

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.3. BENEFICIATION

## 6.1.3.1. FLOTATION

The cost curve in this section is based on flotation operations that produce a single concentrate product. However, for operations that produce multiple concentrate products, costs can be estimated by reapplying the curve for each product, making the appropriate input tonnage reduction before each reapplication.

The capital cost for flotation covers the acquisition and installation of pulp agitator-conditioners, mechanical flotation machines (self-aerating type), slurry pumps, and any associated piping, pulp distribution, and launder facilities. If mechanical flotation machines other than the self-aerating type are employed, the additional cost of an external blower system should be added to the base curve cost. However, if flotation machines other than the mechanical type are employed (e.g., pneumatic or column machines), then the capital cost obtained from the base curve cannot be accurately modified.

## BASE CURVE

The total capital cost is based on a single cost curve having an adjusted feed rate (X), in metric tons of ore to the flotation section for each product per day. The curve is valid for operations between 40 and 95,000 mtpd, operating three shifts per day. Each flotation section consists of all rougher, scavenger, and cleaner circuits required to produce a final concentrate.

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

|                               |     |
|-------------------------------|-----|
| Construction labor cost.....  | 12% |
| Construction supply cost..... | 19% |
| Purchased equipment cost..... | 66% |
| Transportation cost.....      | 3%  |

The capital cost consists of the following typical range of major equipment costs:

|                              | Small<br>(40 to<br>250 mtpd) | Medium<br>(250 to<br>47,600 mtpd) | Large<br>(47,000 to<br>95,000 mtpd) |
|------------------------------|------------------------------|-----------------------------------|-------------------------------------|
| Pulp agitator-conditioners.. | 12%                          | 2%                                | 2%                                  |
| Flotation machines.....      | 78%                          | 84%                               | 92%                                 |
| Slurry pumps.....            | 10%                          | 14%                               | 6%                                  |

The total capital cost is  $(Y_C \text{ SMALL}) = 7,813.781(X)^{0.600}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L \text{ SMALL}) = 937.654(X)^{0.600}$
- (S) Construction Supply Cost  $(Y_S \text{ SMALL}) = 1,484.618(X)^{0.600}$
- (E) Purchased Equipment Cost  $(Y_E \text{ SMALL}) = 5,391.509(X)^{0.600}$

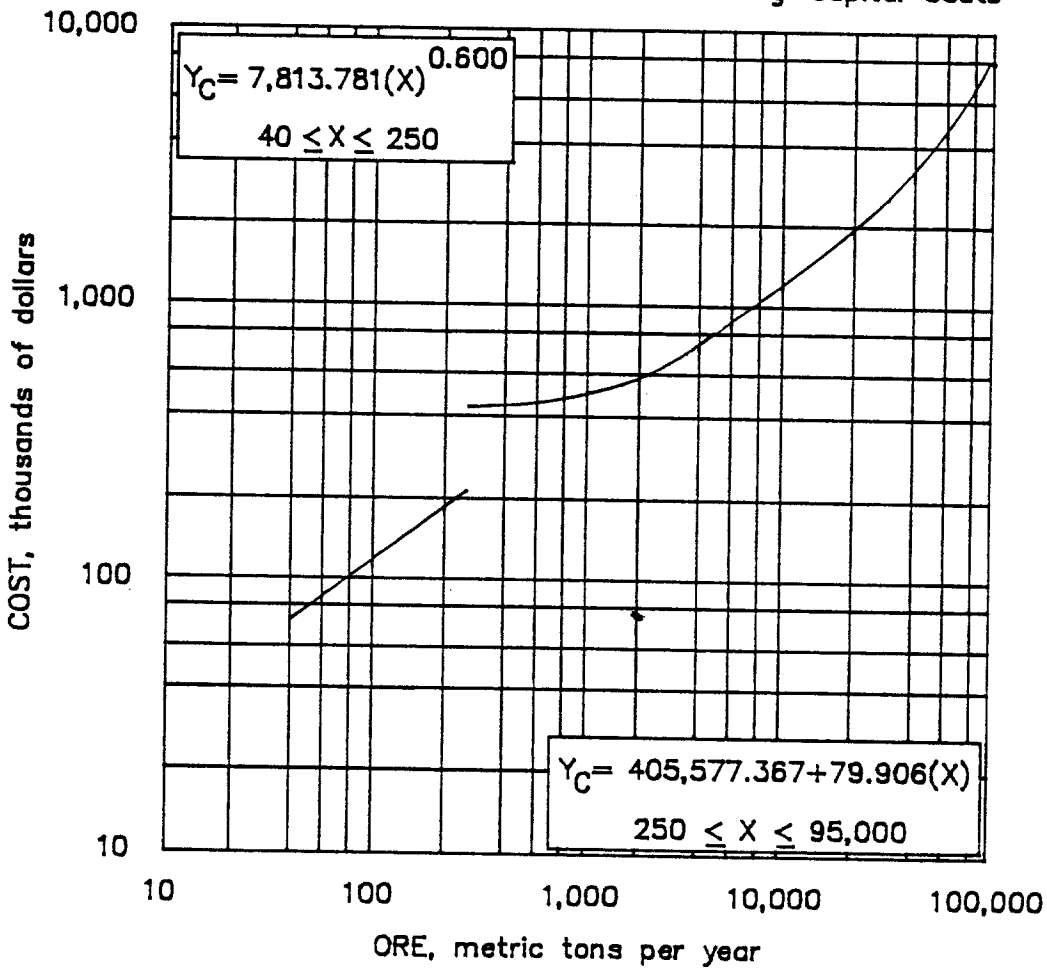
The total capital cost is  $(Y_C \text{ MEDIUM/LARGE}) = 405,577.367 + 79.906(X)$  and is distributed as follows:

(L) Construction Labor Cost  $(Y_L \text{ MEDIUM/LARGE}) = 48,669.283 + 9.589(X)$

(S) Construction Supply Cost  $(Y_S \text{ MEDIUM/LARGE}) = 77,059.699 + 15.182(X)$

(E) Purchased Equipment Cost  $(Y_E \text{ MEDIUM/LARGE}) = 279,848.385 + 55.135(X)$

Mineral Processing—Capital Costs



6.1.3.1. Flotation

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.3. BENEFICIATION

6.1.3.2.1. GRAVITY SEPARATION  
JIGS

Costs are primarily for the acquisition and installation of jigs, vibrating and trommel screens, pumps, and surge bins. The cost curves are most applicable to barite, gold placer, diamond, and chromite processing operations. Use of the curves for other types of mineral deposits, or for unique treatment systems, may give less accurate results. To estimate costs for jig equipment used in closed-circuit grinding, refer to section 6.1.3.2.2.

## BASE CURVE

The total capital cost is based on a single cost curve having an adjusted feed rate (X), in metric tons of ore to the jig circuit per day. The curve is valid for operations between 400 and 10,000 mtpd, operating three shifts per day. The curve includes all costs associated with acquisition, freight, and installation of equipment.

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

|                               |     |
|-------------------------------|-----|
| Construction labor cost.....  | 6%  |
| Construction supply cost..... | 14% |
| Purchased equipment cost..... | 79% |
| Freight cost.....             | 1%  |

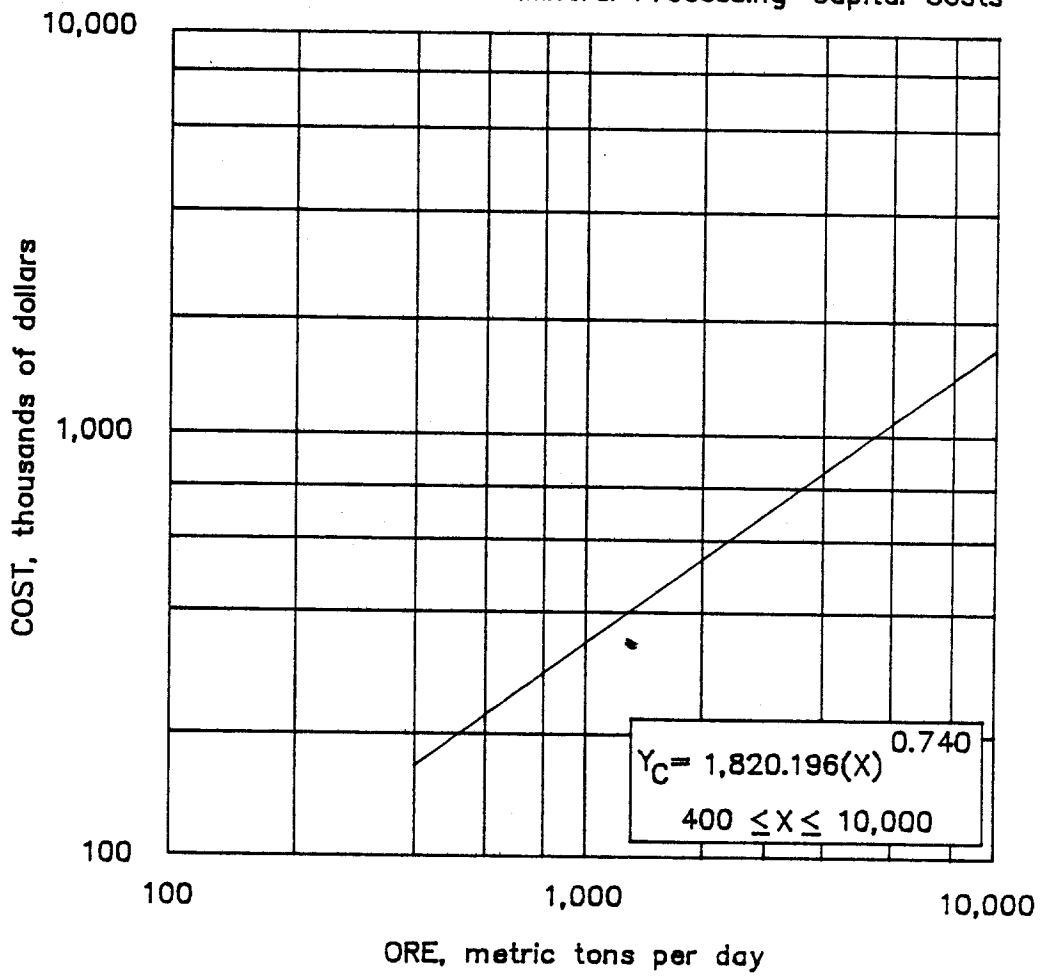
A typical breakdown of the major cost components is

|                 | Small<br>(400 to<br>2,000 mtpd) | Large<br>(2,000 to<br>10,000 mtpd) |
|-----------------|---------------------------------|------------------------------------|
| Screens.....    | 10%                             | 5%                                 |
| Pumps.....      | 3%                              | 2%                                 |
| Surge bins..... | -                               | 2%                                 |
| Jigs.....       | 87%                             | 91%                                |

The total capital cost is  $(Y_C) = 1,820.196(X)^{0.740}$  and is distributed as follows:

|                                     |                                |
|-------------------------------------|--------------------------------|
| (L) <u>Construction Labor Cost</u>  | $(Y_L) = 109.212(X)^{0.740}$   |
| (S) <u>Construction Supply Cost</u> | $(Y_S) = 254.827(X)^{0.740}$   |
| (E) <u>Purchased Equipment Cost</u> | $(Y_E) = 1,456.157(X)^{0.740}$ |

Mineral Processing—Capital Costs



6.1.3.2.1. Gravity separation  
JIGS

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.3. BENEFICIATION

6.1.3.2.2. GRAVITY SEPARATION  
JIGS IN CLOSED-CIRCUIT GRINDING

Costs are for the acquisition and installation of jigs, pumps, and screens used in closed-circuit grinding. This is an accessory process used prior to other forms of treatment, such as flotation or cyanidation, where coarse material, or large particles, would not be recovered. Jigs in closed-circuit grinding are most commonly employed in small flotation and cyanidation mills that process ores of gold, lead-silver-zinc, and fluorspar. Do not use this section to estimate costs for entire circuits of jigs that process large tonnages of ore (see section 6.1.3.2.1.).

## BASE CURVE

The total cost is based on a single cost curve having an adjusted feed rate (X), in metric tons ore to the jig circuit per day. The curve is valid for operations between 25 and 700 mtpd, operating three shifts per day. The curve includes all costs associated with acquisition, freight, and installation of equipment.

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

|                               |     |
|-------------------------------|-----|
| Construction labor cost.....  | 5%  |
| Construction supply cost..... | 10% |
| Purchased equipment cost..... | 84% |
| Freight cost                  | 1%  |

A typical breakdown of the major cost components is

|              | Small<br>(25 to<br>350 mtpd) | Large<br>(350 to<br>700 mtpd) |
|--------------|------------------------------|-------------------------------|
| Screens..... | 47%                          | 27%                           |
| Pumps.....   | 9%                           | 5%                            |
| Jigs.....    | 44%                          | 68%                           |

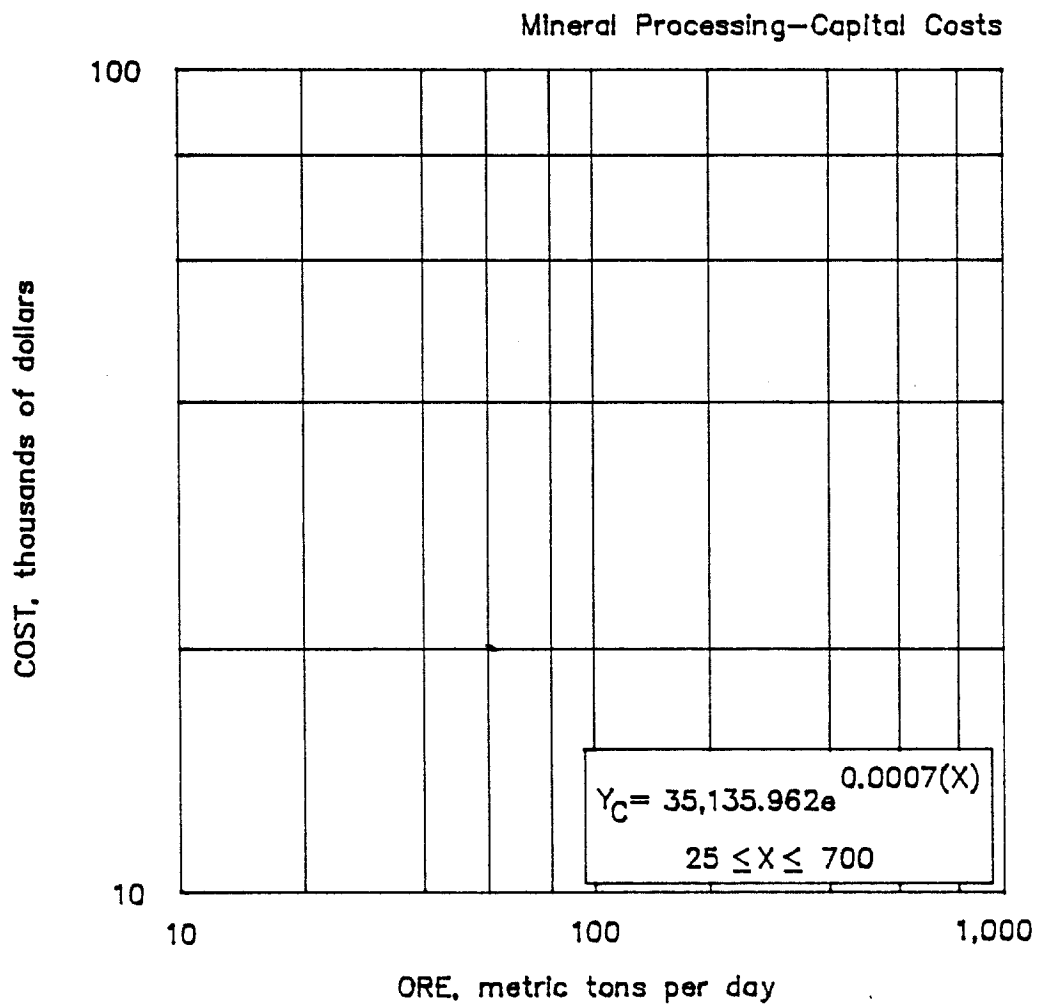
The total capital cost is  $(Y_C) = 35,135.962e^{0.0007(X)}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L) = 1,756.798e^{0.0007(X)}$
- (S) Construction Supply Cost  $(Y_S) = 3,513.596e^{0.0007(X)}$
- (E) Purchased Equipment Cost  $(Y_E) = 29,865.568e^{0.0007(X)}$

## ADJUSTMENT FACTOR

Screen Factor The curve includes costs for screens; however, in many instances, screens are not used with this type of jig treatment. If screens are not used, multiply the cost obtained from curve by the following equation:

Screen factor  $(F_s) = 0.495 + 0.00296(X)$   
where X = ore to the jig circuit, in metric tons per day.



6.1.3.2.2. Gravity separation  
JIGS IN CLOSED CIRCUIT GRINDING

6.1. MINERAL PROCESSING--CAPITAL COSTS

6.1.3. BENEFICIATION

6.1.3.2.3. GRAVITY SEPARATION  
REICHERT CONES

The capital cost for gravity separation (Reichert cone) is for the acquisition and installation of equipment needed to process the ore containing heavy minerals. The Reichert cone circuit includes rougher, scavenger, cleaner and recleaner cones. The Reichert cone circuit can process ores containing 0.15 to 5.0% heavy minerals and yield a product containing a minimum of 80% heavy minerals. The feed for the Reichert circuit is assumed to be 100% minus 10 mesh at a slurry density of 60% solids by weight.

BASE CURVE

The total cost is based on a single cost curve having an adjusted feed rate (X), in metric tons ore per day. The curve is valid for operations between 2,900 and 52,440 mtpd, operating one shift per day. The curve includes all costs associated with the acquisition and installation of the necessary cones, pumps, cyclones, sumps, and distributors.

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

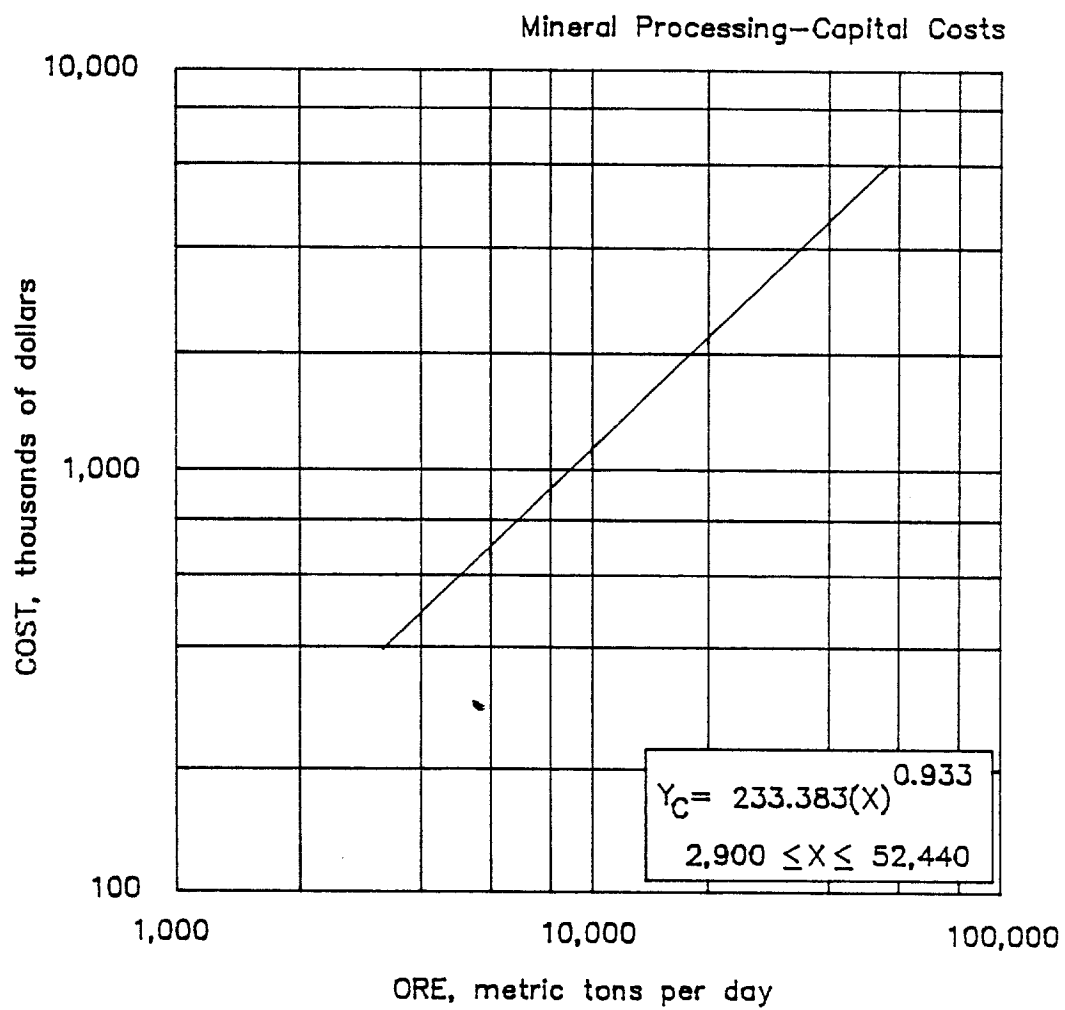
|                               |     |
|-------------------------------|-----|
| Construction labor cost.....  | 9%  |
| Construction supply cost..... | 7%  |
| Purchased equipment cost..... | 83% |
| Transportation cost.....      | 1%  |

A typical breakdown of the major cost components is

|            | Small<br>(2,900 to<br>34,420 mtpd) | Large<br>(34,420 to<br>52,440 mtpd) |
|------------|------------------------------------|-------------------------------------|
| Cones..... | 73%                                | 65%                                 |
| Pumps..... | 16%                                | 14%                                 |
| Other..... | 11%                                | 21%                                 |

The total capital cost is  $(Y_C) = 233.383(X)^{0.933}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L) = 23.338(X)^{0.933}$
- (S) Construction Supply Cost  $(Y_S) = 16.337(X)^{0.933}$
- (E) Purchased Equipment Cost  $(Y_E) = 193.708(X)^{0.933}$



6.1.3.2.3. Gravity separation  
REICHERT CONES

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.3. BENEFICIATION

6.1.3.2.4. GRAVITY SEPARATION  
SLUICING

The capital cost for sluicing is for the acquisition and installation of equipment needed to process gravels containing gold or valuable heavy minerals. The feed for the sluicing operation is a slurry that has been prepared by screening with either a vibrating or trommel screen, or by hydraulic mining. The cost associated with washing, screening, and water distribution is not contained in the capital cost for sluicing.

## BASE CURVE

The total cost is based on a single cost curve having an adjusted feed rate (X), in metric tons of feed material per day. The curve is valid for operations between 160 and 3,320 mtpd, operating three shifts per day. The curve includes all costs associated with the acquisition and installation of the necessary chutes and sluices.

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

|                               |       |
|-------------------------------|-------|
| Construction labor cost.....  | 13.2% |
| Construction supply cost..... | 17.5% |
| Purchased equipment cost..... | 67.1% |
| Transportation cost.....      | 2.2%  |

The total capital cost is  $(Y_C) = 15.327(X)^{0.809}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L) = 2.176(X)^{0.809}$   
 (S) Construction Supply Cost  $(Y_S) = 2.836(X)^{0.809}$   
 (E) Purchased Equipment Cost  $(Y_E) = 10.315(X)^{0.809}$

## ADJUSTMENT FACTOR

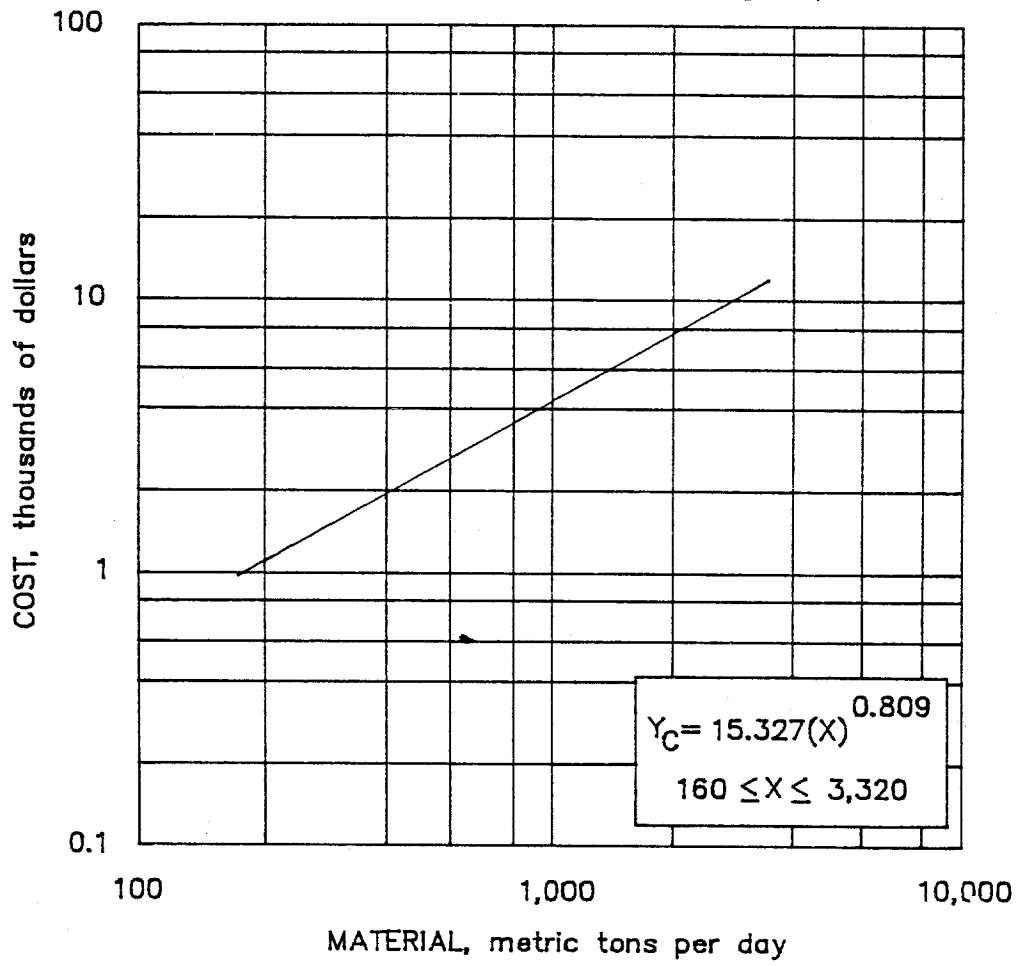
Gravel Size Factor The base curve is predicated upon processing  $-1/4$  in gravel.

The processing of coarser gravel can represent the ability to process a higher tonnage through a given sluice if the higher transport velocity for the coarser rock is developed by adding more slurry at the same density as used for the base case (15% by volume). If the transport velocity is attained by adding more water to the same tonnage as treated by the  $1/4$  in sluice, then no adjustment is needed.

To adjust for adding more slurry to transport the larger gravel, multiply the cost obtained from the curve by the following factor:

Gravel size factor  $(F_R) = 0.316(R)^{-0.554}$   
 where R = radius of the top size gravel to be processed, in inches.

Mineral Processing—Capital Costs



6.1.3.2.4. Gravity separation  
SLUICING

6.1. MINERAL PROCESSING--CAPITAL COSTS

6.1.3. BENEFICIATION

6.1.3.2.5. GRAVITY SEPARATION  
SPIRALS

Costs are for the acquisition and installation of spiral concentrating equipment. Major items of equipment are spiral concentrators, screens, pumps, and slurry distributors. This cost curve does not include equipment for slurry preparation, dewatering, drying, or other types of gravity concentration. To incorporate these other processes, use the appropriate sections of this handbook.

For beach sand operations, the feed slurry is often partially dewatered prior to spiral concentrating. If this is the case, use the tailings thickening section, 6.1.4.1.2., of the handbook.

The cost curves were developed using information from heavy-mineral beach sand operations. Use of the curves may give less accurate results for other types of deposits or for systems designed by other manufacturers.

BASE CURVE

The total cost is based on a single cost curve having an adjusted feed rate (X), in metric tons material per day. The curve is valid for operations between 100 and 25,000 mtpd, operating three shifts per day. The curve includes all costs associated with acquisition, freight, and installation of equipment.

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

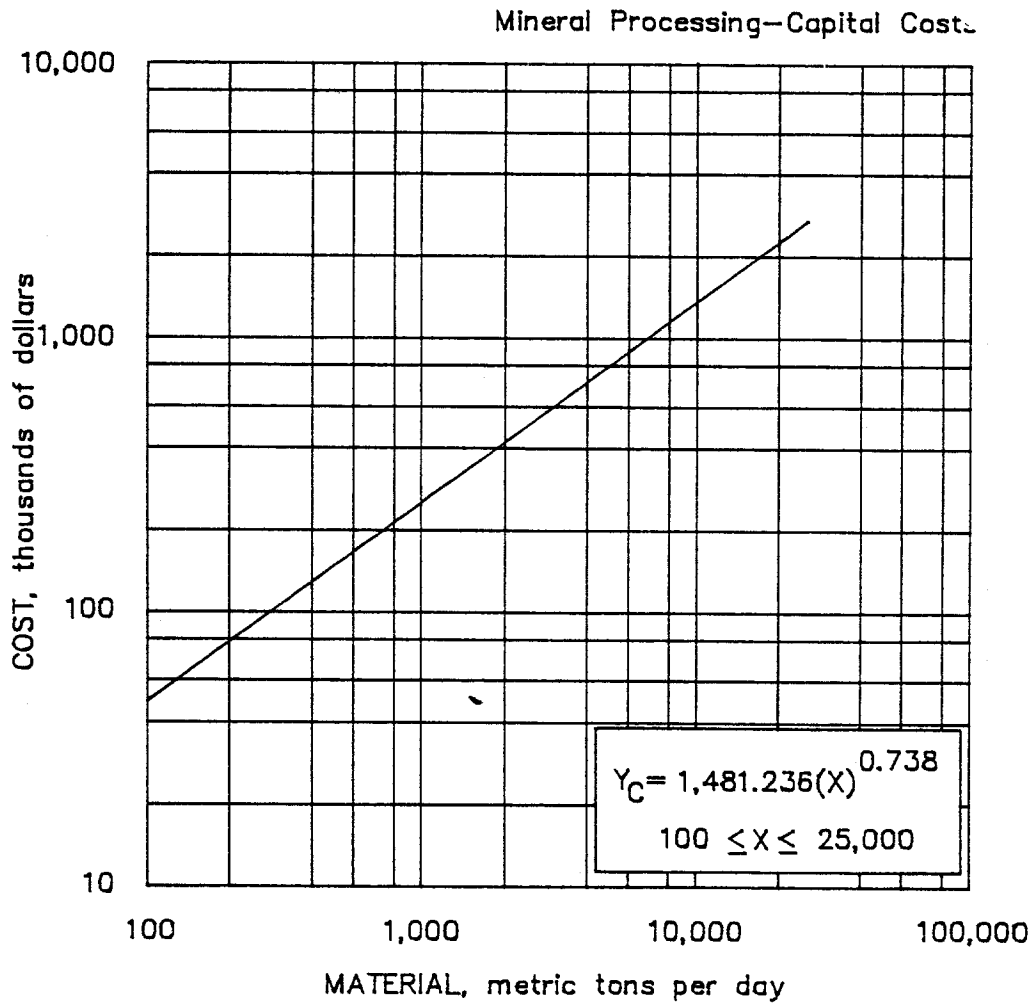
|                               |     |
|-------------------------------|-----|
| Construction labor cost.....  | 27% |
| Construction supply cost..... | 13% |
| Purchased equipment cost..... | 59% |
| Transportation cost.....      | 1%  |

A typical breakdown of the major cost components is

|  | Small<br>(100 to<br>12,000 mtpd) | Large<br>(12,000 to<br>25,000 mtpd) |
|--|----------------------------------|-------------------------------------|
| Screens.....                                   | 21%                              | 8%                                  |
| Feed arrangement<br>(pumps, piping, etc.)..... | 49%                              | 27%                                 |
| Spirals.....                                   | 30%                              | 65%                                 |

The total capital cost is  $(Y_C) = 1,481.236(X)^{0.738}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L) = 385.121(X)^{0.738}$
- (S) Construction Supply Cost  $(Y_S) = 192.561(X)^{0.738}$
- (E) Purchased Equipment Cost  $(Y_E) = 903.554(X)^{0.738}$



6.1.3.2.5. Gravity separation  
SPIRALS

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.3. BENEFICIATION

6.1.3.2.6. GRAVITY SEPARATION  
TABLES

The capital cost of concentrating tables includes the acquisition and installation of equipment to concentrate by gravity, ground, or finely crushed, ores or concentrates of copper, gold, lead, potash, tungsten, tin, zinc, or graphite. This section covers the total cost of rougher tables only. If the handbook user desires to re-table or clean the product or middlings from this circuit, the curves should be entered again with a reduced feed. Typical ratios of circuit feed between rougher and cleaner tabling sections are 3:1 or 4:1. The efficiency (and cost) of a tabling operation is not dependent on the absolute specific gravity of the material being concentrated, but on the difference in specific gravity between the valuable mineral and the gangue being fed to the tables, as well as on the particle size of the feed. This section does not include material handling to and from this circuit, which is covered in sections such as grinding, flotation, tailings dewatering, and drying.

## BASE CURVE

The total cost is based on a single cost curve having an adjusted feed rate (X), in metric tons material per day. The curve is valid for operations between 10 and 4,000 mtpd, operating three shifts per day. The curve includes all costs associated with acquisition and installation of tables and pumps.

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

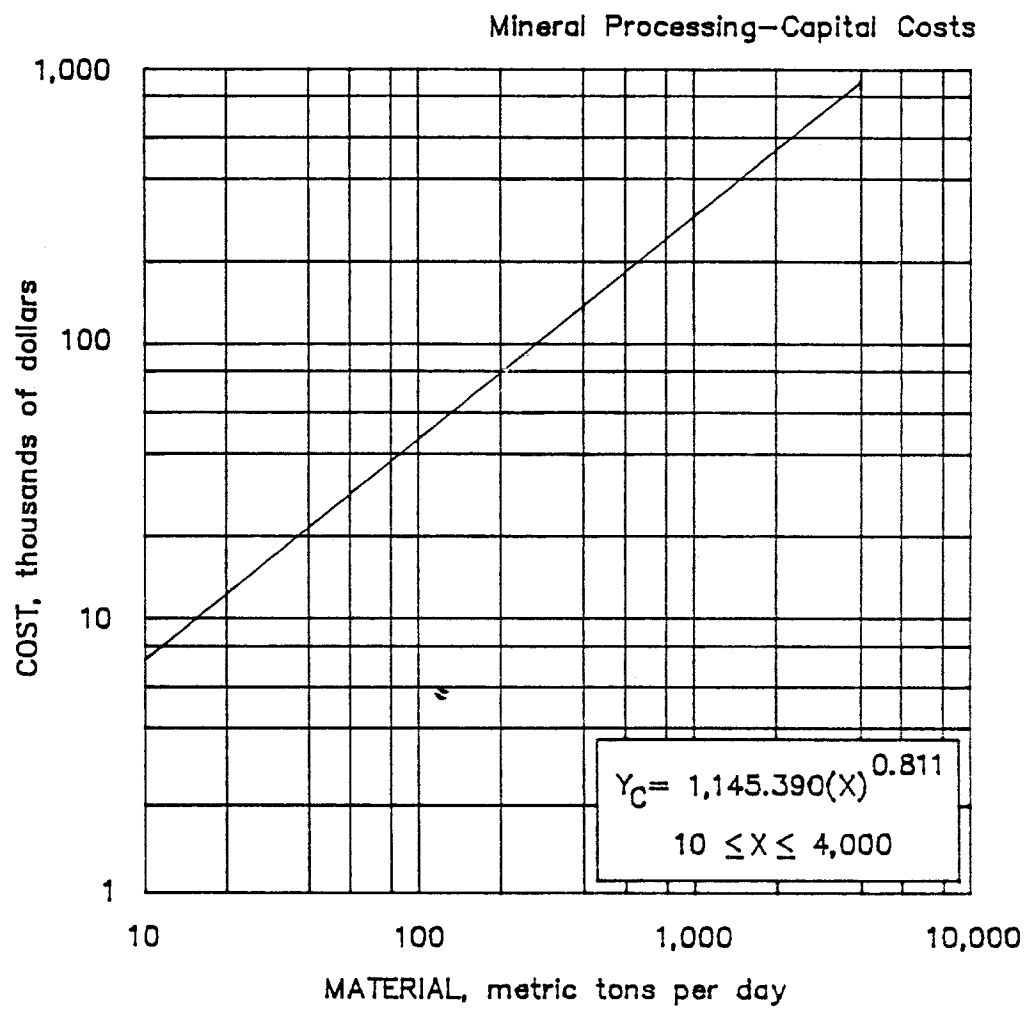
|                               |     |
|-------------------------------|-----|
| Construction labor cost.....  | 6%  |
| Construction supply cost..... | 6%  |
| Purchased equipment cost..... | 87% |
| Transportation cost.....      | 1%  |

Over the range of the curve, the capital cost consists of the following typical ratio of equipment costs:

|             |     |
|-------------|-----|
| Tables..... | 82% |
| Pumps.....  | 18% |

The total capital cost is  $(Y_C) = 1,145.390(X)^{0.811}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L) = 68.723(X)^{0.811}$
- (S) Construction Supply Cost  $(Y_S) = 68.723(X)^{0.811}$
- (E) Purchased Equipment Cost  $(Y_E) = 1,007.944(X)^{0.811}$



6.1.3.2.6. Gravity separation  
TABLES

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.3. BENEFICIATION

## 6.1.3.3. HEAVY-MEDIA SEPARATION

Costs are for acquisition and installation of the heavy-media circuit equipment. Major items of equipment are heavy-media drums, screens, conveyors, demagnetizing coils, densifiers, pumps, and magnetic separators. The cost curves are based on operations that are low in slimes; consequently, thickeners for medium cleaning are not included in the costs. To incorporate thickeners within the circuit to handle ore containing slimes, use section 6.1.4.1.1. (concentrate thickening) and adjust the cost using the settling area for ferrosilicon. Also, the cost curves are derived for dynamic drum heavy-media systems that use only magnetite or ferrosilicon as media. Dyna Whirlpool and static systems (OCC) are not included in the curves, nor are circuits that use barite, sand, or galena as media.

## BASE CURVE

The total cost is based on a single cost curve having an adjusted feed rate (X), in metric tons of feed per day. The curves are valid for operations between 400 and 10,000 mtpd, operating three shifts per day. The curve includes all costs associated with acquisition, freight, and installation of the equipment.

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

|                               |     |
|-------------------------------|-----|
| Construction labor cost.....  | 21% |
| Construction supply cost..... | 12% |
| Purchased equipment cost..... | 65% |
| Transportation cost.....      | 2%  |

A typical breakdown of the major cost components is

|                            | Small<br>(400 to<br>5,200 mtpd) | Large<br>(5,200 to<br>10,000 mtpd) |
|----------------------------|---------------------------------|------------------------------------|
| Screens.....               | 10%                             | 3%                                 |
| Pumps.....                 | 6%                              | 2%                                 |
| Conveyors.....             | 11%                             | 3%                                 |
| Magnetic separators.....   | 12%                             | 1%                                 |
| Heavy-media equipment..... | 61%                             | 91%                                |

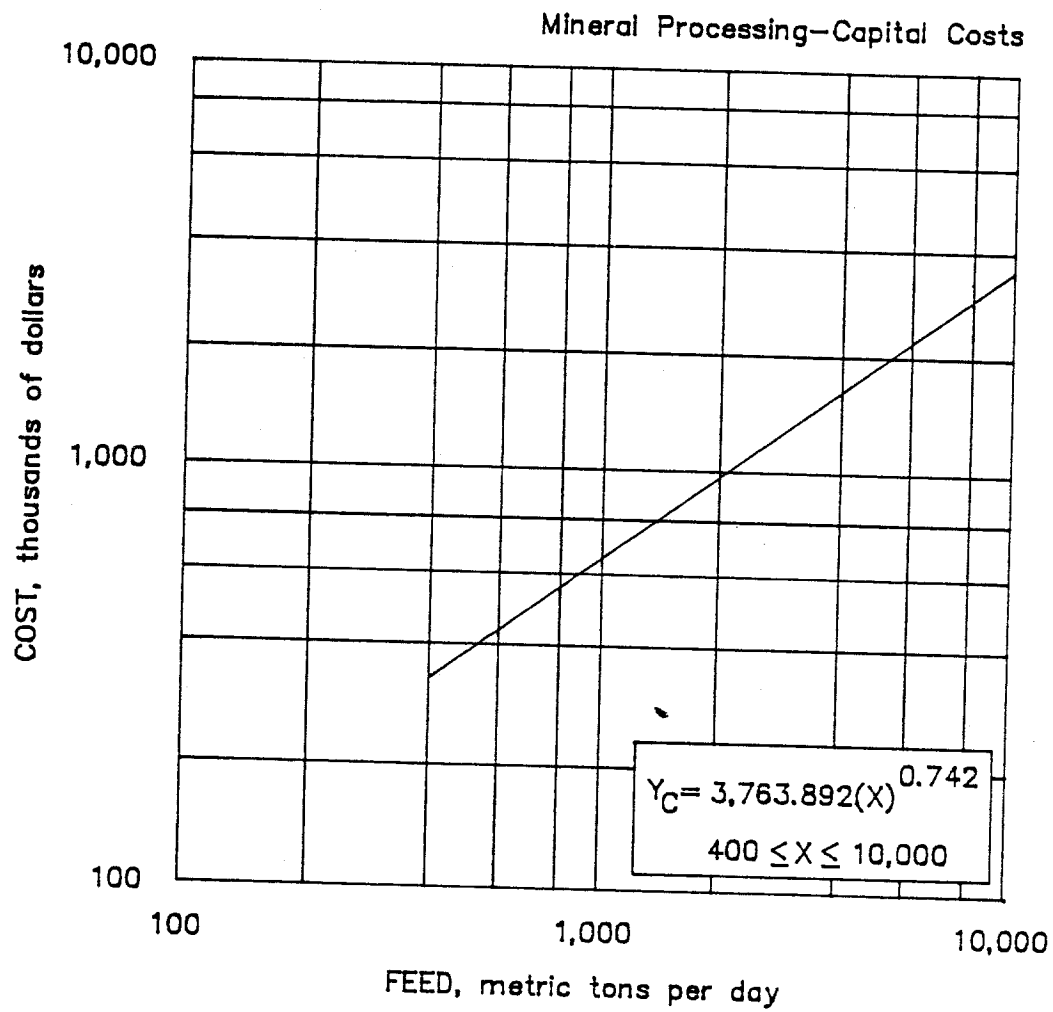
The total capital cost is  $(Y_C) = 3,763.892(X)^{0.742}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L) = 790.417(X)^{0.742}$
- (S) Construction Supply Cost  $(Y_S) = 451.667(X)^{0.742}$
- (E) Purchased Equipment Cost  $(Y_E) = 2,521.808(X)^{0.742}$

## ADJUSTMENT FACTOR

Cone Separation Factor If heavy-media cone separators are to be used, multiply the cost obtained from the curve by the following factor:

Cone separation factor  $(F_C) = 0.9$



6.1.3.3. Heavy-media separation

## 6.1. MINERAL PROCESSING---CAPITAL COSTS

## 6.1.3. BENEFICIATION

## 6.1.3.4.1. MAGNETIC SEPARATION

The costs are for acquisition and installation of low-intensity wet magnetic separation equipment. Major items include magnetic separators, screens, slurry pumps, and miscellaneous materials. The curve does not include costs for dewatering, desliming, tramp-iron removal, or grinding and regrinding. If any of these processes are to be included within the circuit, the appropriate section of this handbook should be used. This section is based on large taconite operations that use low-intensity, wet magnetic separation. For smaller operations, or operations using other types of magnetic processing, the curve is less accurate.

## BASE CURVE

The total cost is based on a single cost curve having a daily adjusted feed rate (X), in metric tons feed per day. The curve is valid for operations between 4,000 and 80,000 mtpd, operating three shifts per day. The curve includes all costs associated with acquisition, freight, and installation of the equipment.

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

|                               |     |
|-------------------------------|-----|
| Construction labor cost.....  | 2%  |
| Purchased equipment cost..... | 96% |
| Transportation cost.....      | 2%  |

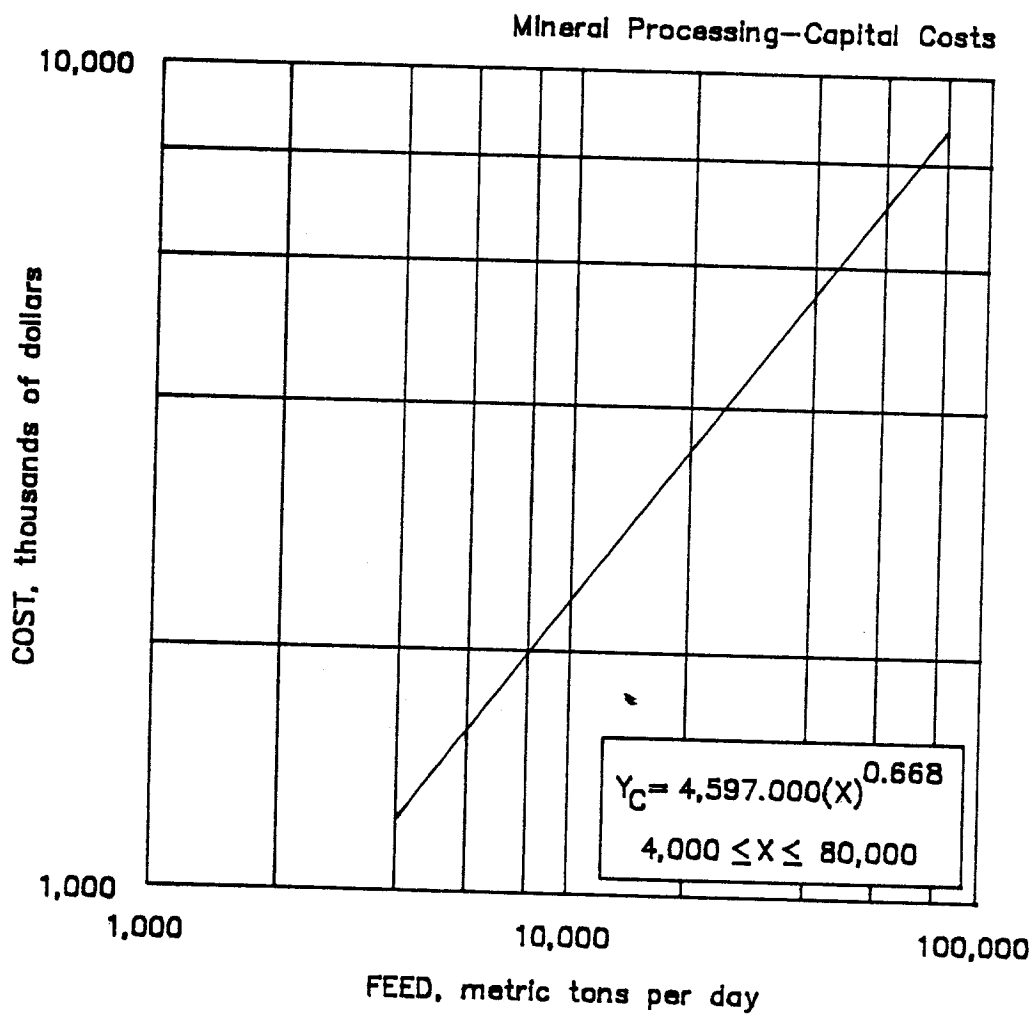
A typical breakdown of the major cost components is

|                          | Small<br>(4,000 to<br>10,000 mtpd) | Large<br>(10,000 to<br>80,000 mtpd) |
|--------------------------|------------------------------------|-------------------------------------|
| Screens.....             | 3%                                 | 8%                                  |
| Pumps.....               | 8%                                 | 8%                                  |
| Magnetic separators..... | 89%                                | 84%                                 |

The total capital cost is  $(Y_C) = 4,597.000(X)^{0.668}$  and is distributed as follows:

$$(L) \text{ Construction Labor Cost } (Y_L) = 91.940(X)^{0.668}$$

$$(E) \text{ Purchased Equipment Cost } (Y_E) = 4,505.060(X)^{0.668}$$



6.1.3.4.1. Magnetic separation

## 6.1. MINERAL PROCESSING---CAPITAL COSTS

## 6.1.3. BENEFICIATION

6.1.3.4.2. HIGH-INTENSITY MAGNETIC SEPARATION  
WET (WHIMS)

The capital cost for high-intensity magnetic separation is for the acquisition and installation of equipment needed to produce a magnetic concentrate from an ore or concentrate. The high-intensity magnetic separation unit operation has been divided into two sections, wet and dry. For both sections the cost includes the cost for the magnetic separator and the necessary materials handling equipment. The total cost is based on a single cost curve having an adjusted feed rate (X), in metric tons dry feed to the magnetic separation circuit per day. The curve is valid for operations between 2,100 and 47,000 mtpd, operating three shifts per day.

## BASE CURVE

The base curve is predicated on processing a hematite bearing ore through wet high-intensity magnetic separators (WHIMS). The base curve assumes a three-shift-per-day operation with an availability of 95%. The base curve is for a single stage of magnetic separation. The total cost includes the costs associated with the acquisition and installation of the oversize removal screens, feed pumps, feed distributors, tailings collection, middling collection and final product collection.

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

|                             |       |
|-----------------------------|-------|
| Construction labor cost.... | 2.3%  |
| Construction supply cost... | 1.5%  |
| Purchased equipment cost... | 95.7% |
| Transportation cost.....    | 0.5%  |

The total capital cost is  $(Y_C \text{ WET}) = 515.411(X)^{0.970}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L \text{ WET}) = 11.855(X)^{0.970}$   
 (S) Construction Supply Cost  $(Y_S \text{ WET}) = 10.308(X)^{0.970}$   
 (E) Purchased Equipment Cost  $(Y_E \text{ WET}) = 493.248(X)^{0.970}$

## ADJUSTMENT FACTORS

Additional Cleaner Stage Factor To produce a higher quality product, a cleaner stage may be added to the base curves. To adjust for the addition of a cleaner stage, multiply the cost obtained from the curve by the following factor:

$$\text{Additional cleaner stage factor } (F_C) = 1.24$$

Feed Rate Factor The WHIMS can be used as a scavenger rather than a primary recovery device. The maximum feed that a WHIMS can handle is a function of mineralogy, ore size distribution, slurry density, magnetic properties of solids. The base case assumes a feed rate of 115 mtpd to a double rotor, 3.17 m wide WHIMS.

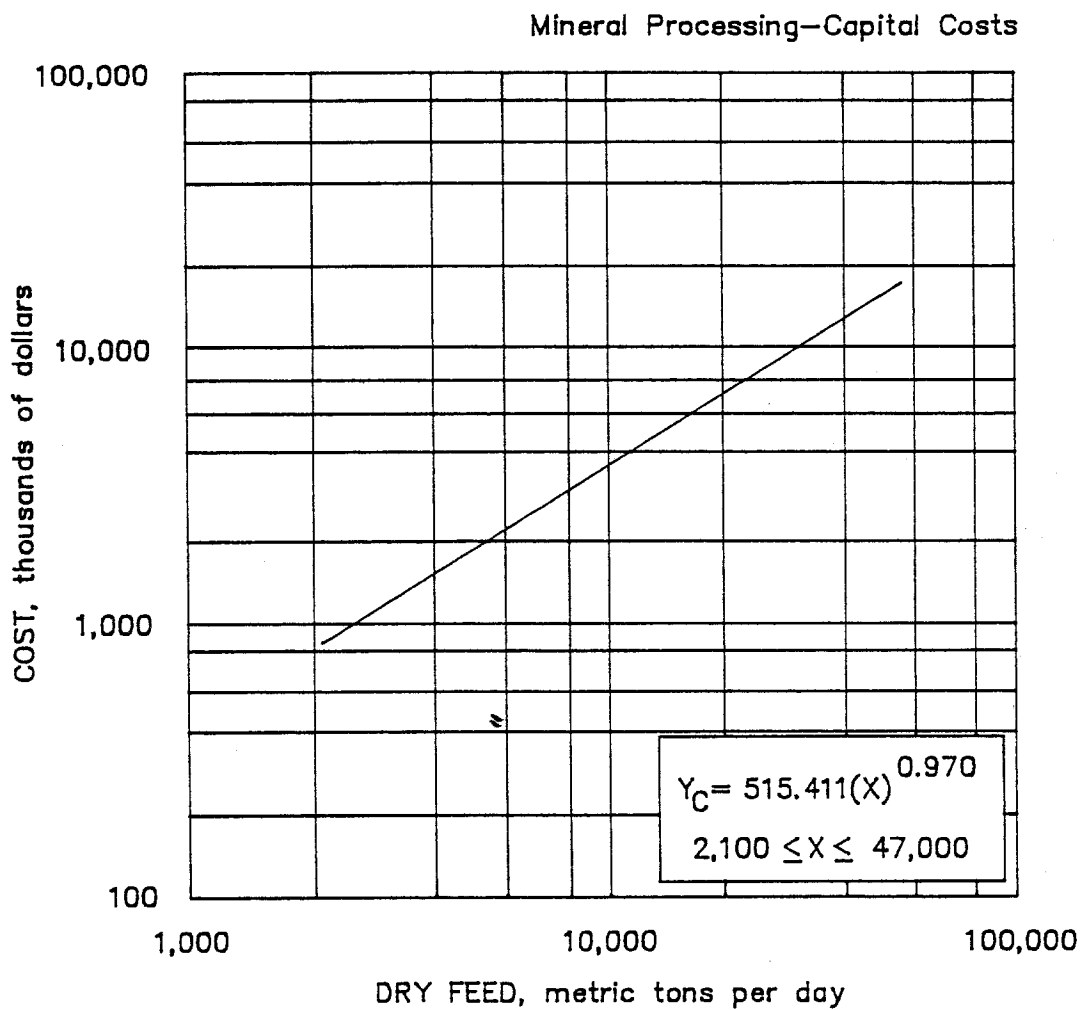
To adjust for different feed rates, the base curve should be multiplied times the following factor:

$$\text{Feed rate factor } (F_R) = 97.867(R)^{-0.966}$$

where R = new feed rate, in metric tons per hour.

While there are no hard and fast guidelines for feed rates for different commodities, the following can be utilized as approximate guidelines:

| <u>Commodity</u>       | <u>mtp</u> |
|------------------------|------------|
| Gold Tailings.....     | 70         |
| Chromite.....          | 50         |
| Iron Ore Tailings..... | 90         |



6.1.3.4.2. High intensity magnetic separation—wet (WHIMS)

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.3. BENEFICIATION

6.1.3.4.3. HIGH-INTENSITY MAGNETIC SEPARATION  
DRY

The capital cost for high-intensity magnetic separation is for the acquisition and installation of equipment needed to produce a magnetic concentrate from an ore or concentrate. The high-intensity magnetic separation unit operation has been divided into two sections, wet and dry. For both sections the cost includes the cost for the magnetic separator and the necessary materials handling equipment. The total cost is based on a single cost curve having an adjusted feed rate (X), in metric tons dry feed to the magnetic separation circuit per day. The curve is valid for operations between 80 and 900 mtpd, operating three shifts per day.

## BASE CURVE

The dry high-intensity magnetic separation cost curve is based on recovering ilmenite from an ore or concentrate in metric tons (X) per day to the magnetic separation circuit. The base curve assumes a three-shift-per-day operation with a 95% availability. The total cost includes the costs associated with the acquisition and installation of feed bins, magnetic separators, tailings conveyor, product conveyor, and product storage bin.

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

|                             |       |
|-----------------------------|-------|
| Construction labor cost.... | 4.4%  |
| Construction supply cost... | 6.8%  |
| Purchased equipment cost... | 87.7% |
| Transportation cost.....    | 1.1%  |

The total capital cost is  $(Y_C \text{ DRY}) = 1,513.748(X)^{0.945}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L \text{ DRY}) = 66.605(X)^{0.945}$
- (S) Construction Supply Cost  $(Y_S \text{ DRY}) = 102.935(X)^{0.945}$
- (E) Purchased Equipment Cost  $(Y_E \text{ DRY}) = 1,344.208(X)^{0.945}$

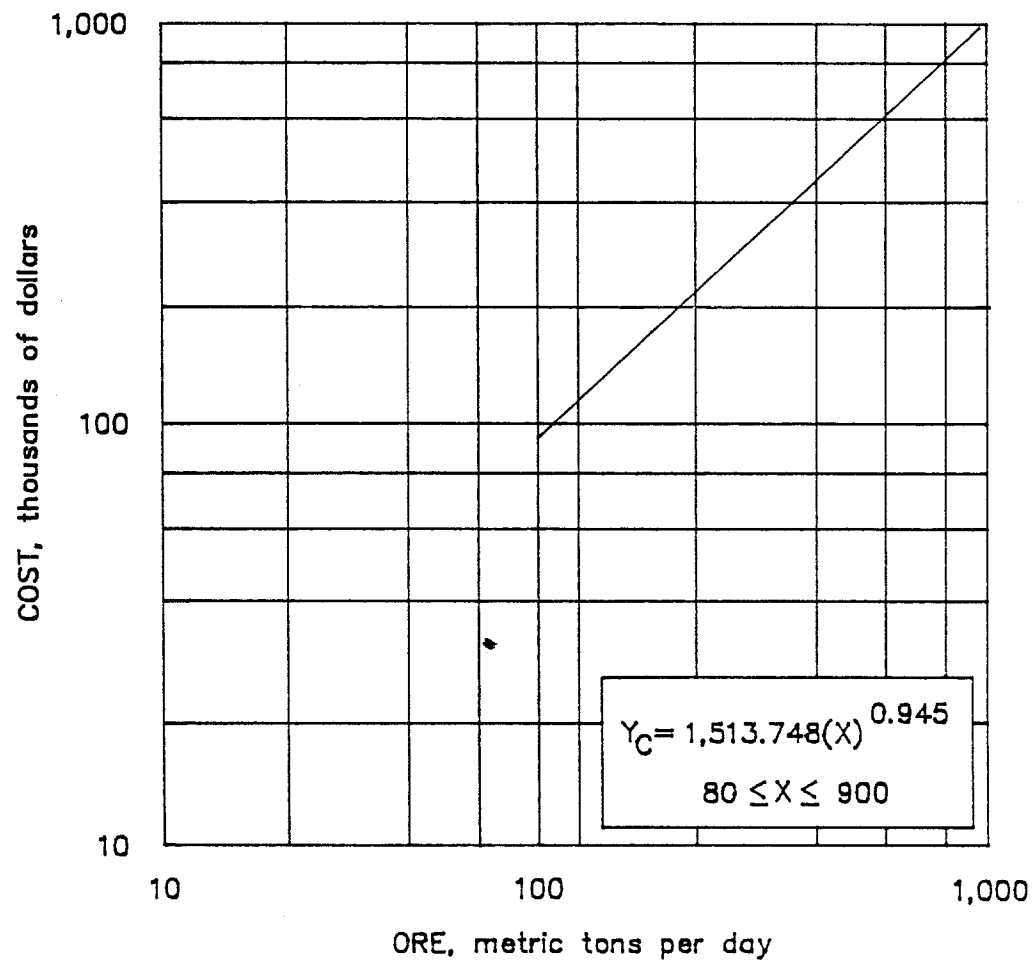
## ADJUSTMENT FACTOR

Feed Rate Factor The base curve is based on feeding a high intensity induced roll separator at a feed rate of 25.8 kg/h per centimeter of roll length. The feed rate can vary from 9 to 179 kg/h per centimeter depending on the application. For the strategic commodities, the range is narrower at 18 to 55 kg/h per centimeter. To adjust for different feed rates, multiply the cost obtained from the curve by the following factor:

$$\text{Feed rate factor } (F_R) = 21.437(F)^{-0.943}$$

where F = new feed rate, in kilograms per hour per centimeter of roll length

Mineral Processing—Capital Costs



6.1.3.4.3. High intensity magnetic separation—dry

## 6.1. MINERAL PROCESSING--CAPITAL COSTS

## 6.1.3. BENEFICIATION

## 6.1.3.5. PHOTOMETRIC SEPARATION

The capital cost for photometric separation is for the acquisition and installation of equipment needed to separate economic minerals from waste, based on a visual difference between these components. The photometric separation circuit consists of photometric sorters and related equipment such as conveyors and air compressors.

## BASE CURVE

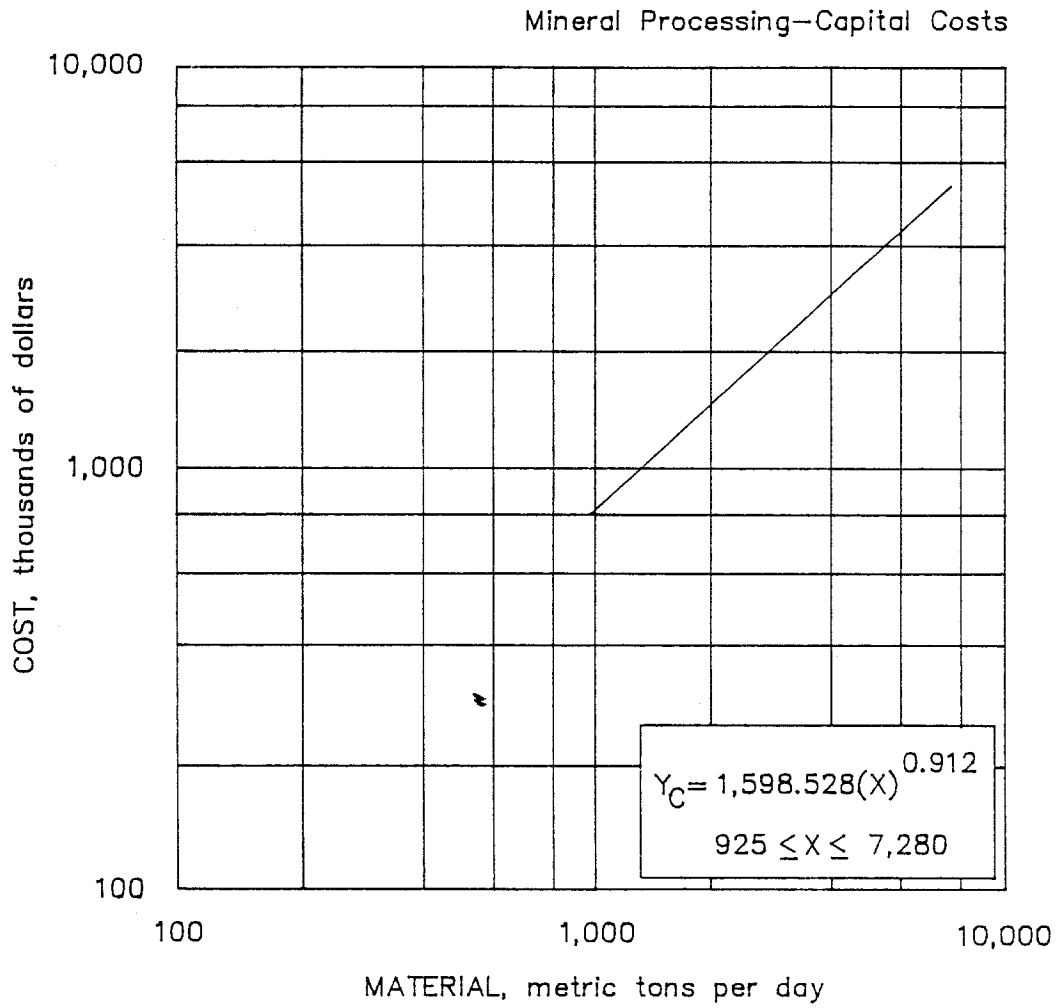
The total cost is based on a single cost curve having a capacity rate (X), in metric tons of feed material to the sorter circuit per day. The curve is valid for operations between 925 and 7,280 mtpd, operating on a continuous basis. The curve includes all costs associated with the acquisition and installation of the photometric separation circuit.

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

|                             |       |
|-----------------------------|-------|
| Construction labor cost.... | 2.6%  |
| Construction supply cost... | 1.7%  |
| Purchased equipment cost... | 94.9% |
| Transportation cost.....    | 0.8%  |

The total capital cost is  $(Y_C) = 1,598.528(X)^{0.912}$  and is distributed as follows:

- (L) Construction Labor Cost  $(Y_L) = 47.956(X)^{0.912}$
- (S) Construction Supply Cost  $(Y_S) = 31.971(X)^{0.912}$
- (E) Purchased Equipment Cost  $(Y_E) = 1,518.602(X)^{0.912}$



6.1.3.5. Photometric separation