Appraisal of Construction Rocks

Second Edition

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Appraisal of Construction Rocks

1.0 Purpose and Scope

1.1 The purpose is to set out principles and some techniques used in appraising construction rocks, viz., crushed rock, sand and gravel, and fill material.

1.2 Reasons for appraisal include:

1.2.1 For government
Eminent domain (condemnation)
Taxation
Disposal of land assets
Planning and miners/conservation

About the last-cited reason: Systematic land planning requires consideration of undeveloped mineral resources that will later be needed by a community. This is officially recognized in California, where communities must recognize future needs for aggregate.

No coherent system has been developed to measure the present value of such resources. Wallace, Dunn, and Bishko (1970) suggested the use of future costs of bringing rock from alternative deposits to points of use. The "transportation advantage" (See later section 3.3) is an important factor in estimating that cost, as noted by Dunn, Hudec, and Brown (1970) and Hudec, Dunn, and Brown (1970). But the major justification for saving undeveloped rock resources still often uneasily depends on conservation philosophy and social judgements.

1.2.2 For lessors (viz. Landowners, royalty owners)
Leasing
Sale
Bank loan
Estate, gift, and income taxation

1.2.3 For lessees (i.e., operators) or lenders
Eminent domain
Bank loan
Sale of purchase
Taxation, primarily ad valorem property

1.3 The physical property to be appraised may be either:

1.3.1 Only the land and rock deposits, which embraces land used for roads, plant site, stockpiles, and buffer zone, or

1.3.2 The "total property," which embraces land and minerals plus the plant and equipment — viz., improvements and personal property — needed

to mine and process the rock.

1.4 The **property rights** to be appraised. The appraiser must know what they are, and so state in his report. They may be:

1.4.1 "Total property rights," which embrace both the lessor's fee or royalty interest, and the lessee's lease-hold interest.

1.4.2 Either the royalty interest alone or the leasehold interest alone.

2.0 The Geologist as Appraiser

Geologists knowledgeable in financial and economic analysis are logical candidates for appraising construction rocks because:

2.1 Geologists understand (a) the nature of depletable mineral reserves and (b) rock characteristics, viz., hardness, toughness, and chemical composition.

2.2 Such factors as the shape of a deposit, the position of the water table, rock porosity and permeability, and overburden thickness and distribution are all geologic in nature.

2.3 Environmental hazards such as landsliding, subsidence, and groundwater contamination involve geology.

2.4 The nature of post-mining or reversionary uses often depends on geological conclusions.

3.0 A Comparison of Construction Rocks with other types of Mineral Deposits

3.1 Construction rocks are produced in large amounts. U.S. production is about 2 billion tons per year, compared, for example, with about 3 billion pounds of copper.

3.2 Prices for construction rocks are low, on the order of a few dollars per ton, with substantial local variations. Prices are commonly determined by local competition, unlike world prices for metallic minerals. Prices of construction rocks usually increase very nearly in line with general inflation.

3.3 A consequence of low prices per ton is that **location** of construction-rock deposits relative to points of use is highly important. A favorably located deposit has a "transportation advantage" over deposits farther from points of use, that is, its haul costs are lower. In contrast, prices of metallic and some non-metallic minerals may be several hundred times those of construction rocks, so transportation cost is not so critical relative either to development and mining or to value.

3.4 Social and environmental issues such as reclamation planning, post-mining use, and reversionary value are often of high importance in the case of construction rocks near metropolitan areas. Paradoxically, a growing shortage of construction rocks in coastal-plain areas appears to be mitigating that issue. Rock is now being shipped to the Atlantic and Gulf coasts from Canada's Maritime Provinces, Scotland, and Mexico.

4.0 The Value Goal and Appraisal Methodology

4.1 In most cases the value goal or standard is **fair market** value, which is briefly defined as the most probable price at which a property would be sold by a willing and knowledgeable seller, who is not under duress to buy, to a willing and knowledgeable buyer, who is not under compulsion to buy. Computation of the **allocated value of a partial taking of land** by condemnation is discussed later in Section 10.0.

If any goal other than fair market value is required by law, as may be the case with eminent domain (condemnation), the appraiser should request a written definition of the value goal to be employed.

4.2 If the value of only the land and minerals (rock deposits) is to be estimated at an active operation, it is necessary to compute the **residual** value, which is the total-property value minus the value of improvements and personal property. This requires the use of the method cited in 4.3.2, below, and of the technique shown in later section 9.4.

4.3 These fundamental methods of appraisal may apply:

4.3.1 If the deposit to be appraised is undeveloped and non-producing, that is, is raw land, the **sales comparison** method is preferable. "Sales comparison" means the appraisal of a property by reference to sales of other properties that are comparable to it. The sales comparisons method correctly applies to properties that are indeed similar and for which sales data are relatively abundant, e.g., homes, vacant land, farms, small commercial properties.

Serious problems attend the use of sales comparison in appraising active construction-rock operations — viz., pits and quarries — because timely sales are rare, and because sold properties and the subject property commonly differ in: (a) the quantity, i.e., reserves, of rock, (b) quality of the rock, e.g., differences in abrasion and chemical characteristics, (c) stage of development, (d) mining and environmental costs, (e) annual production rates, (f) product prices, and (g) distance to markets, i.e., relative locations.

If the appraisal of an active pit or quarry is at issue, and the appraiser is told that local law permits appraisal only by reference to sales comparison, the appraiser should refuse the assignment. Sales comparison is often useful, however, in appraising the personal property (mobile equipment, et al.) at a subject pit or quarry.

4.3.2 The **capitalized income** method is the only method appropriate to appraisal of an active construction-rock operation. That is because: (a) data on sales of other similar operations are both rare and meaningless, and (b) people either develop or buy construction-rock properties for the purpose of enjoying net income from them. Data necessary to the use of the income method is given later in section 7.4.

4.3.3 The **cost less depreciation** method is required in appraising the plant and equipment at a pit or quarry. "Depreciation" here means the property's

loss in value as of the date of appraisal from the level of replacement cost new. The use of "Replacement cost" is preferred, although the appraiser may have to employ "Reproduction cost." Replacement costs are obtained from the market, while reproduction costs are computed using original costs and price index factors.

5.0 Post-Mining Use and the Reversionary Value

In all cases, the appraiser should consider possible post-mining uses, which may produce substantial value. Depleted pits and quarries may be used for such purposes as rubbish disposal and recreational lakes. The values of those uses, if they are not too distant in time, may exceed the value of the rock deposit itself.

6.0 The Appraisal of Royalty Interests

6.1 **Sales of royalty interests** in deposits or operations of construction rocks are so rare as to be virtually unknown. It is therefore necessary to employ capitalized income. Two cases may exist regarding the royalty rate: (a) a contract rate is in effect, or (b) a rate does not exist, and must be estimated.

6.2 If a **contract royalty rate** will be in effect for years to come, it should be used as the lessor's unit income per ton or cubic yard, even if it does not reflect the current market. If the contract stipulates that the royalty rate will escalate in line with inflation, the rate at the date of appraisal should be used throughout if income is stated in dollars of constant purchasing power.

6.3 If the appraiser uses an **estimated royalty rate**, he should ignore all existing royalty contracts unless they: (a) apply to similar rocks, (b) are current, (c) contain an escalation clause, and (d) involve lessors who are as knowledgeable as the prospective lessee (see Paschall, December 1986).

In pure financial terms, a lessor (royalty owner) should receive a given percentage of the **net income from the land and minerals**. This income is residual to total net income, after subtracting a charge for amortization ("depreciation" in accounting terms) of the cost of plant and equipment. Computing such net incomes requires a substantial data bank of past appraisals of rock operations, and is thus not easily come by. If the data are available, net incomes can be computed and then translated into royalty rates as a percent of sales.

6.4 The annual income from royalty payment, and the duration of the income stream, depend on the property's reserves of salable rock and the forecasted annual rate of production. These things are most readily obtained from the operator, with a field check on reserves and on audit of the operator's recent annual reports of production. The royalty owner's right to such audits should be stated in the royalty contract.

6.5 The **discount rate** used in present-worthing future royalty income cannot be derived from the market because of the absence of relevant sales data. The appraiser can turn here to what is called the "opportunity cost," that is, rates of return on alternative investments available to prospective buyers of the royalty

interest, and which would be foregone if ignored.

Some common opportunity costs relative to discount rates for royalty income are interest rates on corporate bonds and on first and second mortgages. It appears logical that a buyer of a royalty interest would seek a higher rate of return than those available from the above-cited better-known and more liquid types of investments. The appraiser must make a judgment in a given case on the premium that would be sought.

6.6 Observe that future royalty income must be **present-worthed**, or **discounted**, to present value. The value of a royalty interest is not the same as annual royalty income times the years over which it will be received.

7.0 Appraisal of Total Property

7.1 "Total property" was defined in section 1.3.1 as the sum of: (a) land, including that needed for roads, plant site, and stock-piles, (b) the processing plant, and (c) mobile equipment, which may embrace a dragline or shovel, loaders, trucks, et al. In ad valorem property taxation, these elements are termed (a) land and mineral rights (b) improvements, and (c) personal property, although the processing plant may qualify as personal property in some jurisdictions.

In parallel, "total-property rights" embrace both lessor's and lessee's (leasehold) interests. Thus, a total-property appraisal embraces both total physical property and total property rights.

7.2 **Capitalization of income**, or **discounted net income**, is the only method applicable to appraising the total property. The preferred income to be present-worthed, or discounted, is **net operating income** (N.O.I.), sometimes called net operating profit. This is defined in California Assessors Handbook 560 as "income before income tax plus interest on debt, which, in turn, is the net income after operating expenses but before [all] taxes, depletion, depreciation, and amortization."

This can also be expressed as "net sales minus future capital costs and direct out-of-pocket expenses other than property taxes, which should be capitalized." It should be noted that depletion, depreciation, and amortization are so-called non-cash, or "book", charges that constitute a return of capital and are part of an operator's cash flow.

Past, or "sunk" costs should be ignored. They should not be deducted as either a capital cost or operating expense, since they are irrelevant to the development of future net operating income.

7.3 **"Cash flow"** is net income after operating cost, all taxes, and interest on debt. Put another way, it is the sum of after-tax ("bottom-line") net income, depletion, depreciation, and amortization (if any). Corporations commonly present-worth cash flow rather than N.O.I. The problems with this from the appraiser's standpoint are that: (a) it requires knowledge of the operator's method of depreciation, (b) it requires knowledge of perhaps changing investment tax credits and tax rates on income, (c) it is much more tedious to compute than N.O.I., and (d) cash flow varies with a company's level of debt, which bears on

the value of a company, but not on the value of a company's physical assets.

7.4 The key elements in a total-property appraisal are rock reserves, future rates of production, product prices, operating expenses, future capital costs, and the discount rate.

7.4.1 **Rock reserves** are measured in either tons or cubic yards. Reserves that will not be mined for more than, say, twenty years are not critical to appraisal because they have so little present worth. That is, the **physical** life of the reserves may exceed their **economic** life. It is important to note, however, that which part of the reserves will be mined now and which in the distant future may not be identifiable, since a rock deposit is an undifferentiated mineral property.

Reserves of solid rock — granite, limestone, trap rock — can be easily measured using known densities. A good rule-of-thumb for estimating reserves of sand and gravel is the figure of **2,500 tons per acre-foot**. A 20-foot-thick body of gravel with an area of 100 acres thus has reserves of about 5,000,000 tons (also see Dunn, 1991).

The volume of a body of gravel in cubic yards is its weight in tons divided by a factor of 1.45 to 1.55, say 1.5.

7.4.2 Estimation of the **future rate of production** is the most subjective judgement the appraiser will make, and one of the most important, because the value of a rock property varies directly with its rate of production. A multi-year production history of a subject property should be graphed and analyzed, because of the cyclical nature of the construction industry. A claimed plan to increase plant capacity and therefore the production rate should also be carefully considered.

7.4.3 Metals — copper, gold, lead, et al. — are priced on a worldwide basis, with daily quotations available. Some industrial minerals – borates, salines, et al. — may be priced administratively, viz., at what the market will bear. In contrast, construction rocks are usually competitively priced at a local level.

A broad array of **product prices** may exist at an aggregate plant, from say $1.50 per ton for fill material to $8.00 per ton for portland-cement concrete (PCC) aggregate (in 1998). Company price lists are misleading because they do not reflect volume discounts for large purchases. The appraiser should use company records in computing the **average** price per ton for all products over two years or so.

7.4.4 Operators' income statements serve as the only reliable source for **operating costs**. Analysis of income (profit-and-loss, or operating) statements is the single most exacting task in appraising a construction-rock property. Non-cash items must be ignored. Non-cash items are depreciation, depletion, and occasionally amortization. These elements are all part of cash flow.

Operating costs must be converted into cost per annual ton or cost per annual cubic yard, for two reasons. One is that the costs may have to be applied to an annual production rate that differs from those in the

income statements. The other is that the operating costs may be a year or so old, and must be indexed to the date of appraisal.

7.4.5 In accounting practice, **capital costs** are capitalized rather than expensed, but future capital costs are nevertheless ones that a buyer will both anticipate and incur. Capital costs are costs of replacement of plant and equipment, and are either periodic or annual. One way to estimate future capital costs is to divide the replacement cost of capital items by their expected useful lives, and use that amount as an annual charge against future income. For example, if mobile equipment has a replacement cost of $2,500,000 and its expected working life is ten years, the annual charge is $250,000. If the date of a future given capital replacement or addition is known, treat it as a cost in the year of occurrence.

7.5 Although operators expense **ad valorem property taxes**, in appraisal practice they should be capitalized by adding a component to the discount rate. For example, if the property-tax rate is 10 mills, that is, one percent of assessed value, one percentage point should be added to the otherwise-derived discount rate.

The reason they should be capitalized is that incurred property taxes themselves presumably reflect the value of a property, since taxes are computed by multiplying the property value by the rate. Expensing the taxes therefore suggests that the value of a property is already known.

7.6 The appraiser may encounter a case of negative value for land and minerals, that is, the replacement cost less depreciation of plant and equipment may exceed discounted N.O.I. This case may result from several different causes.

7.6.1 The appraiser used a production rate that applied to a low in the construction cycle, rather than an anticipated future average rate of production.

7.6.2 The appraiser's **reproduction** cost of plant and equipment may have exceeded their replacement cost.

7.6.3 The rock deposit may truly be uneconomic. In this case the land should be appraised for an applicable alternative use, and the plant and equipment appraised at their salvage or scrap value.

8.0 The Discount Rate

8.1 The discount rate may not be the most difficult thing to judge — actually, the future rate of production is — but it is the most contentious element in appraisal cases and the one most subject to unprofessional conclusions.

8.2 The discount rate is the rate of return on investments anticipated and sought by knowledgeable investors. Tens of billions of dollars' worth of stocks and bonds are traded daily by several hundred thousand knowledgeable investors, and thereby conform to the demand by courts for **sales-derived** data. The derivation of a discount rate from the securities market would therefore not appear to be either difficult or disputatious.

Yet, a presumable reputable mining engineering firm once applied a **six-percent** discount rate to yet-undiscovered and speculative mineral deposits in the Arctic, at a time when the yield on Aaa-rated corporate bonds was 10.5%, that on long-term Treasury bonds was 9.0%, and the average pre-tax over-all capitalization rate for metal-mining companies was 24%. The firm's action ignored both financial reality and the opportunity cost (which was defined as section 6.5 of this guide).

8.3 Extensive empirical analyses have revealed that discount rates for natural-resource companies range from 6 to 9 percentage points above the bond-interest rate that applies to the industry. This premium over the debt-interest rate reflects a reward for management and entrepreneurship, plus general business risks, e.g., unanticipated strikes or cost increases.

For example, if the industry's bonds are rated Baa, and the current interest rate on Baa bonds is 9.0%, the discount rate will typically fall in a range of 15% to 19%, plus the appropriate component for property taxes. The cited range reflects the market's perception of the risks inherent in different companies. Market-derived discount rates apply to corporations, not to properties. However, the cited range can also be employed in judging the risks of different deposits of construction rocks, e.g., their location and the quality of and market for their materials.

9.0 A Sample Appraisal of Total Property, and the Residual Value of Land and Minerals

9.1 Input data:

Reserves of salable rock	10,000,000 tons
Future rate of production	500,000 tpy
Derived economic life	20 years
Average price of products	$8.00 per ton
Direct operating costs	$4.50 per ton
Resultant N.O.I.	$3.50 per ton
Annual replacement costs	$200,000 per year
Discount rate including property taxes	16%
Cost less depreciation of plant and equip.	$4,500,000

9.2 Computation data:

Annual N.O.I.:	
(500,000 x $3.50) - $200,000 =	$1,550,000
Factor for Present Worth of 1 per	
Annum at 16% for 20 years:	5.929

9.3 Computation of value of total property:

$1,550,000 x 5.929 =	$9,189,950
Rounded to:	$9,200,000

9.4 Residual value of land and rock deposit:

$9,200,000 - $4,500,000 =	$4,700,000

10.0 The Case of a Partial Taking by Eminent Domain

10.1 This fairly common occurrence is not one often understood by appraisers of two-dimensional properties, who fall to recognize that a mineral deposit is a **unit property**, all of whose parts have equal value. That is, sellers or buyers of mineral properties never claim that "This ton is worth more than that ton, because it will be produced sooner."

10.2 An **incorrect** computation of a partial taking of 500,000 tons from the property appraised in above section 9.0:

10.2.1 Original residual value of land and minerals:	$1,950,000
10.2.2 Present worth of 9,500,000 tons to be produced in 19 years: [(500,000 x $3.50) - $200,000] x 5.877 =	$9,109,350
Rounded to	$9,109,000
10.2.3 Revised residual value of land and minerals: $9,109,000 - $4,500,000 =	$4,609,000
10.2.4 Value .of the taking: $4,700,000 - $4,609,000 =	$91,000

The taking of five percent of the reserves resulted in a value loss of only 0.99 percent. THIS CANNOT BE RIGHT. It is wrong because it unwittingly assumes, by virtue of the two present-worth factors, that the reserves taken will be the last to be mined.

10.3 The correct way to compute the value of the taking:

Value of land and minerals	$5,900,000
Value per ton:	
$4,700,000 divided by $10,000,000 =	$0.47/ton
Value of tons taken:	
$500,000 x $0.47	$235,000

10.4 Restated in condemnation terms:

Value before the taking	$4,700.000
Value after the taking	$4,465,000
Value of the taking	$235,000

11.0 The Use of Constant Versus Inflated Dollars

Some appraisers attempt to forecast future inflation, and thereby use annually inflated prices and operating costs. This action has its hazards. The first is that even expert economists have a dismal record in forecasting inflation. The second is that this action has the inevitable result of overstating present value. And the third is that no one knows the extent to which market-derived discount rates reflect investors' anticipation of inflated prices and costs.

As a result of these uncertainties, it is advisable to employ **constant dollars**

in appraisement, that is, dollars of constant purchasing power as of the date of appraisal.

12.0 "Businessman's Profits" Versus Income to Land

12.1 A serious problem may arise, particularly east of the Mississippi, in court cases involving rock properties. Courts often object to the income method of appraisal in eminent domain cases, claiming that the law does not recognize the loss of "businessman's profits." This problem occurs in the Eastern United States because of unfamiliarity with mining, which dominated early settlement and economic development in the West.

This stand by the courts is fallacious, and a determined effort by the appraiser may overcome the objection. Here is where the fallacy lies:

12.2 The concept of "businessman's profits" arose where mercantile properties were condemned, and their owners claimed compensation for a loss of sales of goods because of interruption stemming from condemnation. Courts claimed, with reason, that sales of goods had no direct bearing on the value of the land or building where the goods were sold.

12.3 In contrast, it is the sale of construction rocks, ton by ton or cubic yard that produces the value of a rock property. Sales of the land itself are therefore the very essence of a property's value. Consider the case of land that is sold, piece by piece, for say $5.00 per ton. This is only one-quarter of a cent per pound. Not much here in the way of entrepreneurial profits.

But the sale of ready-mixed concrete provides an example of "businessman's profits." Six sacks of sand and gravel worth $30 mixed with $10 worth of portland cement may be sold for about $75. The $35 mark-up represents businessman's profits. No such mark-up exists in the price of construction rocks.

12.4 Level (1970) discussed the valuation of "special purpose" properties, which are defined in part as those for which there are little market data. If a court accepts that construction-rock properties are special-purpose, which they are by any measure, the court may admit evidence based on capitalized income.

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