Measurement and Evaluation under the FIDIC Standard Form Contracts

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05 December 2022

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INTRODUCTION

Disputes often arise on matters relating to the fixing or revision of rates and when it is appropriate to adopt revised rates for varied quantities. Generally, rebuttals for requests for varied rates tend to focus on the preposition that whilst quantities may have varied, there were no major changes in the deployment of workmen, equipment, or materials.

4 Key Principles

1st PRINCIPLE

- To establish the Method, refer to the appropriate Contract Clauses
  - **SC 12.2** [*Method of Measurement*]
    - Local practice has no rule under the Contract
    - Performed in accordance with the BoQ and other applicable Schedules
    - Net actual quantity of each item of the Permanent Works is to be measured
  - **SC 13.3** [*Variation Procedure*]
    - Contractor's proposal for evaluating the Variation
    - Evaluation of variations issued under instruction by the Engineer
  - **SC 20.1** [Contractor's Claims]
    - If particular conditions do not substantiate the whole of the claim, payment is only made against that part of the claim that has been substantiated.

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2nd PRINCIPLE

- Measurement is all about the numbers and being able to quantify performance or the abilities.

Certificate Date:		03 August 2020	Statement Date:		06 July 2020			Period:	01-Jun-20	30-Jun-20			
BOQ Item	Payment Ref. Number	Description	Rate		Quantity				Value (Maloti)				
			Unit	Rate	Contract	Total To Date	Previous Total	This Period	Contract	Certified to Date	Certified Previously	This Certificate	Remaining to be certified
		Widening of cuttings							65,491.50	58,488.15	58,488.15	0.00	7,003.35
C 1040	8.009	Widening of completed cutting in soft	m3	48.96	100.00	10.000	10.000	0.000	4,896.00	489.60	489.60	0.00	4,406.40
C 1050	8.009	Widening of completed cutting in hard	m3	173.13	350.00	335.000	335.000	0.000	60,595.50	57,998.55	57,998.55	0.00	2,596.95
		Excavation by hand							54,260.00	5,426.00	5,426.00	0.00	48,834.00
C 1060	8.010	Excavation by hand	m3	217.04	250.00	25.000	25.000	0.000	54,260.00	5,426.00	5,426.00	0.00	48,834.00
		SOIL NAILING							**3,355,318.91**	**6,741,489.19**	**6,040,930.54**	**700,558.66**	**3,386,170.28**
		Drainage							549,359.24	0.00	0.00	0.00	549,359.24
C 1070	9.001	Geocomposite band drain	m	181.04	646.00	0.000	0.000	0.000	116,951.84	0.00	0.00	0.00	116,951.84
C 1080	9.002(a)	Drainage holes, 75mm nominal diameter PVC piping, at bottom end of Geocomposite drains	No	2,136.80	198.00	0.000	0.000	0.000	423,086.40	0.00	0.00	0.00	423,086.40
C 1090	9.002(b)	Pressure relief holes, 75mm nominal diameter PVC piping, at positions indicated by the Engineer	No	93.21	100.00	0.000	0.000	0.000	9,321.00	0.00	0.00	0.00	9,321.00
		Sprayed Concrete							327,219.80	4,526,337.04	4,130,232.41	396,104.63	4,199,117.24
C 1100	9.003	Class A, 25mm thick initial layer	m2	84.29	970.00	13417.730	12243.530	1174.200	81,761.30	1,130,980.46	1,032,007.14	98,973.32	-1,049,219.16
C 1110	9.003	Class A, 75mm thick second layer	m2	253.05	970.00	13417.730	12243.530	1174.200	245,458.50	3,395,356.58	3,098,225.27	297,131.31	-3,149,898.08
		Soil Nails							532,849.61	37,089.30	37,089.30	0.00	495,760.31
C 1120	9.004	Galvanised soil nail, fully grouted, untensioned, 20mm dia, 6.00m long, in soil, fully grouted	No	1,236.31	431.00	30.000	30.000	0.000	532,849.61	37,089.30	37,089.30	0.00	495,760.31
		Soil Nail length tendered (**6.50m long**)											
		Welded Mesh Reinforcement							639,250.87	1,546,250.81	1,453,794.30	92,456.51	906,999.94
C 1130	9.005	3.95 kg/m2 welded mesh reinforcement including mesh pins	m2	78.74	970.00	13417.730	12243.530	1174.200	76,377.80	1,056,512.06	964,055.55	92,456.51	-980,134.26
C 1140	9.006	Mesh retaining spider placed with soil nails and dowels	No	1,305.97	431.00	375.000	375.000	0.000	562,873.07	489,738.75	489,738.75	0.00	73,134.32

3rd PRINCIPLE

- Evaluation uses the data and information contained in the documents forming the Contract to Agree or Determine the Contract Price:
  - **SC 12.3** [*Evaluation*]
    - Appropriate rate or price for an item is the rate or price specified for such item in the Contract.
    - If no such item exists, then the rate or price for an item is the rate or price specified for similar work.
    - New rates apply under the following circumstances:
      - Measured quantity changes by more than 10% from the items or quantities expressed in the BoQ.
      - The change in quantity multiplied by the expressed rate for the item in the BoQ exceeds 0.01% of the Accepted Contract Amount.
      - The Cost per Unit quantity is changed by more than 1%
      - The item is not specified in the Contract as a “fixed rate item”.
      - The Work is instructed under Clause 13 [*Variations and Adjustments*]
      - No rate or price specified in the Contract for this item
      - Item of work is not of similar character, nor is executed under similar conditions, as any item in the Contract.

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4th PRINCIPLE

- Evaluation cannot take place without numerical measurement as it measures performance.
  - **SC 12.3** [*Evaluation*]
    - Measured quantity changes
    - Accepted Contract Amount Changes
    - Cost per Unit changes

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MEASURED QUANTITY CHANGES

Measured Quantity Changes

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ACCEPTED CONTRACT AMOUNT CHANGES

Case Study Data

- Accepted Contract Amount = **ZAR 517, 081, 848.97**
- Quantity in BoQ = 970m²
- Measured quantity = 13,417.93m²
- BoQ item rate = ZAR253.05/m²
- Change in Quantity: 13,417.93 – 970 = 12,447.93m²
- Accepted Contract Amount Changes Value: 12,447.93 x ZAR253.05 = ZAR3,149,948.69
- Accepted Contract Amount Changes (%): 3,149,948.69 x 100 ÷ 517,081,848.97 = 0.61%

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COST PER UNIT CHANGES

Cost Per Unit

- Cost per unit calculations are generally used in product-based businesses
- Referred to as the cost of goods sold or the cost of sales
- In the construction industry it refers to the cost of executing a BoQ item of Work.
- The lower the cost to execute a BoQ item of Work, the more profit a company can expect.
- Often ignored in advancing and defending construction claims where the remedy includes the payment of additional Cost.
- In its Standard Form, FIDIC defines Cost as excluding profit.
- Cost per unit calculations should be used, but is generally not used in disruption claims.
- Instead claims rely on Earned Value calculations or advanced on a global claims basis.
- Cost per Unit Calculation = (Total Fixed Costs + Total Variable Costs) ÷ Total Units of Work

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Cost Per Unit Elements

- Fixed Costs
  - They remain the same over time and is independent of the item of Work to be performed
  - May include a contribution to head office overheads, site offices, equipment rental etc.

- Variable Costs
  - They may change regularly and depend on the quantity of Work to be performed.
  - May include direct labour costs, direct material costs etc.

- Quantify the items of Work to be performed and link it to a duration
  - The Cost per Unit for 100 units of Work to be completed over a period of 10-days (working 12-hours per day) would be different from the Cost per Unit for 100 units of Work to be completed over a period of say 10-days (working 8-hours per day).

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Case Study Data

- Quantity in BoQ = 970m²
- BoQ item rate = ZAR253.05/m²
- Fixed Cost per Work Item = ZAR130.25/m²
- Variable Cost per Work Item = ZAR70.75/m²
- Working Hours Pre-Covid Lockdown = 12 hours per day
- Task As-Planned Duration = 10 days
- As-Planned Work Units per day = 97m² per day
- Working Hours Post-Covid Lockdown = 8 hours per day

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As-Built Data Attributable to Reduced Working Hours

- Hours lost per day: 4 hours
- Hours lost per as-planned duration: 4 hours/day x 10 days = 40 hours
- Additional working days: 40 hours lost ÷ 8 hours per working day = 6 days
- As-Built Duration: 10 days + 6 days = 16 days (attributable to the reduced working hours)
- Revised Work Units Per Day: 970 ÷ 16 = 60.625m²
- Fixed Cost Increase: ZAR130.25 + (130.25 ÷ 10 x 6) = ZAR208.40
- Variable Cost Increase: ZAR70.75 + (70.75 ÷ 10 x 6) = ZAR113.20

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As-Planned Cost Per Unit

- Accepted Contract Amount: ZAR253.05 x 970 = ZAR245,458.50
- Total Fixed Cost: ZAR130.25 x 970 = ZAR126,342.50
- Total Variable Cost: ZAR70.75 x 970 = ZAR68,627.50
- Cost Per Unit: (ZAR126,324.50 + ZAR68,627.50) ÷ 970 = ZAR201
- Profit Per Unit: ZAR253.05 – ZAR201 = ZAR52.05

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As-Built Cost Per Unit

- Accepted Contract Amount: ZAR253.05 x 970 = ZAR245,458.50
- Total Fixed Cost: ZAR208.40 x 970 = ZAR202,148.00
- Total Variable Cost: ZAR113.20 x 970 = ZAR109,804.00
- Cost Per Unit: (ZAR202,148.00 + ZAR109,804.00) ÷ 970 = ZAR321.60
- Additional cost attributable to reduced working hours: (ZAR321.60 – ZAR201) x 970 = ZAR116,982.00

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SIMILAR CHARACTER AND CONDITIONS

Understand the Meaning

- **Similar: h**aving a resemblance in appearance, character or quantity without being identical

- **Character: h**aving the qualities or features by which one type of specific work is distinguished from another

- **Conditions:** the physical situation the work is executed under and affected by:
  - Weather
  - Methods of Work

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OMISSIONS

Conditions to Discharge SC 3.5 Determination

- Omitted Work must sit partially or fully under a Variation and the value of such Varied work has not been agreed.

  - If the work had not be omitted, then such work would be covered by a sum forming part of the Accepted Contract Amount.
  - Such sum will not form part of the Contract Price
  - Contractor must have incurred or will incur Costs in respect thereof
  - Cost is not included in the evaluation of any substituted Work

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1999 vs 2017 Edition

Red Book Changes 1999 vs 2017 editions

12	MEASUREMENT AND EVALUATION	12	MEASUREMENT AND VALUATION	Reword
12.1	Works to be Measured	12.1	Works to be Measured	
12.2	Method of Measurement	12.2	Method of Measurement	
12.3	Evaluation	12.3	Valuation of the Works	Reword
12.4	Omissions	12.4	Omissions	

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SC 12.1 [*Works to be Measured*]

- 1999 Red Book requires the Engineer to give the Contractor reasonable notice when any part of the works is to be measured.

- 2017 Red Book is more specific. The Engineers notice to the Contractor shall be given within 7-days of the works to be measured. In addition such notice must express:

  - The part of the Works to be measured
  - The date on which the Works will be measured.
  - The place on Site at which the measurement will be made.

- 2017 Red Book requires the Engineer to give notice to the Contractor for the inspection of the records the Engineer has prepared.

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SC 12.2 [*Method of Measurement*]

- No substantive changes made between the 1999 and 2017 editions of the Red Book

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SC 12.3 [*Valuation of the Works*]

- Introduction of an alternative method of deriving the appropriate rate or price:
  - Reasonable cost of executing the Work
  - 5% for profit, if none stated in the Contract Data
- Introduction of a time limit in respect of Agreeing or Determining the Rate.
- Engineer is obliged to assess a provisional rate or price for the purposes of the IPC until such time that an appropriate rate or price is Agreed or Determined.

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SC 12.4 [*Ommissions*]

- No substantive changes made between the 1999 and 2017 editions of the Red Book

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