constants</u>
Moderate- slopes up to 45%	(1)
Steep- slopes steeper than 45%	(1.1)

<b>Cover types</b>	
Light cover	(.8)
Medium cover	(1)
Heavy cover	(1.3)
(see photo series for guidance)	

$$\text{Terrain constant} \times \text{X} \times \text{Cover constant} = \text{Adjustment factor}$$

The clearing and grubbing costs shown above represent the total per acre cost for disposal of nonmerchantable material and stumps.

Make sure that you use the correct cost for the type of method that is actually being required in the field. For example sidecast of Clear and Grub debris is one of the most common methods in use on State Forests and should not be confused with Scattering which is sometimes specified but is not actually being done. The appraiser should be familiar with the definitions and differences of these methods.

## EXCAVATION COSTS

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1. Basic Excavation Costs: (basic cost includes haul to 200') (Slopes over 50% may need add on cost for end hauling)

<u>Classification</u>	<u>% Sideslope</u>	<u>Base Cost</u>
A. Common (soil and loose rock 2' in diameter)	0-20	55.49 \$/sta
	0-50	1.09 \$/cy
	over 50	1.41 \$/cy
B. Boulders (rocks greater than 2' in diameter)	0-20	89.63 \$/sta
	0-50	1.73 \$/cy
	over 50	1.84 \$/cy
C. Loose Rock (Talus Material 2' in diameter with minor amounts of soil)	0-20	60.53 \$/sta
	0-50	1.21 \$/cy
	over 50	1.59 \$/cy
D. Rippable Rock	0-20	161.33 \$/sta
	0-50	2.24 \$/cy
	over 50	3.19 \$/cy
E. Solid Rock	0-20	249.48 \$/sta
	0-50	3.84 \$/cy
	over 50	5.66 \$/cy

### 2. Basic Add-on Costs

a. <u>Embankment Placement Method</u>	Common	Rippable
1. Side casting and end dumping.	0.00	0.00
2. Layer placement.	.15	.15
3. Layer placement (Roller Compaction).	.31	.29

#### b. End Haul

Cost on a time and equipment basis

#### 2. Loading cost only

- a. Excavator (w/dozer excavation)                      \$1.46/cy
  - b. Front end loader    \$ .83/cy
- (or use the production computation sheets for excavators or loaders)

#### 3. Truck haul (use "haul cost computation sheet")

- c. Slope Rounding \$ .17/L.F. (Consider any additional grubbing requirements)
- d. Subgrade Finishing (\$/Mile)

## BRUSH CUTTING

Costs for brush cutters should be based on current estimates from contractors in your local area. Typical mechanical brush cutters have the following characteristics:

a. Specifications - The average reaches for a brush cutter are:

<u>Uphill @ 45°</u> <	<u>Level</u>	<u>Downhill @ 45°</u> <	<u>Height</u>
11 ft.	15 ft.	9 ft.	16 ft.

b. Production rates - average 3/4 to 1 mile per day brushing both sides of road.

c. Equipment and manpower

1. Brushcutter and operator
2. Pickup and laborer

d. A tractor mounted flail mower setup should run between \$45 to \$65 per hour for rough estimating.

## SUBGRADE TREATMENTS

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Grading (\$/Mile)	<u>Surfaced</u>		<u>Unsurfaced</u>	
	common	rocky	common	rocky
1. Single lane without ditch	422	641	492	693
2. Single lane with ditch	586	731	774	949
3. Double lane with ditch	821	1128	1044	1283
4. Grid roll only	233			
5. Dips				
a. Drain Dips	138.00 \$/ea			
b. Rolling Dips	69.00 \$/ea			
Geotextiles (\$/S.Y.)	Material only		Installed	
1. Woven 500x (stabilization)	1.71		1.86	
2. Nonwoven 140n (separation)	.71		.86	

## EQUIPMENT/OPERATOR RATES

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Division	---- Equipment Rates ---- \$/HR.		
Equipment (Make - Model)	<u>Average</u>	<u>Standby</u>	<u>Operator(s)</u>
<b><u>BRUSH CHIPPERS</u></b>			
Brush Mower 8'	89.26		35.90
<b><u>COMPACTION EQUIPMENT</u></b>			
Vibratory Roller	36.33	8.60	34.94
Grid Roller	9.00	1.70	
Sheeps Foot	6.12	2.00	
Hand Held Tamper	1.68	.22	34.94
<b><u>4" DRILL &amp; COMPRESSO</u></b>	45.0	12.05	(2) 70.36
<b><u>EXCAVATORS, CRAWLER MOUNTED (BACKHOES)</u></b>			
1.00 CY (225)	40.54	12.71	36.04
1.50 CY (235)	73.75	23.27	36.04
<b><u>GRADERS</u></b>			
12-G	26.26	8.32	35.90
14-G	37.35	11.75	35.90
16-G	53.93	17.0	35.90
<b><u>LOADERS - FRONT END/BACKHOES</u></b>			
1.00 CY/24" HOE	13.09	3.56	35.26
1.25 CY/30" HOE	20.06	5.67	35.26
<b><u>LOADERS - FRONT END</u></b>			
3.00 CY (950B)	35.77	5.49	35.16
4.00 CY (966D)	48.55	13.56	35.60
5.25 CY (980C)	58.96	15.36	36.68
7.00 CY (988B)	83.28	22.08	37.05
<b><u>SCRAPERS</u></b>			
11 CY (613B)	40.74	10.67	35.60
14 - 20 CY (TS14B)	76.21	21.35	35.60
<b><u>TRACTORS</u></b>			
D4	19.71	4.72	35.60
D6	35.14	8.35	35.60
D7 WINCH	59.78	15.59	35.60
D8 WINCH	91.44	25.73	35.60
D8 RIPPER	94.71	26.71	35.60

Division Equipment (Make - Model)	---Equipment Rates		\$/HR. Operator(s)
	Average	Standby	
<u>TRUCKS</u>			
Distributor Truck	45.43		33.21
Dump: 10 CY	15.32	3.59	33.21
: 12 CY	24.46	5.23	33.21
: 20 CY (Belly)	40.11	9.48	33.51
Water: 2000 Gal.	14.77	3.48	33.29
: 3000 Gal.	23.95	5.14	33.29
Lowboy	38.33	8.92	33.29
1/2 Ton P.U.	5.80	.92	33.07
3/4 Ton P.U. (Crew Cab)	6.70	1.19	33.07
1 Ton Stake	14.89	2.04	33.07
<u>CRUSHING EQUIPMENT</u> (typical 3 stage equipment)			
Jaw 22" X 36"	29.98		35.60
Cone 45" Standard	42.03		
Rolls 30" X 18" standard	21.79		
Belt 24" X 60'	12.03		
Screen 5' X 12' Triple Deck	10.34		
Apron 48" X 14' - Heavy Duty	17.39		
Grizzly 52" X 27' Vibrating feeder	21.13		
Typical cost for entire setup includes feeding equipment			
1 stage	\$312.31/hr		
2 stage	\$422.05/hr		
3 stage	\$466.21/hr		
<u>MISCELLANEOUS</u>			
CHAIN SAW: BRUSH CUTTERS	3.14		27.65
: FALL AND BUCK	3.14		28.07
ELECTRIC MOTOR 200 HP	14.66		
GENERATOR: 250 KW	21.84	2.78	35.47
: 355 KW	31.34	4.44	35.47
HYDRO-MULCHER	42.75	(2)	70.94
LOG SKIDDER - CAT 518	41.06		35.60
<u>WATER PUMPS</u>			
4" - 600 GPM	2.69	.22	34.64
- 1100 GPM	13.12	1.00	34.64
Welder, 200 AMP	8.50	.49	35.60

## CULVERT COSTS PER FOOT

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The following costs were derived from the USFS Cost Estimating Guide. For large projects where a full load of culverts (truck and trailer) will be ordered these costs may be reduced 20%. For small projects where only a few culverts will be needed these costs may be increased by 20%.

The cost shown is an average cost and can be used for culvert estimating without regard for culvert order size and should be within a reasonable range of the true cost.

Costs include bands and delivery				Coated corrugations	
2-2/3" X 1/2 "	Material	Material+		Material	Material+
<u>Thickness</u>	<u>Diameter(in)</u>	<u>Price</u>	<u>installation</u>	<u>Price</u>	<u>installation</u>
16 Gage	18	7.59	13.48	8.85	14.74
	21	8.86	14.75	10.33	16.22
	24	10.12	16.01	11.80	17.69
	30	12.65	19.13	14.75	21.23
	36	15.18	26.90	17.70	29.42
	42	17.71	31.61	20.65	34.55
	48	20.25	37.50	23.61	40.86

corrugations					
2-2/3" X 1/2"	Material	Material+		Material	Material+
<u>Thickness</u>	<u>Diameter(in)</u>	<u>Price</u>	<u>installation</u>	<u>Price</u>	<u>installation</u>
14 Gage	18	9.45	15.34	10.71	16.63
	21	11.02	16.91	12.49	18.38
	24	12.60	18.49	14.28	20.17
	30	15.75	22.23	17.85	24.33
	36	18.90	30.62	21.42	33.14
	42	22.05	35.95	24.99	38.89
	48	25.20	42.45	28.56	45.81
	54	38.35	48.44	32.13	52.22
60	31.50	53.94	35.70	58.14	

corrugations					
3" X 1"	Material	Material+		Material	Material+
<u>Thickness</u>	<u>Diameter(in)</u>	<u>Price</u>	<u>installation</u>	<u>Price</u>	<u>installation</u>
14 Gage	48	28.19	46.30	31.55	49.66
	54	31.72	52.81	35.50	56.59
	60	35.24	58.80	39.44	63.00
	66	38.77	65.40	43.39	70.02
	72	42.29	71.41	47.33	76.45
	78	45.81	78.52	51.27	83.98

### CORRUGATED POLYETHYLENE PIPE

18	7.02	11.93
24	8.77	14.98

For pipe arches - find the cost for equivalent round pipe & add 10%

**MOVE IN AND SET-UP COSTS**

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Equipment Allowances

Equipment Description within <u>(\$/mile)</u>	Move-in	Project area _____	Move <u>(dollars)</u>
Fire Equipment	120	N/A	
Powder House			241
N/A			
Drill and Compressor			241
N/A Cranes - 20 tons			241
N/A			
- 60 tons			533
N/A			
Graders - all sizes			241
7.05			
Loader - 1 1/2 - 2 1/2 cy			241
6.83			
- 3 cy and over			387
8.15			
Roller and Compactors			241
13.73			
Scrapers - 11 cy and under			241
4.91			
- over 11 cy			533
7.21			
Excavators, large backhoes, etc.			533
21.42			
Backhoes 24/30" Bucket (rubber tired)			241
3.52			
Tractors - D5 -7			387
18.47			
- D8			533
25.53			
Dump trucks : under 10 cy			121
2.30			
: over 10 cy			144
2.76			
Water Truck			158
3.03			
Rock Crusher (setup not included)			
1 stage			1066
2 stage			1597
3 stage			2489
Screening Plant			387

Crusher <u>setup</u>	1 stage	733	COSTS are complete per stage, don't add together
	2 stage	1598	
	3 stage	2520	
cost to change gradation:		207	
Screening Plant:		395	

THE COST TO MOVE THE EQUIPMENT TO THE PROJECT AREA WITH OR WITHOUT A LOWBOY, AS APPLICABLE, IS BASED UPON 50 MILES (ONE WAY). ADJUST COSTS, AS SHOWN ON EXHIBIT 15.

COST TO MOVE THE EQUIPMENT WITHIN THE PROJECT ARE WITHOUT THE USE OF A LOWBOY. IF THE USE OF A LOWBOY IS NECESSARY WITHIN THE PROJECT AREA, USE THE COSTS FROM THE MOVE IN COLUMN.

**EXHIBIT 15  
MILEAGE FACTORS  
(ONE WAY MILES)**

Apply to \$ / each costs obtained from move in chart

<u>DISTANCE</u>	<u>FACTOR</u>
0 - 25	0.58
30	0.66
35	0.74
40	0.82
45	0.91
50	1.00
55	1.07
60	1.15
65	1.23
70	1.31
75	1.40
80	1.48
85	1.56
90	1.64
95	1.72
100	1.80
110	1.97
120	2.13
130	2.29
140	2.46
150	2.62
160	2.78
170	2.95
180	3.11
190	3.27
200	3.44
210	3.60
220	3.76
230	3.93
240	4.09
250	4.25

## GATES

### Railroad Iron Gates

These gates are extensively used in many areas and many designs are available.

Four designs are shown, the rock filled barrel counterweight being very popular.

The cost is \$450-650, the 95-125 lb. rails being more expensive.

Add \$200 for installation.

Because of short sight distances on mountain roads, gates must be placed so as to allow sufficient stopping distance for traffic. If this is impossible, warning signs must be placed alongside the road 500 to 1000 feet away on one or both approaches. In addition, gates must be painted a light or fluorescent color that is highly visible. Do not use white where snow is encountered.

Quite often an information sign hung from the center of the gate can also serve to make the gate more easily detected.

<u>Powder River Gates</u>		<u>dollars</u>	
	52" X 12'	139.00	add 11% for delivery
heavy duty with	52" X 14'	153.00	
chain latch,	52" X 16'	176.00	
no installation	52" X 18'	212.00	

### Steel tube Gate (see exhibit)

These are custom made gates, the approximate cost is \$1000

(see exhibit section for picture)

Cable gates will not be used on State land.