



INNOVATIVE SCIENTIFIC VALUATION OF MINERAL RESERVE

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ABSTRACT

One of the largest companies in India, producers of minerals and manufacturer of cement was finding it difficult to continue to operate two limestone mines for economic and environmental reasons. The company wanted a proper evaluation of the mining reserve and engaged ITCOT (Industrial and Technical Consultancy Organization of Tamilnadu). ITCOT considered Various Mine Valuation methods

like The International Valuation Standards (IVS), The ISVC IVSC technique, SAMVAL Code of South Africa for the Valuation of Mineral Assets, American Institute of Mineral Appraisers, MINASCO, Australia, Canadian Guidelines for Valuation of Mineral Properties (CIMVAL), Market Price Method, Net Price Method, User Cost Method, Net present value (NPV), Appropriation Method. RBSA report was not adequate and BCL wanted a correct evaluation of the mining property and so the author as Director, Project & Environment Consultants, was engaged by ITCOT for proper computation of two limestone mine reserves by ITCOT Consultancy & Services Limited a Joint Venture of (ICICI, SIDBI, IFCI, SIPCOT, TIIC, SIDCO & Banks).

KEYWORDS: Mineral Assets; Valuation; Mining Reserve; Market Price; Appraiser.

1. INTRODUCTION

Mining Reserve is of 3 types: - 1) Proved, 2) Indicated, and 3) Inferred and some reserve could come under Proved category on further exploration (Lin CG, Wang YS, 2012). Moreover, there could be extraction losses of up to 20% in the Proved category have been accounted (Ellis TR, DM Abbott Jr, Sandri HJ 1999). Valuation of BCL AMLI &

THANDIBERI Limestone Mines of Binani Cement Ltd. Valuation of Limestone Reserves has been done on the basis of data sent through several emails up to 1-2-16. Reserve estimates were done on a section-wise basis and UNFC charts of 2014. Further updating was done in 2015, on which valuation has been made for both mines. Only proved reserves have been taken into account by ITCOT and not Indicated mineral resources, the resources which cannot be mined on account of statutory barriers (7.5 m along lease boundary) and mineral likely to be blocked in closing benches at ultimate pit limit. RBSA Mineable reserves have been calculated by taking into account the reserves in all Measured and Indicated categories. The Appraised Value Method and so on. RBSA (Returns Based Style Analysis) was done by ITCOT. RBSA Valuation report was based on the “Going Concern Concept” –continue to operate and run its business on a standalone basis. RBSA investigation included a review and analysis of the available information as provided by BCL’s Management, including the historical operating performance (Production and Costs) of the Mines, recent Mining Schemes, Progressive Mining Closure Plans, and other documents/ information. Legally, confirmation of reserve valuation was referred to the author, as Director, Project & Environment Consultants, and the report was submitted.

2. Feasibility Assessment

Geological: Details of exploration carried out, core recovery, and sample analysis have been carried out. Boreholes were drilled at a spacing of 100 x 100 m. Details of boreholes are given in Table 1.

Mining: Mining is being carried out by deep hole drilling and blasting with the use of excavators & dumpers for loading and transportation. Reserves were proved up to 390 MRL up to the conceptual limit for mining.

Beneficiation: A 1350 TPH capacity crusher is operational for three shifts along with a screening system which has been installed to optionally screen out – 10 mm sized material for upgradation of the overall quality of limestone.

Environmental Concern: Company has obtained the Environmental clearance and consent to operate and all the conditions are being complied with. Returns are submitted timely. Proposals for Progressive Mine Closure Plan are being followed.

Economic Aspects: This is the captive mine of the company for the cement plant. A feasibility report has been prepared for the project. The mine is in operation since 1997.

Legal / Administrative aspects: All the relevant mining laws i.e. Mines Act 1952, MMR 1961, MCDR 1988, MCR 1960, Conditions imposed in Environment Clearance, Consent to operate, and other applicable laws are being followed and required returns are submitted.

3. Earlier Evaluation

Binani Cement Limited was engaged in manufacturing and selling high-grade/ quality Cement to domestic as well as International markets. The company has two captive limestone mines i.e. Amli Limestone Mine and Thandi Beri Limestone Mine for the supply of basic raw materials. The mines are fully mechanized and were working with a system of deep hole drilling and blasting and deployment of heavy earth moving machinery. BCL is engaged in manufacturing and selling high-grade/ quality Cement to domestic as well as International markets. The company has two captive limestone mines i.e. Amli Limestone Mine and Thandi Beri Limestone Mine for the supply of basic raw materials. The mines are fully mechanized and worked with a system of deep hole drilling and blasting and deployment of heavy earth moving machinery.

The Company is desirous to obtain the Valuation of its two mines situated at Amli (area of 4.68 sq. km) and Thandi Beri (area of 2.56 sq. km) for Banking and Management Review purposes as on March 31, 2013.

RBSA Valuation Advisors LLP ('RBSA') has been approached by Binani Cement Limited to act as an independent valuation consultant and to carry out the Valuation of aforesaid mines/mineral reserves of the Company situated at Thandi Beri; Sirohi; Rajasthan for Banking and Management Review purposes. RBSA investigation included a review and analysis of the available information as provided by BCL's Management, including the historical operating performance (Production and Costs) of the Mines, recent Mining Schemes, Progressive Mining Closure Plans, and other document/ information to conduct the valuation exercise. RBSA also interacted and discussed with BCL's Management team and technical personnel related to Mines to understand the nature of operations, and conducted a review of the economic status and prospects of the mining operations/ business.

Based on the review and analysis of the historical costs and production, extracts of approved mining plans, and other data and documents provided by the Company's management as well as current market analysis, RBSA has estimated the Fair Value of Mineral Reserves of Thandi Beri Limestone Mines which is as follows: Valuation Summary as of 31st March 2013 INR in Millions; Approach Method Mineral Reserve Value; Income Approach Multi-Period Excess Earning Method 529.50; Value of the Mineral Reserve (rounded) 529.50

4. Basis of Valuation by RBSA

This Valuation report is based on the "Going Concern Concept" – which assumes that the enterprise/asset shall continue to operate and run its business on a standalone basis. This in our opinion gives the best estimate of the value of the business/asset. The Fair Value definition adopted and reported is as follows.

"The Fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date."

In the course of our valuation, they have relied upon the documents related to Mines, secondary research, and other relevant documents provided to us by the BCL's Management. RBSA has been provided with only the extracts of the approved Mining Scheme and Progressive Mine Closure Plan of Amlu Mine by the management due to confidentiality issues. Documents related to the Mines and other pertinent information provided by the BCL's Management have been accepted without further verification as correctly reflecting the results of operations and the financial and business conditions of BCL. RBSA Amlu Mining operations commenced in January 1997. The details of Amlu Mines - Land put to use as per the extracts of the approved Mining Plan provided to RBSA.

Whilst we consider our conclusions to be both reasonable and defensible based on the information available to us, others may place a different value on the intangible assets based on the same information. This Valuation does not consider the expected/ potential future liability on account of mine closure, environmental issues, or Asset Retirement Obligations (ARO). Table 1 shows the valuation of Mines Reserves with the Indian Bureau of Mines Price.

Table 1.

Valuation of Mines Reserves (IBM Sale Price basis)				
Sale Price of Limestone (IBM price of Oct'15)	Rs / MT	530		
Cost of Limestone	Rs / MT	220		
Net margin on Limestone	Rs / MT	310		
Reserve of Limestone		Proved	Resource	Total
Amlı Mines	Million MT	223.09	84.09	307.18
Thandiberi Mines	Million MT	155.245	71.39	226.635
Valuation of Reserve				
Amlı Mines	Rs Crores	6916	2607	9523
Thandiberi Mines	Rs Crores	4813	2213	7026
Total Value of Reserve	Rs Crores	11728	4820	16548
Note :				
The above calculations are based on the reserves proved and resources available to the extent study has been done. Apart from the above reserve, the further may be increased after further exploration.				

Unless required by law, it shall not be provided to any third party without our prior written consent. In no event, regardless of whether consent has been provided, shall we assume any responsibility to any third party to whom the report is disclosed or otherwise made available (Slade ME 2001). While our work has involved an analysis of available information related to Mines, our engagement does not include an audit or a detailed financial review of BCL or its Mines. An Appraiser (Heffernan V 2004) reserves the right to alter our conclusions should any information that we are not aware of at the time of preparing this report comes to light that has a material impact on the conclusions herein. The Valuation of intangible assets is not a precise science and the conclusions arrived at in many cases (Shafiee S, Topal E, Nehring M 2009) will be subjective and dependent on the exercise of individual judgment.

RBSA used business strategies like Fair Value Methodology, Cost or Asset Approach, Market Approach, Income Approach, Discounted Cash Flow (DCF) Method, and Multi-Period Excess Earnings Model ("MPEEM") in 2012. ITCOT considered present performance of Binani Cement Ltd. Sale price ₹5000/ MT: Sale Price of Cement (Net of VAT & Discount) ₹4339/ MT; Normal EBIDTA -18 or ₹ 781/ MT; Depreciation ₹ 113/ MT; Profit before interest & Tax ₹ 668/MT @ (60% PPC) Limestone per MT Cement - 1.19 MT. Profit before interest & Tax per MT Limestone ₹ 560/ MT. Table 2 gives summary of mine Amlı Reserve Calculations. Methods adopted by RBSA are suited for business or industrial organizations, where there is no inherent underlying wealth like a very valuable mineral reserve. But, ITCOT mineral valuation is based on the latest geological data, supplied by

BCL and discounting other assets created by BCL like buildings, types of machinery, etc. Referring to the second schedule of Mines & Mineral (Development & Regulation) Act, 1957, as updated in 2009

TABLE 2

AMLI RESERVE CALCULATIONS

SUMMARY OF RESOURCES UNDER UNFC (Million Tonnes as of 01.07.2014)

Total resources =Reserves+ remaining resources			Limestone	Detailed breakup constraint wise
Reserves	Proved	(111)	158.35	
		(121)		
	Probable	(122)	68.74	
Resources	Feasibility Mineral resources	(211)	21.32	Ultimate pit limit
			1.84	Lease barrier/ safety barrier
				Non-diverted Forest land
				Permanent Infrastructure like Road, power line, habitation
				Low grade part
				Non beneficiable part
	Pre-Feasibility Mineral resources	(221)		Others (<i>to specify</i>)
				Ultimate pit limit
				Lease barrier/ safety barrier
				Non-diverted Forest land
				Permanent Infrastructure like Road, power line, habitation
				Low grade part
Remaining		(222)		Non beneficiable part
				Others (<i>to specify</i>)
			16.14	Ultimate pit limit
			2.36	Lease barrier/safety barrier
				Non-diverted Forest land
				Permanent Infrastructure like Road, power line, habitation
	Measured Mineral Resources	(331)		Low grade part
				Non beneficiable part
				Others (<i>to specify</i>)
	Indicated Mineral Resources	(332)	84.09	
	Inferred Mineral Resources	(333)		
				Specify /outline

	Reconnaissance Mineral Resources	(334)		
SUB	RESERVES (a)		227.09	
TOTAL	Remaining resources(b)		125.75	
ALL Total	Resources (a+b)		352.84	

ITCOT considered the Summary of Resources of Amlu Limestone mine under UNFC Reserve as computed on 01.04.2015. RBSA has relied on the Financial Statements/ Cost Data/ Profitability Statements etc. up to 2013 of Binani Cement Limited. RBSA used the Costplus Mark-up method with a notional indicative selling price of Limestone of INR 179.52 per MT in 2012 and 2013. ITCOT Considered the Sale Price of Limestone (IBM price of Oct'15) for Rajasthan as ₹530/ MT, and the Cost of Limestone production ₹220/ MT gives the Net margin on Limestone ₹310/ MT. RBSA considered a discount to a prospective buyer @ 20% on market/auction prices in 2013. But, ITCOT found there is a terrific increasing demand for cement and so limestone as well, as such no discount was needed. Table 3 gives section-wise tonnage calculations of the Thanderberi reserve.

TABLE 3.**Thanderberi Measured Resources: (UNFC Code 331)****Section wise tonnage calculation**

S. No.	Section No.	Cross section area(M ²)	Length of influence	Volume	Sp. Gravity	Tonnage
1	TN 14-14'	13,219	100	1,321,900.00	2.5	3304750.00
2	TN 13-13'	32,684	100	3,268,400.00	2.5	8171000.00
3	TN 12-12'	104,397	100	10,439,700.00	2.5	26099250.00
4	TN 11-11'	13,057	100	1,305,700.00	2.5	3264250.00
5	TN 10-10'	52,363	100	5,236,300.00	2.5	13090750.00
6	TN 9-9'	13,833	100	1,383,300.00	2.5	3458250.00
7	TN 8-8'	75,751	100	7,575,100.00	2.5	18937750.00
8	TN 7-7'	16,692	100	1,669,200.00	2.5	4173000.00
9	TN 6-6'	10,379	100	1,037,900.00	2.5	2594750.00
10	TN 5-5'	26,762	100	2,676,200.00	2.5	6690500.00
11	TN 4-4'	51,295	100	5,129,479.00	2.5	12823697.50
12	TN 3-3'	24,382	100	2,438,200.00	2.5	6095500.00
13	TN 2-2'	44,744	100	4,474,400.00	2.5	11186000.00
14	TN 1-1'	48,843	100	4,884,300.00	2.5	12210750.00
15	TN 0-0'	58,843	100	5,884,342.00	2.5	14710855.00
16	TS 1-1'	33,683	100	3,368,300.00	2.5	8420750.00

17	TS 2-2'	8,997	100	899,700.00	2.5	2249250.00
18	TS 3-3'	43,394	100	4,339,400.00	2.5	10848500.00
19	TS 4-4'	3,990	100	399,000.00	2.5	997500.00
20	TS 5-5'	33,763	100	3,376,300.00	2.5	8440750.00
21	TS 6-6'	8,973	100	897,300.00	2.5	2243250.00
22	TS 7-7'	41,732	100	4,173,152.00	2.5	10432880.00
23	TS 8-8'	14,413	100	1,441,300.00	2.5	3603250.00
24	TS 9-9'	2,551	100	255,100.00	2.5	637750.00
25	TS 10-10'	27,144	100	2,714,400.00	2.5	6786000.00
26	TS 11-11'	12,152	100	1,215,200.00	2.5	3038000.00
27	TS 12-12'	10,540	100	1,054,000.00	2.5	2635000.00
28	TS 13-13'	13,930	100	1,393,000.00	2.5	3482500.00
29	TS 14-14'	12,799	100	1,279,900.00	2.5	3199750.00
	TOTAL	855304.73			In million Tonnes	213.83

5. Modern Trends

This paper and review of mining valuation methodologies and valuation guidelines have been segregated into several research areas. An in-depth reading, data gathering, and interpretation found a number of areas of studies in relation to mining valuation and have been identified as follows.

- a) International practices of mining valuation which should discuss in the manual, codes and standards that have been applied worldwide in regards to mining valuation.
- b) Risk assessment in mining valuation which highlights the common valuation approaches applied in the mining industries; and
- c) Alternative approaches that have been suggested and implemented by various scholars and practitioners to determine the value of mining businesses.

International Mining Standards (Mine Valuation)- the various valuation methods (Ellis TR 2015) proposed for mine valuation across the main mining countries in the world.

Australia (The Valmin Code, 2005); Canada (CIMVal, 2004); South Africa (SamVal, 2008); USA (USPAP)

Income Approach- 1. Discounted Cash Flow (DCF); 2. Option Pricing; 3. Monte Carlo Analysis; 4. Probabilistic Method

Cost Approach- 1. Appraised Value Method; 2. Multiple Exploration Expenditure; 3. Geo-science Factor Method (Cawood FT 2004)

Market Approach- Comparable Transactions-1. Option Agreement Terms; 2. Gross ‘in-situ’ value; 3. Net Metal Value or Value Per Unit of Metal; 4. Value Per Unit Area5. Market Capitalisation

Both the level and the variability of prices are exogenous to the firm. Costs and reserves, however, can vary for endogenous reasons. In addition, Real Option Theory of Mining Investment (Slade, 2000) there is an exogenous systematic component to cost and reserve fluctuations due to, for example, changes in factor prices. International Valuation Standards Committee (IVSC) was created (Ellis, 2004) for developing standards for the mining and petroleum industries. Valuation should be done by a Qualified Valuer and the owner of the property should furnish the right information. Uniform Standards of Professional Appraisal Practice (USPAP) requires the appraiser to reconcile the results of the approaches used, discussing the quality and quantity of data available, and the applicability or suitability of the approaches. A risk-adjusted discount rate (Pitkin, 2009), uses the capital asset pricing model (CAPM) and the weighted average cost of capital (WACC) to estimate the impacts of equity. In 2006, China issued new International Financing Reporting System (IFRS) based accounting standards for business enterprises. As an independent valuer needed (Jain, 2018) the author summarises Reserves as given below.

Table 4 shows Resource estimation considering losses.

TABLE 4

Resource estimation after considering losses: (in million Tonnes as on 01.07.2014)

UNFC Code	Insitu Tonnage (A)	Tonnage of Reject bands (B)	ROM tonnage (A-B=C)	Tonnage after considering Core Recovery	Tonnage after considering Mining Losses at 10%	Tonnage considering after loss of 10% screen reject	Tonnage Available
331	288.05	21.88	266.17	224.09	201.68	181.51	181.51
332	135.25	7.31	127.94	107.71	96.94	87.24	87.24
333	133.60	10.29	123.31	103.82	93.44	84.09	84.09
Total	556.90	39.48	517.42	435.62	392.06	352.84	352.84

6. CONCLUSIONS

Modern Asset Pricing (MAP) Real option is included as a form of MAP valuation whereby the policies and strategies of managing the asset are best and have been adopted by ITCOT. But, RBSA has done the valuation on Income Approach Multi-Period Excess Earning Method. Only proved reserves have been taken into account by ITCOT and not Indicated

mineral resources, the resources which cannot be mined on account of statutory barriers (7.5 m along lease boundary) and minerals likely to be blocked in closing benches at ultimate pit limit. RBSA Mineable reserves have been calculated by taking into account the reserves in all Measured and Indicated categories.

The author also finalized the valuation using the modern methods of mining properties of Tandiberi and Amla mines as given below.

Price to Net Asset Value (P/NAV) - The formula is as follows:

$$P/NAV = \text{Market Capitalization} / [\text{NPV of all Mining Assets} - \text{Net Debt}]$$

Price to Cash Flow (P/CF) - The formula is as follows:

$$P/CF = \text{Price per Share} / \text{Cash From Operations per Share}$$

Total Acquisition Cost (TAC) - The formula is as follows:

$$TAC = [\text{Cost to Acquire} + \text{Cost to Build} + \text{Cost to Operate}]$$

Royalty for Limestone is 63/MT & Mineral Cess for Limestone was 63/MT. ITCOT assumed that Royalty and Cess are included in the cost of limestone production. RBSI has taken Weighted Selling Price for Limestone (rounded), and ITCOT has taken the actual price declared by Rajasthan Govt. Sale Price of Limestone (IBM price of Oct'15) for Rajasthan as ₹530/ MT, and it is notified every month. RBSA has used a model normally applied to value intangible assets, the Multi-Period Excess Earnings Model ("MPEEM"), whereas ITCOT applied Modern Asset Pricing (MAP) Real option for mine reserve evaluation.

As per The Minerals (Evidence of Mineral Contents) Rules, 2015, of India, Detailed Exploration involves the detailed three-dimensional delineation of a known mineral deposit achieved through sampling, such as from outcrops, pits, trenches, boreholes, shafts, and tunnels, etc. Sampling locations are closely spaced such that size, shape, structure, quantity, grade, and other relevant characteristics of the deposit are established with a high degree of accuracy. So, the final valuation by the author has been done according to the latest Indian laws.

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