4.2. UNDERGROUND MINING--CAPITAL COSTS

4.2.7. INFRASTRUCTURE

4.2.7.1.1. ACCESS ROADS CLEARING

The total cost per kilometer is the sum of two separate cost curves (labor and equipment operation) having a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with clearing for access roads. Supplies have not been considered in the clearing costs because it is assumed that cleared brush or timber would be buried under the excavation waste; thus, supplies of fuel oil for burning the clearing slash are not required.

BASE CURVE

The curves are based on estimated costs for clearing medium growth on terrain with a side slope of 25%. Medium growth varies from heavy brush to one tree, 0.33 m in diameter, per 40 m^2.

(L) Labor Operating Cost $(Y_L) = 1135.467(X)^{0.711}$
The operating labor costs are distributed as follows:

Direct labor................	86%
Maintenance labor...........	14%

The direct labor costs consist of the following typical range of personnel:

	%	Av salary per hour (base rate)
Dozer operator.............	12%	$16.33
Wheel-loader operator......	12%	16.33
Flatbed-truck driver.......	12%	15.89
General laborer............	64%	13.86

The average wage for labor is $14.63 per worker-hour (including burden and average shift differential).

(E) Equipment Operating Cost $(Y_E) = 467.945(X)^{0.711}$
The equipment operating cost consists of 35% for repair parts, 53% for fuel and lubrication, and 12% for tires.

The equipment operation curve consists of:

Dozer crawler..............	31%
Wheel loader...............	47%
Flatbed truck..............	12%
Pickup truck...............	9%
Chainsaws..................	1%

The equipment operating cost distribution is

	Repair parts	Fuel and lube	Tires
Dozer crawler..............	52%	48%	-
Wheel loader...............	36%	43%	21%
Flatbed truck..............	9%	80%	11%
Pickup truck...............	8%	90%	2%
Chainsaws..................	39%	61%	-

ADJUSTMENT FACTORS

Brush Factor For light clearing conditions where the growth consists mainly of brush and small trees, multiply the curves by the following factor:

Brush factor $(F_{B\ LIGHT}) = 0.25$

For heavy clearing conditions, defined as when clearing a dense growth of trees (diameter of the trees commonly exceeding 0.33 m), multiply the curves by the following factor:

Brush factor $(F_{B\ DENSE}) = 1.75$

Side Slope Factor For clearing on terrain with side slopes other than 20% to 30% multiply the curves by the following factors:

For clearing on terrain with side slopes of 0% to 20%,

Side slope factor $(F_{S\ 0\%-20\%}) = 0.8$

For clearing on terrain with side slopes of 30% to 50%,

Side slope factor $(F_{S\ 30\%-50\%}) = 1.8$

For clearing on terrain with side slopes of 50% to 100%,

Side slope factor $(F_{S\ 50\%-100\%}) = 2.5$

Burning Equation If fuel oil (for burning slash) or other supplies, such as cables and chokers, are used, add the following supply cost equation to the total cost per kilometer. The total cost per kilometer for supplies is for a roadway of width (X), in meters, varying in width from 3 to 30 m.

(S) Supply Operating Cost $(Y_{S\ BURNING}) = 269.796[0.100(X)]^{-0.0303}$

This cost is multiplied by the total kilometers, valid for values between 3.33 to 3,333.33 km, to obtain the capital cost.

For clearing operations from 1 to 500 ha (roadway width in meters multiplied by roadway length in meters multiplied by 0.0001), the supplies consist of 78% for fuel oil and 22% for tools, cables, and chokers. For clearing operations of 500 to 1,000 ha, supplies consist of 83% for fuel oil (for burning wood and scrub) and 17% for tools, cables, and chokers.

Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation value by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

Shifts per day.............	1	2	3
Factor.....................	1.91	1.68	1.61

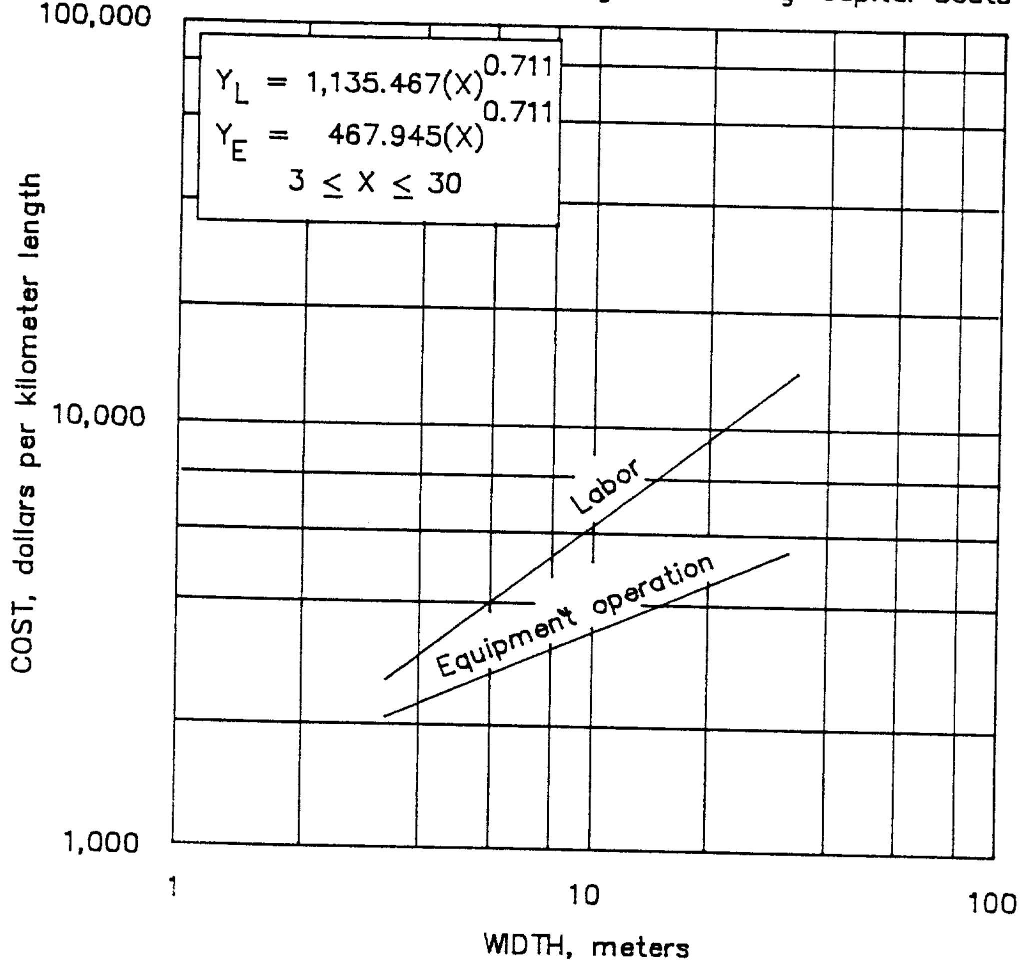
Subcontractor Factor If a subcontractor is used, to compensate for the subcontractor's markup, multiply the costs obtained from the curve by the following factors:

Labor factor (F_L) = 1.5

Supply factor (F_S) = 1.2

Equipment operation factor (F_E) = 1.2

Underground Mining—Capital Costs



4.2.7.1.1. Access roads
CLEARING

4.2. UNDERGROUND MINING--CAPITAL COSTS

4.2.7. INFRASTRUCTURE

4.2.7.1.2. ACCESS ROADS
DRILL AND BLAST

The total cost per kilometer is the sum of three separate cost curves (labor, supplies, and equipment operation) for a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with drilling and blasting for access roads.

BASE CURVE

The curves are based on estimated costs for drilling and blasting a cut with a single ditch. The terrain has a side slope of 25%, and the cut contains 50% rock.

(L) Labor Operating Cost $(Y_L) = 9{,}633.822(X)^{0.496}$
The operating labor costs are distributed as follows:

Direct labor...............	79%
Maintenance labor..........	21%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Air-track driller..........	33%	$16.78
Compressor operator........	17%	17.23
Chuck tender...............	27%	13.86
Powderman..................	8%	16.33
Powderman helper...........	7%	14.56
Flatbed-truck driver.......	8%	15.89

The average wage for labor is $15.68 per worker-hour (including burden and average shift differential).

(S) Supply Operating Cost $(Y_S) = 7{,}247.524(X)^{0.644}$
The supply cost consists of 79% blasting supplies and 21% drilling supplies. Drilling supplies consist of percussion drill bits, rods, striking bars, and couplings; blasting supplies consist of dynamite, ANFO, electric blasting caps, and connecting wire.

(E) Equipment Operating Cost $(Y_E) = 4{,}109.384(X)^{0.496}$
The equipment operation curve consists of 51% for repair parts, 48% for fuel and lubrication, and 1% for tires.

The equipment operation curve consists of:

Air-track drills...........	33%
Portable compressors.......	55%
Flatbed truck..............	7%
Pickup truck...............	5%

The equipment operating cost distribution is

	Repair parts	Fuel and lube	Tires
Air-track drills...........	93%	7%	-
Portable compressors.......	34%	65%	1%
Flatbed truck..............	9%	80%	11%
Pickup truck...............	8%	90%	2%

ADJUSTMENT FACTORS

Rock Factor For drilling and blasting cuts that contain other than 50% rock, multiply the curves by the following factors:

For drilling and blasting cuts containing 25% rock,

Rock factor $(F_{R\ 25\%}) = 0.6$

For drilling and blasting cuts containing 100% rock,

Rock factor $(F_{R\ 100\%}) = 1.4$

Side Slope Factor For terrain with side slopes of 0% to 20% that require drilling and blasting for two ditches and for providing material for a minimum fill, the base curve costs should be used without any adjustments.

For clearing on terrain with side slopes of 20% to 50%, multiply the costs obtained from the curves by the following factors:

Side slope factor $(F_{S\ 20\%-50\%}) = 1.5$

On terrain with side slopes in the range of 50% to 100%, multiply the costs obtained from the curves by the following factors:

Side slope factor $(F_{S\ 50\%-100\%}) = 3.0$

Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation value by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

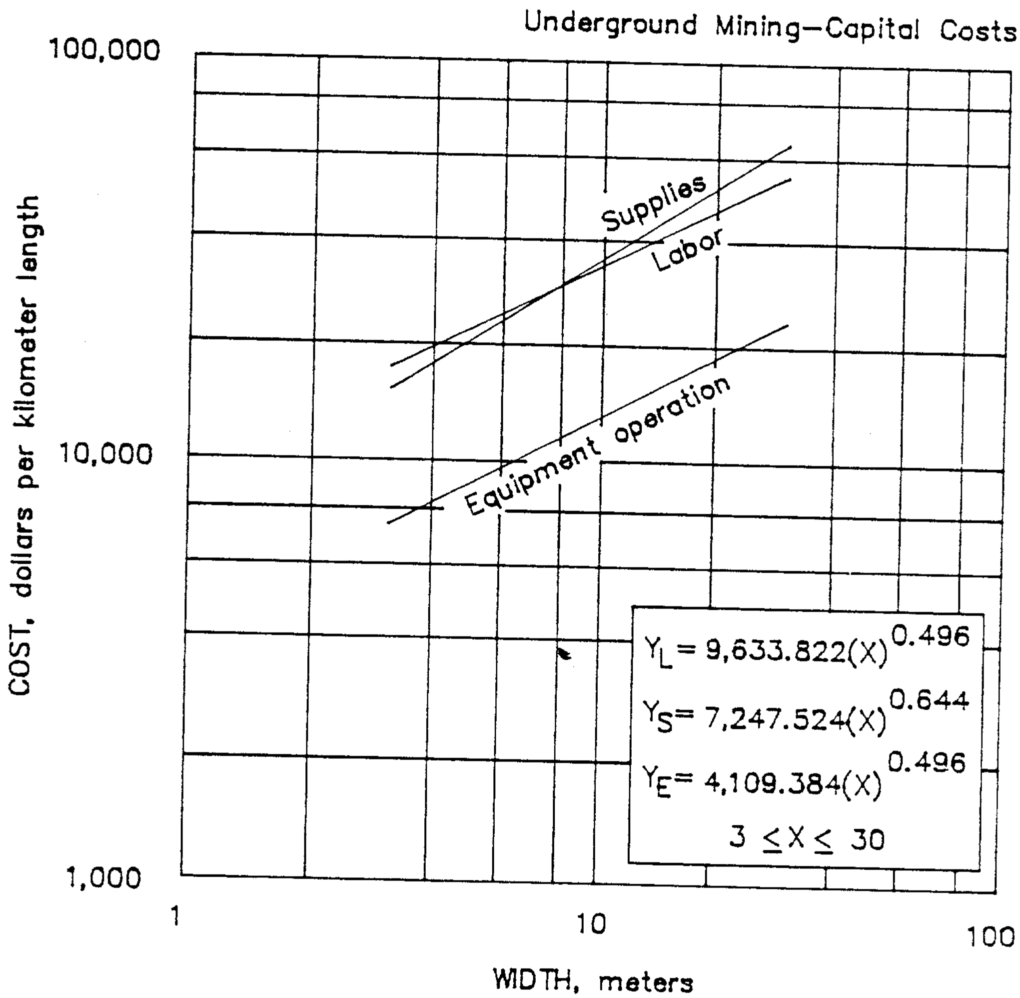
Shifts per day.............	1	2	3
Factor.....................	2.12	1.84	1.75

Subcontractor Factor If a subcontractor is used, to compensate for the subcontractor's markup, multiply the costs by the following factors:

Labor factor $(F_L) = 1.5$

Supply factor $(F_S) = 1.2$

Equipment operation factor $(F_E) = 1.2$



4.2.7.1.2. Access roads
DRILL AND BLAST

4.2. UNDERGROUND MINING--CAPITAL COSTS

4.2.7. INFRASTRUCTURE

4.2.7.1.3. ACCESS ROADS
EXCAVATION

The total cost per kilometer is the sum of two separate cost curves (labor and equipment operation) having a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with excavation for access roads.

BASE CURVES

The curves are based on a dozer excavation operation that is working on terrain with a side slope of 25%, side-casting from cuts or ditches to a 30-cm fill or to waste. The material to be excavated is either blasted rock or a common conglomerate that presents some difficulty in cutting and drifting.

(L) Labor Operating Cost $(Y_L) = 29.843(X)^{1.870}$
The operating labor costs are distributed as follows:

Direct labor...............	60%
Maintenance labor..........	40%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Dozer operator.............	60%	$16.33
Grader operator............	20%	16.33
Water-truck driver.........	20%	15.89

The average wage for labor is $16.24 per worker-hour (including burden and average shift differential).

(E) Equipment Operating Cost $(Y_E) = 27.128(X)^{1.870}$
The equipment operation curve consists of 46% for repair parts, 50% for fuel and lubrication, and 4% for tires.

The equipment operation curve consists of

Dozer crawlers.............	47%
Dozer-ripper crawler.......	25%
Motor grader...............	15%
Water truck................	9%
Pickup truck...............	4%

The equipment operating cost distribution is

	Repair parts	Fuel and lube	Tires
Dozer crawlers.............	51%	49%	-
Dozer ripper crawler.......	53%	47%	-
Motor grader...............	45%	41%	14%
Water truck................	29%	55%	16%
Pickup truck...............	8%	90%	2%

ADJUSTMENT FACTORS

Side Slope Factor On terrain with a side slope other than 20% to 30%, excavation costs can be determined by multiplying the costs obtained from the curves by the following factors:

For clearing on terrain with side slopes of 0% to 20%,

Side slope factor $(F_{S\ 0-20\%}) = [0.8(S)]^{0.600}(W)^{0.756}$
where S = side slope [defined as 1+(percent slope/100)],
and W = roadway width, in meters.

For clearing on terrain with side slopes of 30% to 100%,

Side slope factor $(F_{S\ 30-100\%}) = [0.8(S)]^{3.958}(W)^{0.087}$
where S = side slope [defined as 1+(% slope/100)],
and W = roadway width, in meters.

Material Factor For excavation of materials that are easy to cut and drift, multiply the costs obtained from the curves by the following factors:

Material factor $(F_{M\ EASY}) = 0.75$

For excavation of extremely wet and sticky material, multiply the curves by the following factors:

Material factor $(F_{M\ DIFFICULT}) = 1.33$

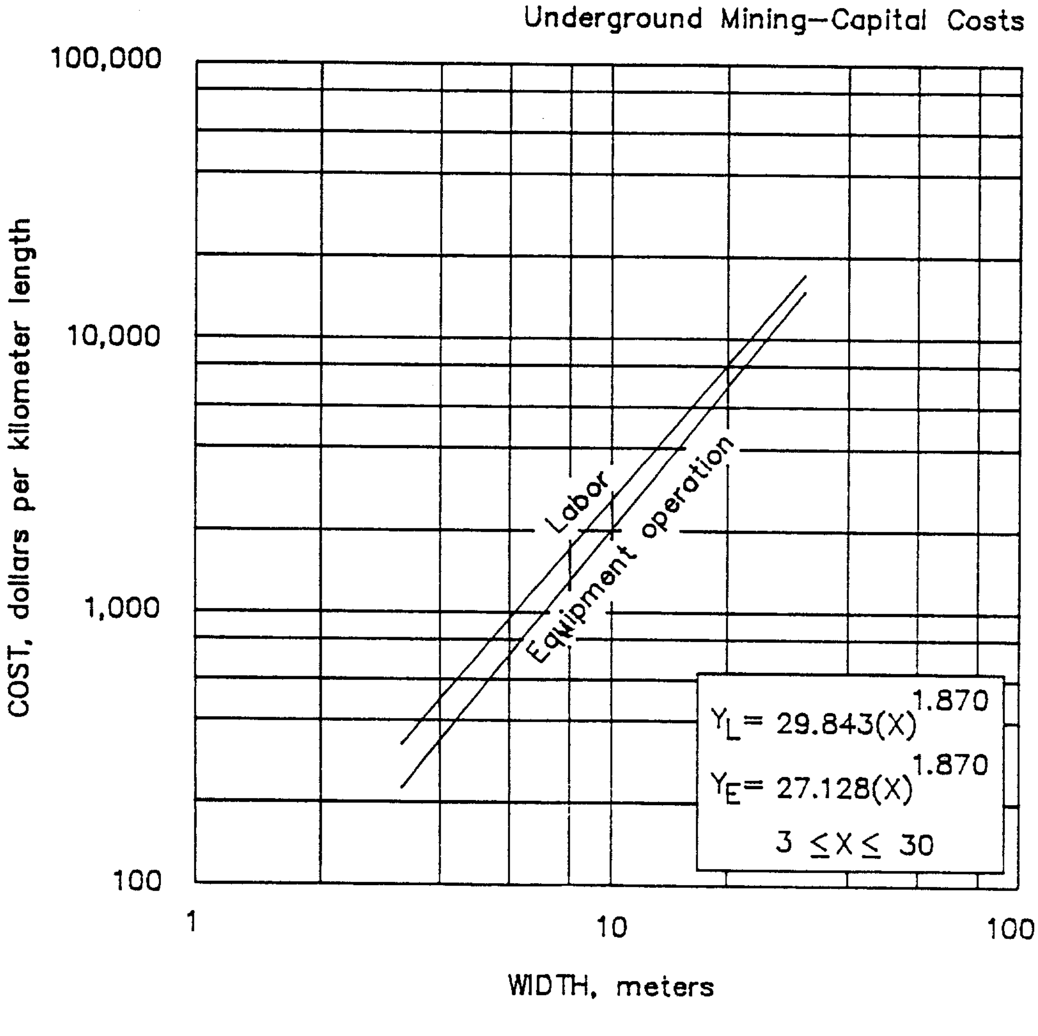
Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation cost obtained from the curve by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

Shifts per day.............	1	2	3
Factor.....................	1.94	1.71	1.63

Subcontractor Factor If a subcontractor is used, to compensate for the subcontractor's markup, multiply the costs obtained from the curves by the following factors:

Labor factor $(F_L) = 1.5$

Equipment operation factor $(F_E) = 1.2$



4.2.7.1.3. Access roads
EXCAVATION

4.2. UNDERGROUND MINING--CAPITAL COSTS

4.2.7. INFRASTRUCTURE

4.2.7.1.4. ACCESS ROADS
GRAVEL SURFACING

The total cost per kilometer is the sum of three separate cost curves (labor, supplies, and equipment operation) for a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with gravel surfacing of access roads.

BASE CURVE

The curves are based on costs for preparing a road subbase, spreading surfacing material on the roadway, and compacting the surfacing material to a depth of 0.20 m. The surfacing material is delivered to the jobsite in suppliers' trucks.

(L) Labor Operating Cost $(Y_L) = 293.304(X)^{0.667}$
The operating labor costs are distributed as follows:

Direct labor...............	83%
Maintenance labor..........	17%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Grader operator............	21%	$16.33
Roller operator............	21%	16.33
Dumpman....................	18%	13.86
Grade checker..............	20%	15.89
Water-truck driver.........	20%	15.89

The average wage for labor is $15.66 per worker-hour (including burden and average shift differential).

(S) Supply Operating Cost $(Y_S) = 6{,}880.012(X)^{1.006}$
The supply cost consists of 100% road surfacing gravel (minus 1.9 cm). The gravel, delivered and dumped on the roadbed by suppliers' trucks, costs $13.76 per metric ton.

(E) Equipment Operating Cost $(Y_E) = 135.032(X)^{0.667}$
The equipment operation curve consists of 37% for repair parts, 51% for fuel and lubrication, and 12% for tires.

The equipment operation curve consists of

Motor grader..............	42%
Rubber-tired, self-propelled roller..........	19%
Water truck................	26%
Pickup truck..............	13%

The equipment operating cost distribution is

	Repair parts	Fuel and lube	Tires
Motor grader....................	45%	41%	14%
Rubber-tired, self-propelled roller........................	49%	40%	11%
Water truck....................	29%	55%	16%
Pickup truck..................	8%	90%	2%

ADJUSTMENT FACTORS

Equipment Factor Where it is necessary to purchase equipment, or have a subcontractor perform the work, multiply the equipment operation cost obtained from the curve by the following applicable factor in order to obtain the total value of equipment expense for ownership and operation:

Shifts per day.................	1	2	3
Factor........................	2.05	1.79	1.70

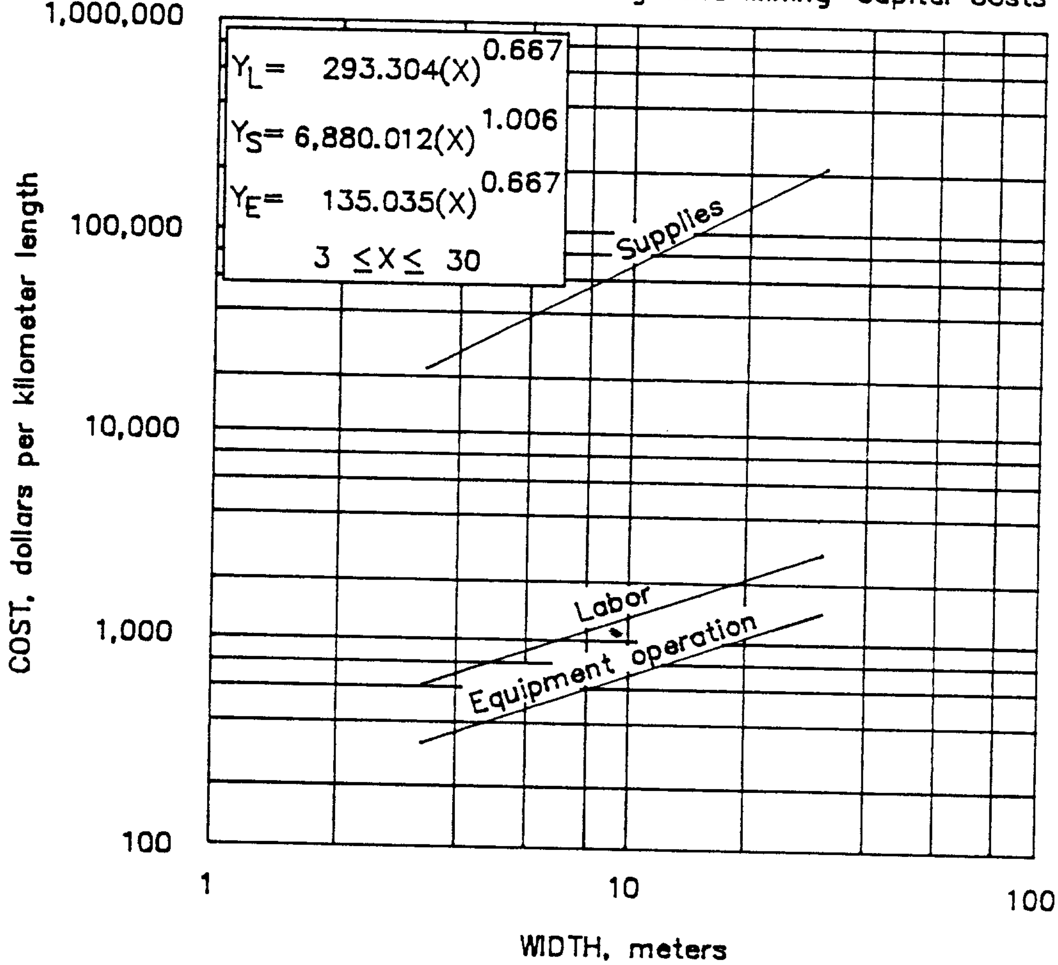
Subcontractor Factor If a subcontractor is used, to compensate for the subcontractor's markup, multiply the costs obtained from the curves by the following factors:

Labor factor $(F_L) = 1.5$

Supply factor $(F_S) = 1.2$

Equipment operation factor $(F_E) = 1.2$

Underground Mining—Capital Costs



4.2.7.1.4. Access roads
GRAVEL SURFACING

4.2. UNDERGROUND MINING--CAPITAL COSTS

4.2.7. INFRASTRUCTURE

4.2.7.1.5. ACCESS ROADS PAVING

The total cost per kilometer is the sum of three separate cost curves (labor, supplies, and equipment operation) for a roadway width (X), in meters. The curves are valid for widths between 3 and 30 m, operating one shift per day. This cost is multiplied by the total kilometers to obtain the capital cost. Each curve includes all of the daily operating and maintenance costs associated with paving of access roads.

BASE CURVE

The curves are based on a paving operation for laying and compacting hot-mix asphalt concrete (purchased locally from a hot-mix plant) to a depth of 5.1 cm. Costs to produce an appropriate paving road base are covered in section 4.2.7.1.4., Gravel Surfacing.

(L) Labor Operating Cost $(Y_L) = 117.710(X)^{1.005}$
The operating labor costs are distributed as follows:

Direct Labor...............	80%
Maintenance Labor..........	20%

The direct labor costs consist of the following typical range of personnel:

		Av salary per hour (base rate)
Paver operator.............	13%	$16.33
Roller operator............	26%	16.33
General laborer............	22%	13.86
Rear-dump truck driver.....	39%	15.89

The average wage for labor is $15.55 per worker-hour (including burden and average shift differential).

(S) Supply Operating Cost $(Y_S) = 2,661.382(X)^{1.005}$
The supply cost consists of 100% asphalt concrete (minus 1.9-cm hot mix). The asphalt concrete, supplied by a local hot-mix plant, costs $26.37 per metric ton.

(E) Equipment Operating Cost $(Y_E) = 68.436(X)^{1.005}$
The equipment operation curve consists of 32% for repair parts, 58% for fuel and lubrication, and 10% for tires.

4.2.7.2. MAIN POWER LINES

If power is to be obtained from a local power company, it is generally necessary to construct new facilities to connect the mine site to the existing power line network. This cost is usually borne by the mine company that desires to receive the service. For shorter distances and lower maximum power loads this may simply entail extending existing, medium voltage (13-24 kV) distribution lines. To satisfy greater loads over longer distances, however, it is necessary to construct higher voltage (115 kV) transmission lines as well as substations dedicated to serve the mine solely. The following tabulation will aid the evaluator in determining the appropriateness of the various options to his/her particular case.

Main power lines

Case	Load Range(MV·A)[1]	Maximum distribution line length, km 24 kV	13 kV	Substation costs
1...	2- 4	105-52	38-19	0
2...	4- 8	52-26	19-10	95,000
3...	8-12	26-18	10- 6	289,000
4...	12-20	18-10	6- 4	630,000
5...	20	0[2]	0	630,000

[1]MV·A(million volt amperes) = 1000kW; KV·A(thousand volt amperes) = kW Both MV·A and KV·A are commonly used in the power generation industry to designate power demand.

[2]At greater than 20 MV·A it is advisable to have the main substation at the mine site, thus only transmission lines are considered.

LINE COSTS:

Transmission lines	$59,000/kilometer
Distribution lines	$42,000/kilometer

It is important to understand that there is an inverse relationship between MV·A and maximum distribution line distances. Thus, in case 2, at 24 kV·A, the first or lowest load figure (4 MV·A) corresponds to the maximum distance figure (52 km) and the highest load to the lowest distance figure.

It is also important to be aware of a few underlying assumptions regarding the five separate cases. Case 1 shows the power requirement range in which it is likely that existing distribution lines could supply the needed power. Thus there is no substation expense. The second and third cases assume that minor and major modifications of an existing substation will be required, respectively. They also assume that new line needed will originate from that modified substation. For cases 4 and 5 the large power requirements necessitate the construction of a completely new, dedicated substation. This facility will thus have to be fed by extending an existing high-voltage transmission line. In the instance of case 4, the site of the substation is as near the existing transmission line network as practicable; for case 5 the substation is assumed to be at the mine site.

The costs contained in this section assume that the power company that will be supplying the power will design and construct the line. Principal costs categories included are right-of-way purchase and clearing, access road construction, line and substation construction, permitting, and preconstruction design.

The procedure for determining the system cost and requirements are as follows:

1. Estimate the maximum power demand that the mine will require. If not available, an estimate of this value may be made by the techniques contained in the appropriate mine and beneficiation electrical system sections contained in this report. It is recommended that, for estimating purposes, horsepower and kW (or KV•A) be considered to be equivalent. Motor efficiencies as well as other system power losses generally account for much of the difference between the two units.
2. Contact the probable power supplier to determine the "nearest useable source," or likeliest point from which power may be obtained. Depending upon present loading within the system this may or may not be the nearest transmission or distribution line.
3. Calculate the actual maximum distribution line length on the basis of the projected load using the following equations:

   24 kV load--Maximum distribution line distance, in km = 210/(P)

   13 kV load--Maximum distribution line distance, in km = 77/(P)
   where P = power requirements, in MV•A.

4. Determine distribution line costs by multiplying the lesser of either the total length of line required or the maximum length of distribution line as calculated in step 3, by line cost per kilometer ($42,000).
5. Estimate the transmission line cost by multiplying the remaining length of line needed by transmission line cost per kilometer ($59,000). Note that for greater than 20 MV•A it is recommended that transmission lines be installed for the entire distance.
6. Based on MV•A, determine a substation cost from the previous tabulation and add this to the line costs already determined. The combination of line and substation costs is the total main power line cost.

BASE CURVE

System costs have been graphed for three different line distances over the load range (X) of 2 to 40 MV•A. These curves are included to aid the manual user that is interested in a very preliminary cost and desires to avoid the procedure outlined above for a more detailed cost determination.

Freight charges from the east coast manufacturing plant to Denver, CO, for the major purchased equipment has been determined to be:

Transformer, mt..............................	$7,500
Oil breaker, 3 at 13 mt each.................	$9,600

All other equipment and materials are considered to be locally available in Denver, CO.

The total capital cost is based on single curves having power loads (X), in megavalt anperes. The curves are valid for power loads of 2 to 40 MV•A.

The capital cost derived from the curve is a combination of the following costs:

	Small (2 to 20 MV·A)	Large (20 to 40 MV·A)
Construction labor cost......	50%	47%
Construction supply cost.....	50%	37%
Purchased equipment cost.....	-	16%

The total 10 km main powerline capital cost is $(Y_{C\ 10\ KM\ LINE}) = 207{,}826.608(X)^{0.563}$ and is distributed as follows:

(L) Construction Labor cost $(Y_{L\ 10\ KM\text{-}SMALL}) = 103{,}913.304(X)^{0.563}$
(S) Construction Supply cost $(Y_{S\ 10\ KM\text{-}SMALL}) = 103{,}913.304(X)^{0.563}$

(L) Construction Labor cost $(Y_{L\ 10\ KM\text{-}LARGE}) = 97{,}678.506(X)^{0.563}$
(S) Construction Supply cost $(Y_{S\ 10\ KM\text{-}LARGE}) = 76{,}895.844(X)^{0.563}$
(E) Purchased Equipment cost $(Y_{E\ 10\ KM\text{-}LARGE}) = 33{,}252.257(X)^{0.563}$

The total 25km main powerline capital cost is $(Y_{C\ 25\ KM\ LINE}) = 644{,}990.250(X)^{0.370}$ and is distributed as follows:

(L) Construction Labor cost $(Y_{L\ 25\ KM\text{-}SMALL}) = 322{,}495.125(X)^{0.370}$
(S) Construction Supply cost $(Y_{S\ 25\ KM\text{-}SMALL}) = 322{,}495.125(X)^{0.370}$

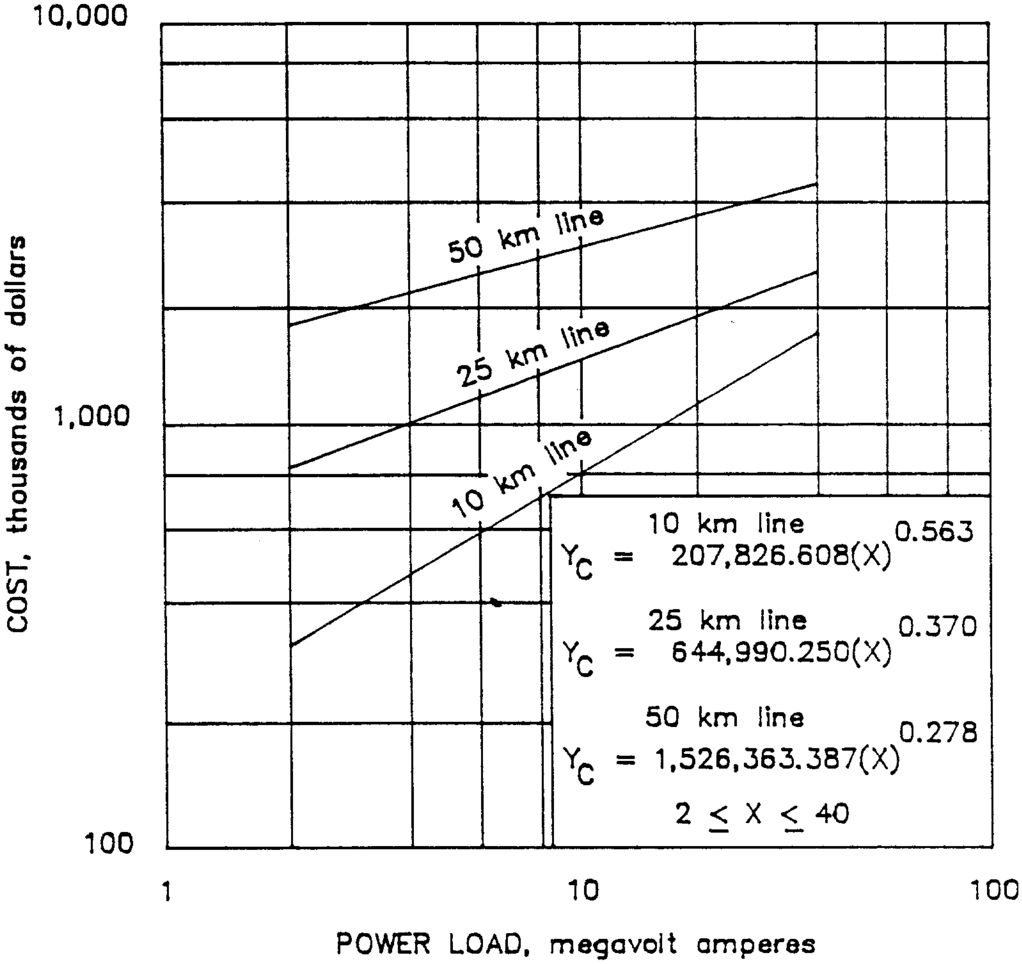
(L) Construction Labor cost $(Y_{L\ 25\ KM\text{-}LARGE}) = 303{,}145.418(X)^{0.370}$
(S) Construction Supply cost $(Y_{S\ 25\ KM\text{-}LARGE}) = 238{,}646.392(X)^{0.370}$
(E) Purchased Equipment cost $(Y_{E\ 25\ KM\text{-}LARGE}) = 103{,}198.440(X)^{0.370}$

The total 50km main powerline capital cost is $(Y_{C\ 50\ KM\ LINE}) = 1{,}526{,}363.387(X)^{0.278}$ and is distributed as follows:

(L) Construction Labor cost $(Y_{L\ 50\ KM\text{-}SMALL}) = 763{,}181.694(X)^{0.278}$
(S) Construction Supply cost $(Y_{S\ 50\ KM\text{-}SMALL}) = 763{,}181.694(X)^{0.278}$

(L) Construction Labor cost $(Y_{L\ 50\ KM\text{-}LARGE}) = 717{,}390.792(X)^{0.278}$
(S) Construction Supply cost $(Y_{S\ 50\ KM\text{-}LARGE}) = 564{,}754.453(X)^{0.278}$
(E) Purchased Equipment cost $(Y_{E\ 50\ KM\text{-}LARGE}) = 244{,}218.142(X)^{0.278}$

Underground Mining—Capital Costs



4.2.7.2. Main power lines

4.2. UNDERGROUND MINING--CAPITAL COSTS

4.2.7. INFRASTRUCTURE

4.2.7.3. TOWNSITE

The following housing costs are for a typical average quality park based on using trailers or manufactured 'mobile home' housing containing between 150 and 200 units. Costs are quoted per individual housing unit. Costs are factored by using the Bureau of Labor Statistics Industrial Materials Cost Index. Site costs do not include land site acquisition, construction of utility trunk lines to the site, or a wastewater treatment plant. Wastewater disposal uses a septic tank and drain field; however, transportation and setup costs to areas within 100 miles of Denver, CO, are included.

Typical average site costs for family or bachelor unit

	Family	Bachelor
Site preparation (typical avg. area 410 sq m)..................	$1,050	$ 320
Streets (7.9- to 9.8-m wide, 7.6-cm asphalt or 7.5-cm gravel edged or curbed)..	810	270
Patios and walks..	610	200
Septic tank, includes drain field............................	1,360	750
Water, connected to unit..................................	550	550
Gas, low pressure connected................................	310	310
Electrical, 80- to 150-A connected service to each unit.........	890	890
Office, recreation, laundry................................	1,250	1,250
Total..	6,830	4,540

The following adjustment factors should be applied to the total typical average site cost where either quality or quantity differs.

Site preparation adjustment multipliers to total typical average site cost are as follows:

Quality description	Quality factor	Quantity	Factor
Low (300 m²/space)........	0.70	40- 80	1.07
		80-125	1.00
		150-250	.92
Average (410 m²/space)....	1.00	50-125	1.10
		150-200	1.00
		250-300	.95
Good (520 m²/space).......	1.30	50-150	1.10
		175-200	1.00
		250-350	.97

In addition, the following accessories may also be required:

Skirting at base of trailer..................	$620.00
Landing and steps............................	360.00
Canopies over landings.......................	550.00
Air conditioning--using existing heater.......	840.00

HOUSING UNITS

Family Units--With living, dining, kitchen, bath, and sleeping facilities for two adults and two to four children. Cost is for typical average quality.

Single-wide (4.27 by 19.50 m)............	$15,400
Double-wide (7.31 by 14.63 m)............	26,400

Quality adjustments to the single and double-wide basic costs are made by multiplying the above housing unit average quality costs by the following factors:

Low quality:	
Single wide......	1.12
Double-wide......	1.16
Average quality:	
Single wide......	0.90
Double-wide......	0.87
Excellent quality:	
Single wide......	1.25
Double-wide......	1.34

Quantity adjustments--For quantities greater than 10 units, decrease overall costs by 10 percent.

Snowload adjustment--For areas of heavy snowfall, increase basic unit costs 5 percent for increased roof support design.

Bachelor Units--Consisting of single-person motel-style rooms with a kitchen and dining room. Rooms share a centrally located restroom and shower facility. Cost is for typical average quality.

Bachelor unit................................	$15,000

Number of persons adjustment--Per person cost is based on housing 400 personnel. Lodging capital costs for greater than 500 people, decrease costs by 10 percent. Increase costs by 15 percent for less than 300 and 20 percent for less than 200.

PRIMARY UTILITIES

Electrical, cost per linear meter:	
Main overhead electric powerlines...........	$26.32
Lateral overhead lines......................	$8.25
Water, cost per linear meter:	
Main, 15.24 cm plastic (add or deduct $5.75 per 2.54 cm diam).......................	$35.80
Lateral, 2.54 cm...........................	$17.22

4.2. UNDERGROUND MINING--CAPITAL COSTS

4.2.7. INFRASTRUCTURE

4.2.7.4.1. WASTE WATER TREATMENT CLARIFICATION

Clarification capital cost is for the acquisition and installation of equipment for water clarification and softening by precipitation and/or coagulation. The all metal solids-contact clarifier combines into one operation--quick mixing, flocculation, clarification, and sludge thickening. The unit will selectively or simultaneously remove turbidity, color, organic matter, manganese, iron, hardness, alkalinity, taste, and odor. The cost curve is based on clarifiers ranging in diameter from 2.74 to 45.72 m (cross-sectional area ranging from 5.9 to 1,642 m^2).

BASE CURVES

Total cost is based on a single cost curve having a tank diameter of (X) in meters. The curve includes all costs associated with acquisition and installation of concrete pad, clarifier structure, and control-monitor equipment for sludge level and sludge density control.

The total clarification capital cost derived from the curve is a combination of the following costs:

Construction labor cost.......	19%
Construction material cost....	5%
Purchased equipment cost......	76%

The total clarification capital cost is $(Y_C) = 15{,}631.070(X)^{0.991}$ and is distributed as follows:

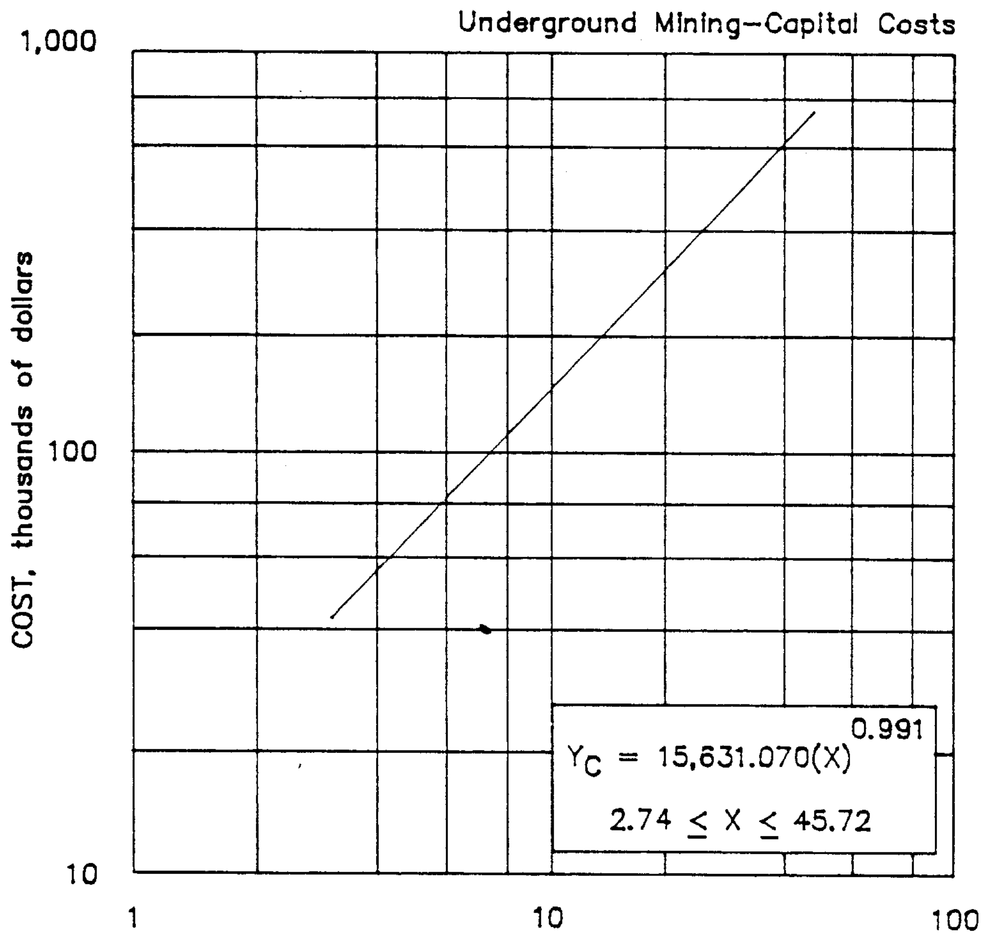
(L) Construction Labor Cost $(Y_L) = 2{,}969.910(X)^{0.991}$

(S) Construction Supply Cost $(Y_S) = 781.550(X)^{0.991}$

(E) Purchased Equipment Cost $(Y_E) = 11{,}879.610(X)^{0.991}$

NOTE:- Sizing of clarifier is based on one principal parameter-- rise rate--the vertical velocity of the stream through the clarifier. If the diameter or cross-sectional area of the clarifier is unknown, and the feed flow rate is known and the rise rate is assumed to be 0.015 m/min, then the diameter (D), or equivalent cross-sectional area, of the clarifier can be estimated with the equation:

Clarifier diameter $(D) = 1.128[(Q)/(R)]^{0.500}$
where R = rise rate, in meters per minute,
and Q = design flow rate, in cubic meters per minute.



4.2.7.4.1. Wastewater treatment
CLARIFICATION

4.2. UNDERGROUND MINING--CAPITAL COSTS

4.2.7. INFRASTRUCTURE

4.2.7.4.2. WASTEWATER TREATMENT NEUTRALIZATION

The Environmental Protection Agency's publication EPA-600/2-82-00/d "Treatability Manual, Vol. IV, Cost Estimating," April 1983, was the source of cost development. One is referred to this manual if further detail in neutralization costs is needed. Additionally, other waste water treatment methods are costed in this EPA manual.

The capital cost curves cover neutralization of waste water effluent (out-of-pipe) when required. The basic design variable is waste water flow. Applicability of the curves are for effluent to be neutralized that ranges in volume from 0.001 to 876 l/s (22.8 to 20 million gal/d). It is assumed that flow equalization is provided by a tailings pond. The costs apply to the neutralization of either acidic or basic waste water streams originating from mine, mill, or combined mine and mill after it flows out-of-pipe from the central impoundment pond. In most mining operations further waste water treatment costs are not required. The system consists of chemical addition and two-stage neutralization tanks. It is assumed that pH and suspended-dissolved solid content of influent to the system will be unknown at this level of costing. Basis of design uses a standard dosage of 100 mg/l lime and 100 mg/l acid to achieve a pH of 7.0 over a pH range of 6.5 to 8.0.

BASE CURVES

Total costs are described by two sets of cost curves based on daily average waste water flow rate (X) in L/s. The curves include all costs associated with the construction of the treatment facility including mixing tank, attenuation tank, chemical storage, agitators, piping, electrical, and instrumentation. These costs are distributed as follows:

Construction labor cost......	22%
Construction supply cost.....	13%
Purchased equipment cost.....	65%

For waste water effluent rates between 0.001 to 8.76 L/s, the capital cost is $(Y_{C\ 0.001-8.76\ L/s}) = 123{,}144.490(X)^{0.094}$ and is distributed as follows:

(L) Construction Labor Cost $(Y_{L\ 0.001-8.76\ L/s}) = 27{,}091.780(X)^{0.094}$

(S) Construction Supply Cost $(Y_{S\ 0.001-8.76\ L/s}) = 16{,}008.780(X)^{0.094}$

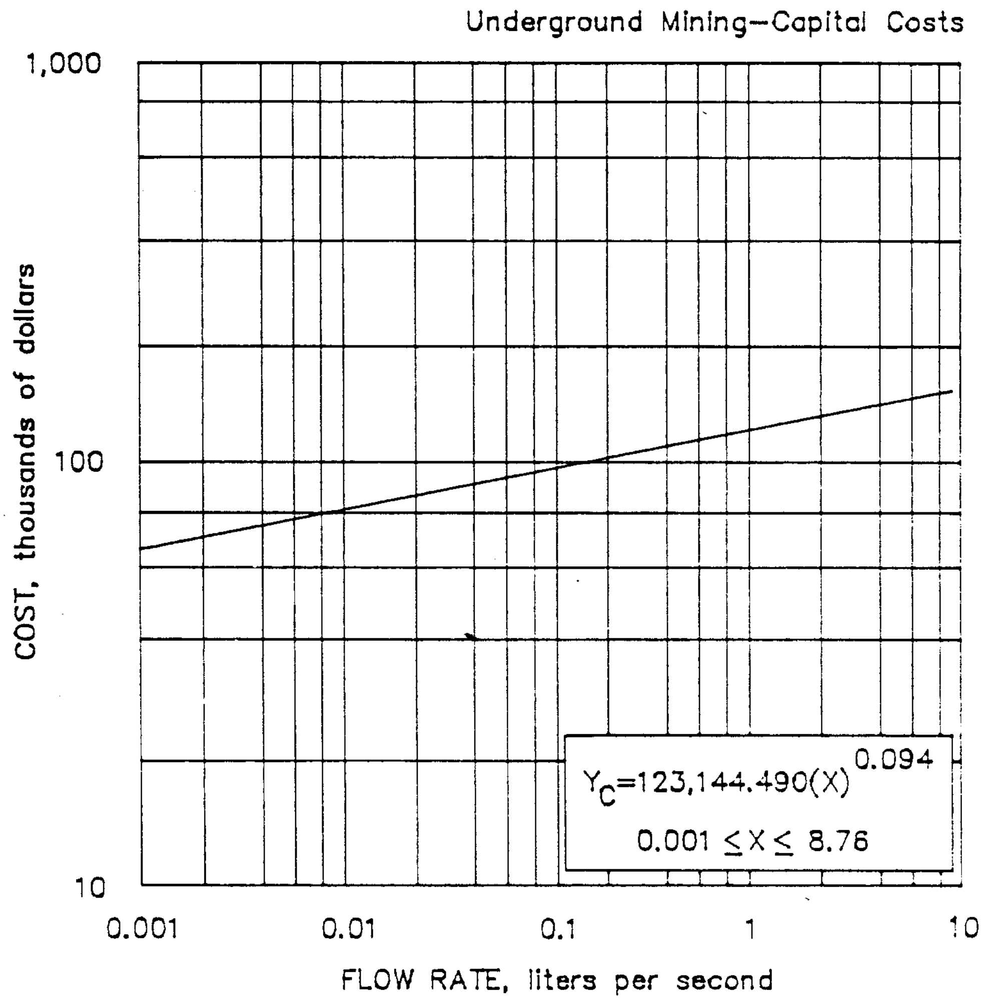
(E) Purchased Equipment Cost $(Y_{E\ 0.001-8.76\ L/s}) = 80{,}043.930(X)^{0.094}$

For waste water effluent rates between 8.76 to 876 L/s, the capital cost is $(Y_C\ 8.76\text{-}876\ L/s) = 26{,}346.39(X)^{0.562}$ and is distributed as follows:

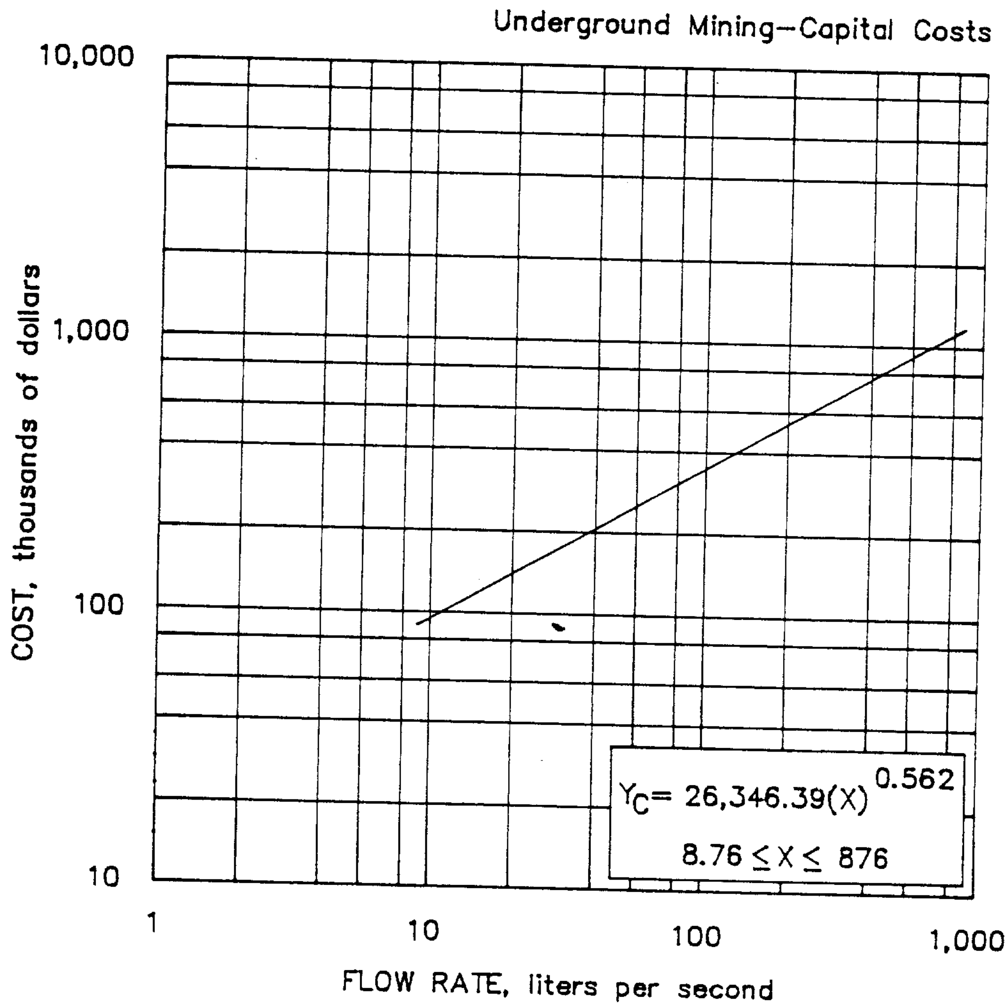
(L) Construction Labor Cost $(Y_L\ 8.76\text{-}876\ L/s) = 5{,}796.21(X)^{0.562}$

(S) Construction Supply Cost $(Y_S\ 8.76\text{-}876\ L/s) = 3{,}425.03(X)^{0.562}$

(E) Purchased Equipment Cost $(Y_E\ 8.76\text{-}876\ L/s) = 17{,}125.15(X)^{0.562}$



4.2.7.4.2.a Wastewater treatment
NEUTRALIZATION



4.2.7.4.2.b Wastewater treatment
NEUTRALIZATION