



Member of the Surbana Jurong Group

Independent EPC Cost Estimate for Gold Mining Project Investment in Indonesia - Approach and Methodology

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SMEC International – Surbana Jurong Group

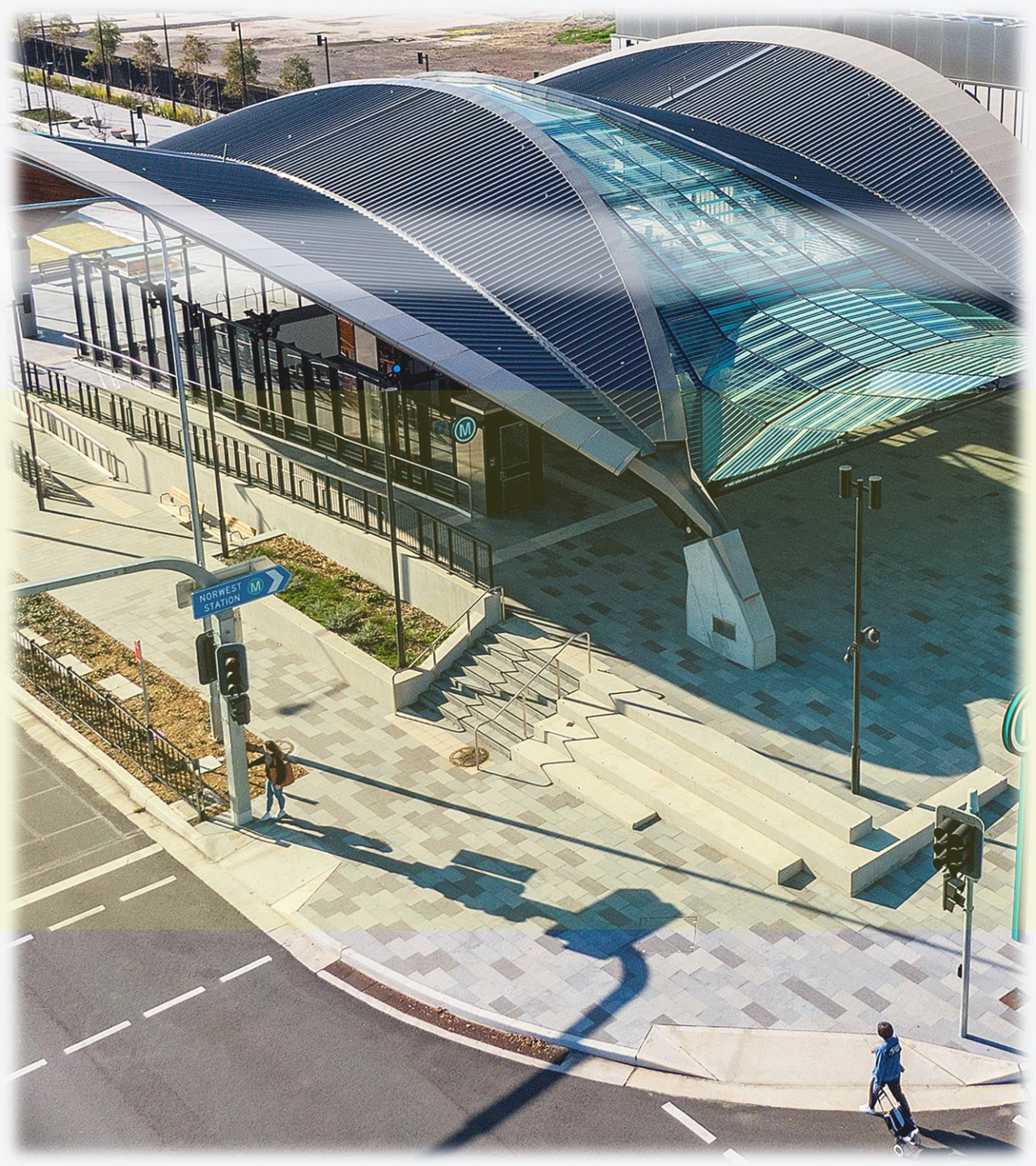
Presented to

ASEAN Quantity Surveying Association (AQSA)

16 May 2023

AGENDA

- **About Us**
- **Project Background**
- **Scope of Services**
- **Approach & Methodology**
- **Results**



ABOUT US



SMEC – Company Overview


Who we are

SMEC is a global engineering, management and development consultancy with a 70-year history of delivering advanced solutions on a global scale across infrastructure, urban development and management services industries.



Member of the Surbana Jurong Group

We are specialists in providing design leadership, consulting and advisory expertise across the roads and highways, rail and metro, aviation, **hydropower** and **renewable energy** sectors.



As a member of the Surbana Jurong Group, SMEC is part of a family of specialists.

Collaborating closely with our parent and sister companies, we have the flexibility to operate in global markets either individually or in partnership to add value.

120+

Offices

40+

Countries

16,000+

Employees

Where we operate



- **Australia, New Zealand & Pacific Islands**
- Australia
- New Zealand
- Fiji
- Papua New Guinea
- Solomon Islands
- **Africa**
- Ethiopia
- Kenya
- Tanzania
- South Africa
- Namibia
- **North America**
- Canada
- US (Seattle)
- North Asia
- China
- **South America**
- Chile
- **South & Central Asia**
- Afghanistan
- Bangladesh
- Georgia
- India
- Kazakhstan
- Nepal
- Pakistan
- Sri Lanka
- Tajikistan
- UAE
- **Southeast Asia**
- Singapore
- Brunei
- Indonesia
- Malaysia
- Philippines
- Myanmar
- Vietnam
- **UK**
- London

We're Specialists In Delivering Infrastructure Projects



< Snowy Mountain Hydroelectric Scheme
Australia

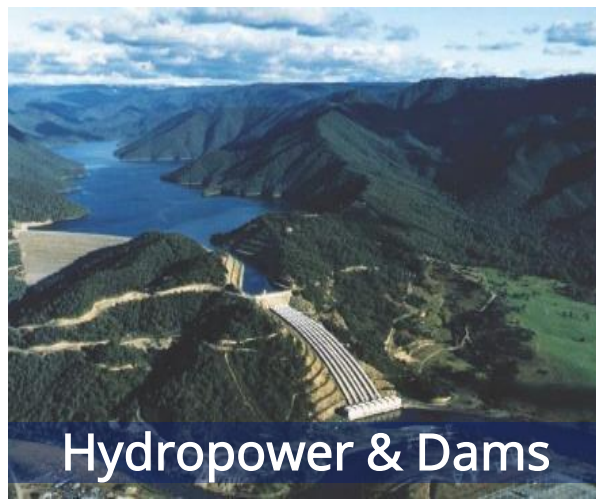
Known for the reliable delivery of complex projects, technical excellence and specialist engineering solutions, SMEC is a trusted partner on transport, energy & infrastructure projects around the world.

SMEC has extensive experience in Feasibility Study, Owner's Engineer and Detail Design roles for energy & infrastructure projects.

Our core market:

- Power & Energy
- Mining & Resources
- Water & Environment
- Roads and Highways
- Rail, Metro & TOD
- Social Development

INFRASTRUCTURE SERVICES



Hydropower & Dams



Water



Mine Infrastructure



Aviation



Waste Management



Energy



Environmental



Ports



Tunnels



Rail & metro



Roads, bridges & highways



Civil Infrastructure

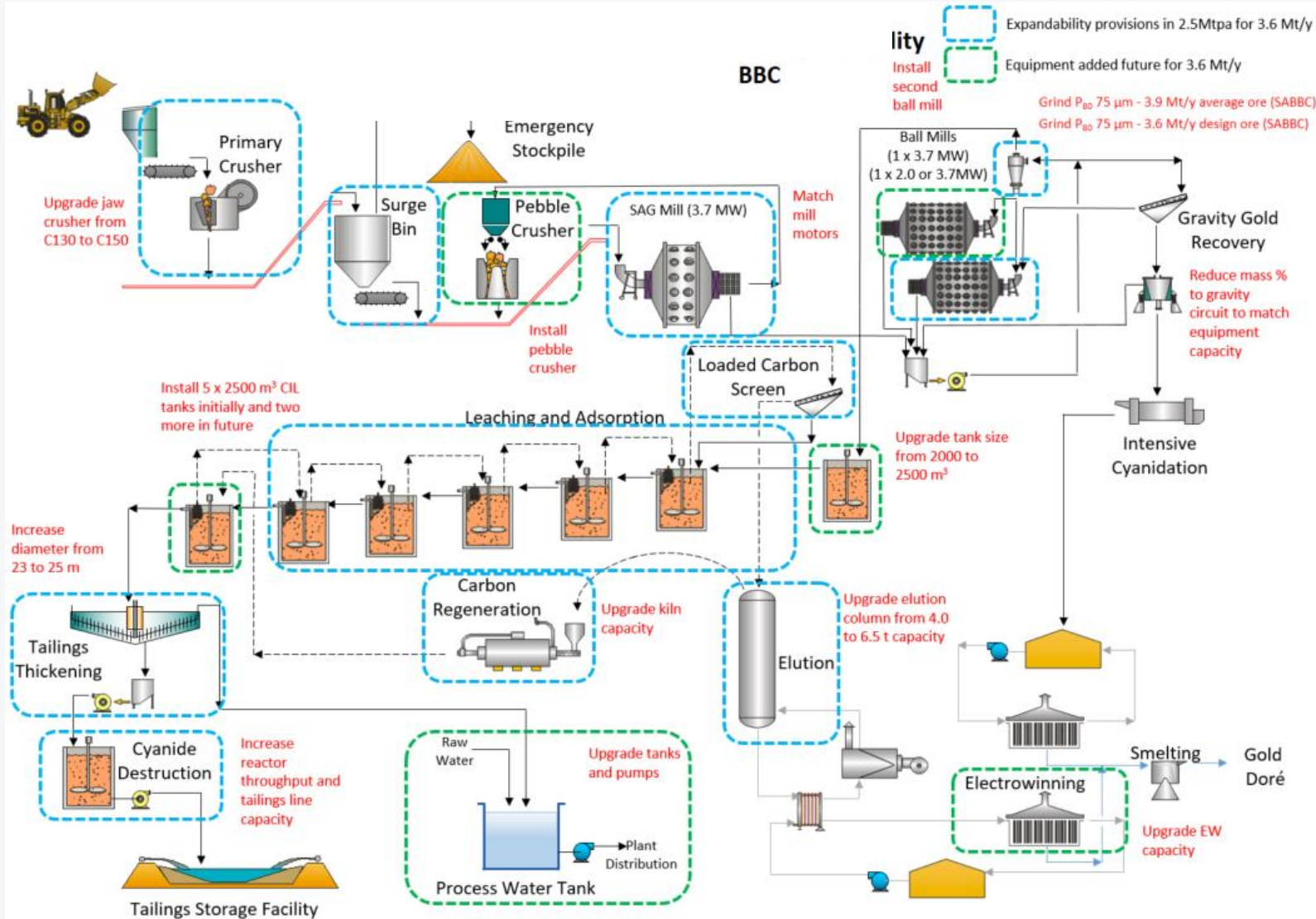


Oil & Gas, LNG

PROJECT BACKGROUND

Project Background

Redefining exceptional SMEC 2023



Overview

- SMEC were engaged by Client in February 2021 to undertake **the services**.
- **Independent Cost Estimating and Scheduling Services for a Gold Project Development**
- Project Location: South Sulawesi, Indonesia.
- The services were officially kicked-off on the 1st week of March 2021.

Fig. 1 - Simple Process Flow Diagram of Gold Process Plant

Project Location

South Sulawesi, Indonesia

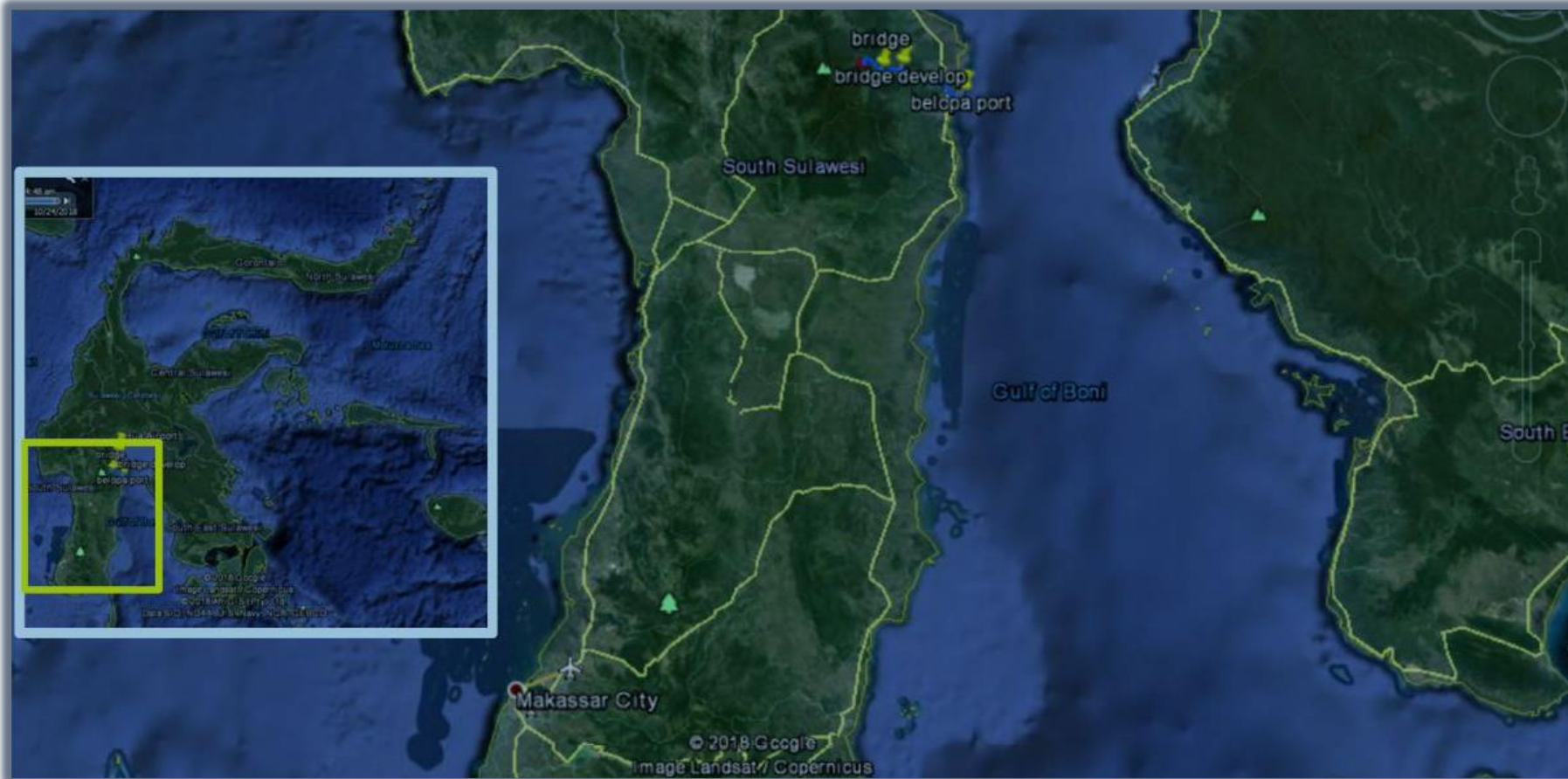


Fig 2 – Project Location

SCOPE OF SERVICES

Scope of Services

The EPC Scope of the total project to be estimated and scheduled:

- Site wide stormwater drainage;
- Earthworks;
 - LV Site Access Roads;
 - ROM, Process, Mine Facility Pad;
 - Non-Processing Infrastructure (NPI) Facility Pad;
 - Primary HV Road & ROM;
- Processing Plant;
- NPI (include Bulk Diesel Storage, raw water supply, CSR facility, balance of HV/MV electrical and communications);
- Tailing Storage Facilities Civils, Pipeline and Deposition;
- Permanent Mine Facilities;
- Construction Fuel;
- Temporary Facilities for EPC;
- Temporary Works Main Access Road and Site Access Roads.



The cost estimate has been requested to meet AACE Class 2 with a target accuracy of:
-5% to -15% on the low side and;
+5% to +20% on the high side.

APPROACH & METHODOLOGY

Site Visit

3-days site visit performed by SMEC team consist of the Project Director, Project Manager and Project Engineer.

Objective: To understand the project site and its accessibility.

The site visit agenda is as follows:

- Providing visualization of the site to the project team with regard to:
 - **topography & geotechnical condition;**
 - **social-communities** and the **environmental situation** surrounding the project area.
- Conducting **assessment of the nearest port and local assessment of the proposed logistics survey** via existing road and bridges which will be passed by project freight (including heavy equipment) to be utilised from port to the project site.



Project Activities

SMEC listed the **Work Breakdown Structure (WBS)** and modified version used for the estimate (i.e. up to Level 7).

The Level 1 summary provided is as below:

- WBS 100 – Open Pit Mining;
- WBS 200 - Not Used;
- WBS 300 – Processing Plant;
- WBS 400 – Tailings Storage Facility;
- WBS 500 – Infrastructure;
- WBS 600 – Site Support Facilities;
- WBS 700 – Temporary Facilities;
- WBS 800 – Owners Costs (Not used by SMEC);
- WBS 000 – Project Management & Overheads;
- WBS 900 – Escalation and Contingency;

SMEC then adopted the same WBS structure (**albeit further developed to level 7**) for consistency with estimation and schedule alignment.



Approach & Methodology

Estimate Overview

SMEC has undertaken the EPC cost estimate in accordance with the requirements of:

AACE (American Association of Cost Engineering) International Recommended Practice No. 18R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries, TCM Framework: 7.3 – Cost Estimating and Budgeting).

It will be Class 2 Estimate agreed with Client.



Approach & Methodology

Estimate Overview - AACE Estimate Classification

	Primary Characteristics	Secondary Characteristics			
ESTIMATE CLASSES	Level of Project Management Definition Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical Variation low and high ranges (a)	PREPARATION EFFORT Typical degree of effort relative to least cost index of 1(b)
Class 5	0% to 2%	Conceptual Screening	Capacity Factored, Parametric Models, Judgment or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study of Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: 20% to 50%	2 to 4
Class 3	10% to 40%	Budget Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to 20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Basis of Estimate

The basis of EPC Cost Estimate calculations is stated as follows:

- a. **The scope and EPC execution approach are based on Project Execution Plan and Scope Statement;**
- b. **Client supplied engineering quantities have been spot checked for accuracy, but in quantum relied upon as listed in MTO.** Engineered quantities are treated as containing no quantity growth allowances;
- c. **Client supplied pricing has been reviewed by SMEC but basically relied upon as listed in Other Relied Upon Information.**

This includes proposal for tagged engineered equipment, concrete batching plant, accommodation/catering and mobile crushing plant (establishment excluded - by others);



Basis of Estimate (Cont.)

- d. **Foreign exchange rates** are based on Client provided assumptions being:
 - US\$ 1.00 : IDR 14,500
 - US\$ 1.00 : AUD 1.42
 - US\$ 1.00 : EUR 0.85
 - US\$ 1.00 : SGD 1.36
- e. **Diesel fuel rate** of IDR 8,311.63 per litre delivered to the site (Client supplied);
- f. **Power based on Client supplied PLN Premium Gold published Tariff I-4** rate of IDR 996.74 per kWhr + IDR 105 per kWh for gold service level premium (i.e. power cost IDR 1,101.74 per kWhr);
- g. **Salary and wages rates for domestic personnel includes Income Tax (PPH);**
- h. **Construction site workforce is based on 20% local hire BIBO and 80% FIFO external to Sulawesi Island**



Basis of Estimate (Cont.)

- i. **Transport and logistics costs have been estimated by a local provider** with international freight experience from affiliate ANTRACK. This includes management and customs clearance/agent fees for international importation, but not customs duty on imported goods;
- j. **Structural steel, platework and pipework are assumed sourced from Surabaya area**, with remaining **electrical and any other bulk materials sourced from Jakarta area**;
- k. **ROM mining bulk earthworks rates** (i.e. drill blast, load, haul, dump), **mine overhaul rates** and **mobilisation/demobilisation fleet costs have been provided by a mining contractor company**;
- l. **TSF (Tailing Storage Facility) Estimate** – site waste rock mining haulage and rehandling (including mobile crushing) **are costed by the Mining Contractor and excluded. TSF estimate includes all necessary civil construction costs** to build the TSF (decant and starter embankment) with the mining delivered rock;



Basis of Estimate (Cont.)

- m. **Bulk earthworks rates are based upon 2 x 8 hours double shift** developed from internal database;
- n. **Civil rates are based upon current market prices**, and SMEC internal cost database similar to related construction works in the project location;
- o. **Structural rates are based upon current market prices**, typical price quotations and SMEC internal cost databases;
- p. **Mechanical rates are based upon current market prices**, typical price quotations and SMEC internal cost databases;
- q. **Pipework rates are based upon current market prices**, typical price quotations and SMEC internal cost databases;
- r. **Electrical rates are based upon current market prices**, typical price quotations and SMEC internal cost databases;



Basis of Estimate (Cont.)

- s. **Wage costs are based on mining sector salary wages in South Sulawesi and working hours regulation** from Indonesian government
- t. **The rates of tagged equipment's are based upon TBE and/or CBE** supplied by Client.
- u. **Temporary facilities rates are based upon estimated workforce manpower quantity, temporary lodge and office rental rates;**
- v. **Project management and Detail Engineering Design (DED) service is based on local rates**, including senior expatriate management. DED of processing plant is based on DRA Global proposal quotation price as nominated by Client;



Basis of Estimate (Cont.)

- w. **Construction and plant equipment mobilisation and rental rates are based on current market prices**, typical price quotations and SMEC internal cost databases;
- x. **EPC contractor overhead assumes direct cost percentage** mark-up of 0.3% insurance, 0.35% bonds and 6% for overhead. The EPC Contractor margin is costed at a 12% mark-up applied to the whole estimate (excluding escalation and contingency);
- y. **Contingency is selected based on probabilistic methods** from Base Estimate to the P50 cost;
- z. **The estimate base date is Q2 2021** on basis of costs adopted;
- aa. **All costs are expressed in US\$** as nominated base project currency;



Project Schedule

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SMEC 2023

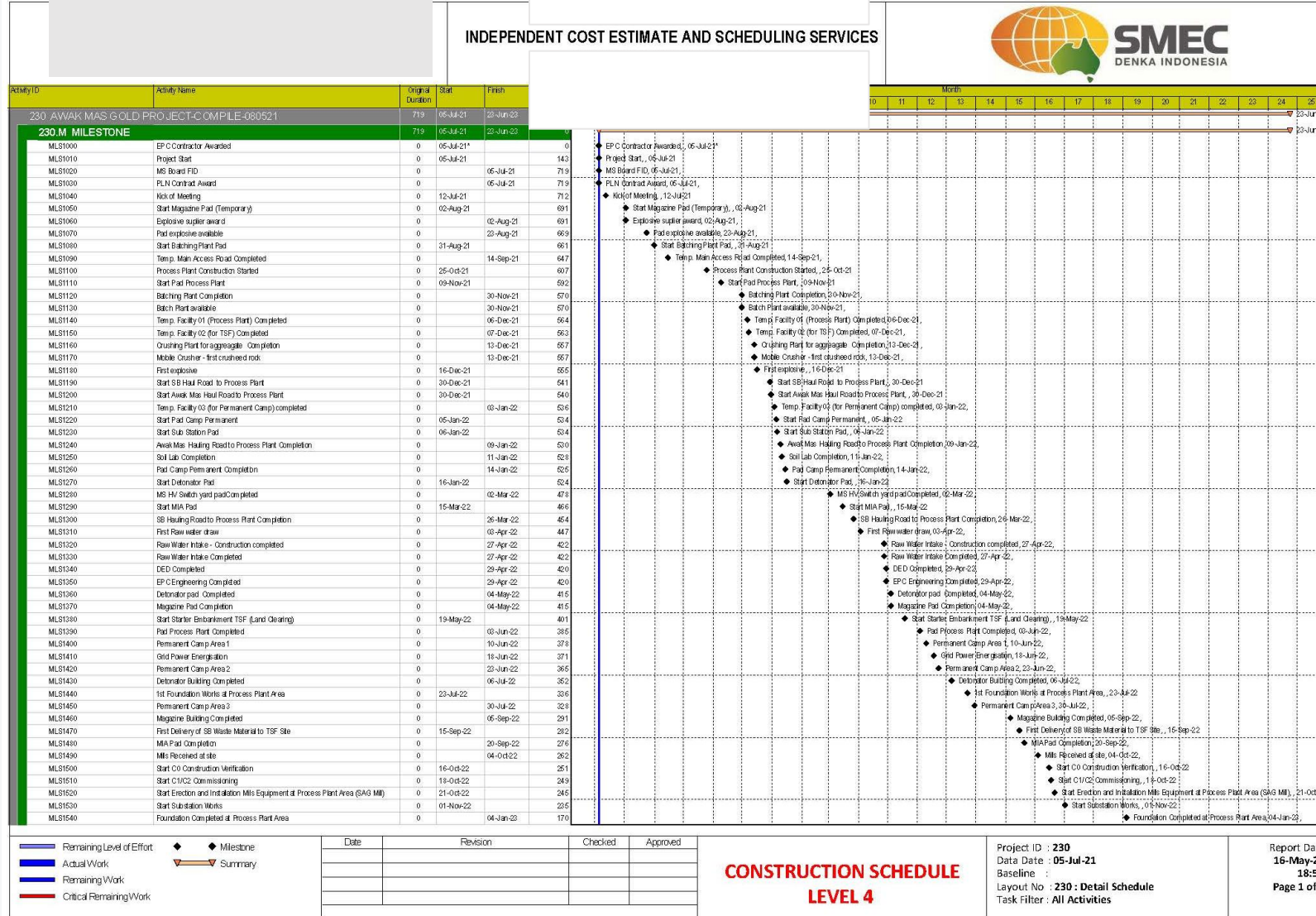


Fig 3 – EPC Project Schedule

Project Schedule

Redefining exceptional
SMEC 2023

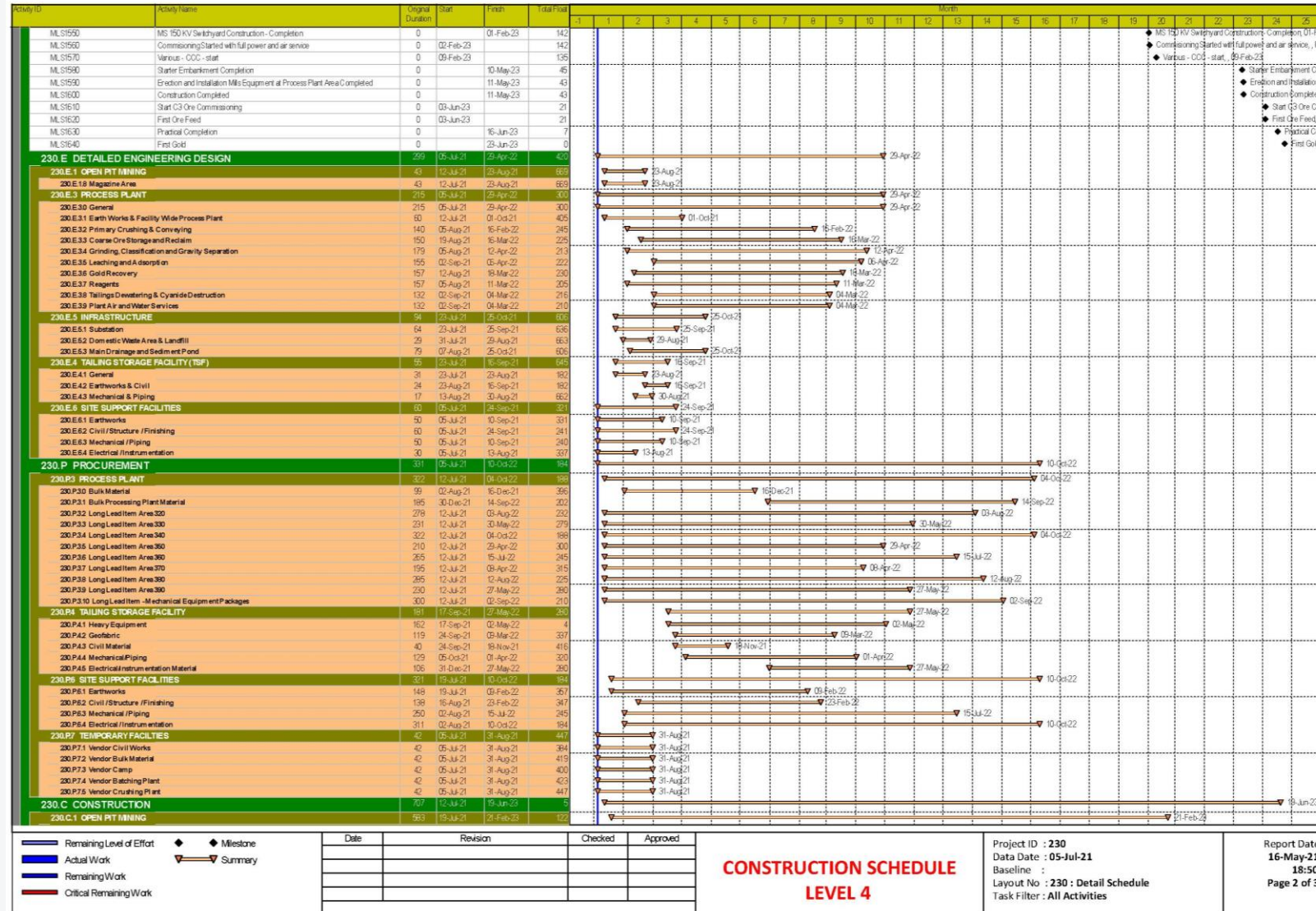


Fig 3 – EPC Project Schedule

Project Schedule

Redefining exceptional
SMEC 2023

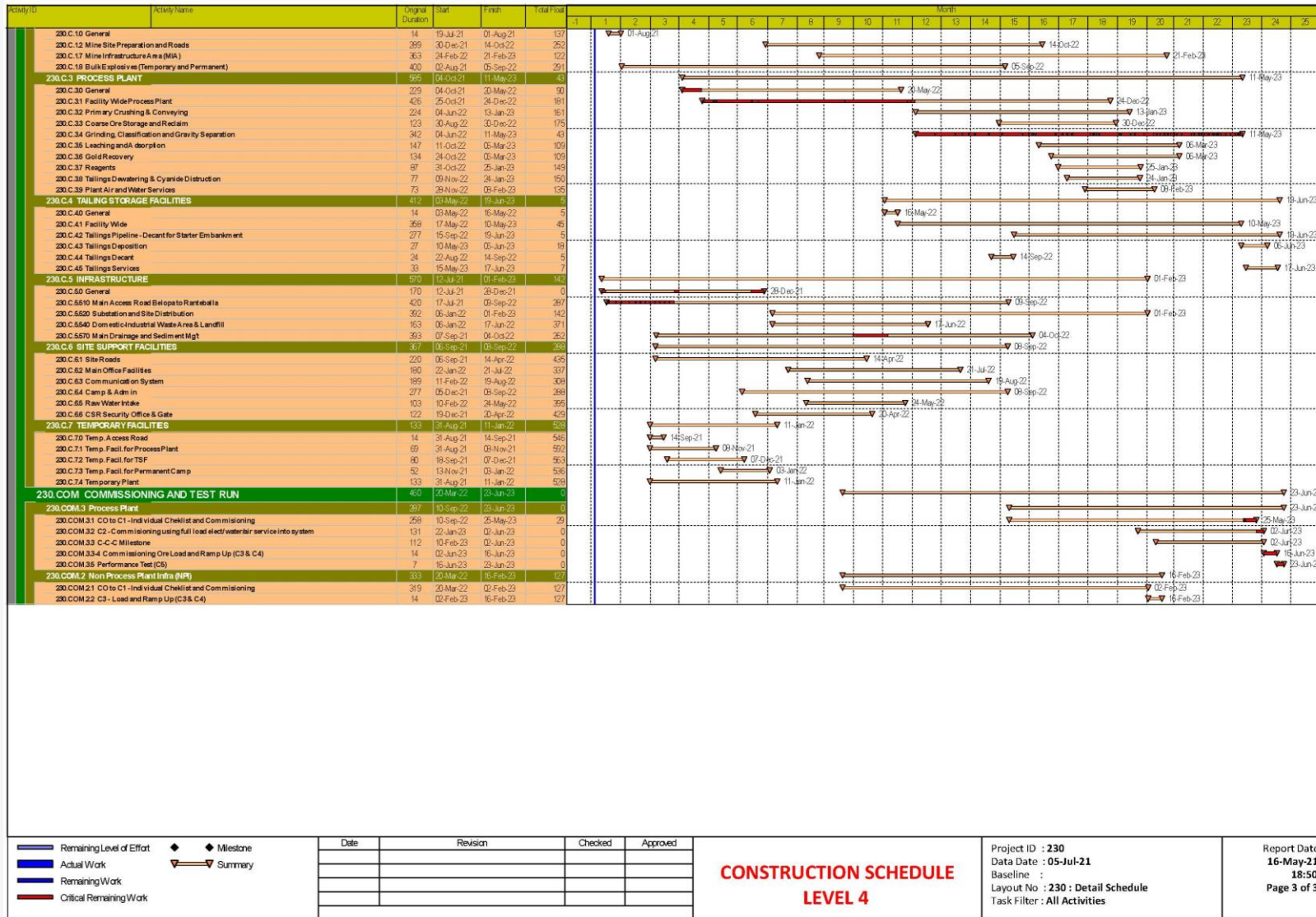


Fig 3 – EPC Project Schedule

Estimate Exclusion

The following exclusions are not included in the EPC cost estimate:

- a. **Owners costs** such land acquisition, project approvals, project financing costs and owners insurances.
- b. **Owners Management cost;**
- c. **Mining pre-production costs** associated with the open pit mining;
- d. **Mining technical services** such as grade control, mine survey, mine management and mine geotechnical;
- e. **Temporary mining facilities costs;**
- f. **Mining capital development costs** including bulk TSF mine rock supply for the TSF;
- g. **Operational Costs including start-up operations and maintenance**



Approach & Methodology

Estimate Exclusion (Cont.)

- h. **Spare parts;**
- i. **Taxes of WHT and VAT;**
- j. **Taxes of GST for overseas supply** from Australia;
- k. **Importation customs duty;** Any imported equipment and materials assumed to be on Client's project importation Master-list;
- l. **Royalties;**
- m. **Any performance bonus scheme;**
- n. **Working capital;**
- o. **Sustaining capital;**
- p. **Pandemic impacts or changes to political policy** interrupting project implementation.



RESULTS

Cost Estimate Recapitulation

WBS	Description	Total (US \$)	% From Total EPC Cost
A	DIRECT COST		
100	OPEN PIT MINING	14,075,909	9.09%
300	PROCESS PLANT	42,542,390	27.48%
400	TAILINGS STORAGE FACILITIES (TSF)	7,648,726	4.94%
500	INFRASTRUCTURE	7,374,963	4.76%
600	SITE SUPPORT FACILITIES	19,491,129	12.59%
Total Direct Cost		91,133,117	58.86%
B	INDIRECT COST		
700	TEMPORARY FACILITIES	3,590,539	2.32%
000	EPC PROJECT MANAGEMENT / SUB-CONSULTANTS	38,449,368	24.83%
Wide	EPC MARGIN	21,307,684	10.32%
900	ESCALATION & CONTINGENCY	5,674,492	3.67%
Total Indirect Cost		63,695,162	41.14%
TOTAL EPC COST (DIRECT & INDIRECT COST)		154,828,279	100.00%

The most of the cost is in WBS Area 300 - Process Plant: US \$ 42,542,390 (27.48% of the total EPC cost).

The local to overseas content of the overall estimate is reported as:

- Local Indonesian cost content US\$ 125,549,022;
- Imported overseas cost content US\$ 29,279,257

Cost Estimate Contingency and Risk Analysis

- **Cost Risk Analysis (CRA)** has been performed by SMEC (Adelaide) experts **using probabilistic assessment techniques** on the base estimate provided by SMEC team in Jakarta.
- **The CRA** was undertaken using **Palisade @Risk 8.1 software**.
- Generally, SMEC adopted the general processes and methodologies given in the following documents.
 - Guidance Note 3A Probabilistic Contingency Estimate, Australian Government Department of Infrastructure Regional Development and Cities, November 2018; and
 - Contingency Guideline 2nd Edition, Risk Engineering Society, February 2019.

Cost Estimate Contingency and Risk Analysis

There are a number of techniques for modelling of risks and methods used:

Line item ranging

- **Uncertainty in quantity is ranged using a three-point estimate** (low – most likely – high);
- Uncertainty in rate is ranged using a three-point estimate that generally only describes the uncertainty in plant/labour productivities or anticipated subcontract uncertainty.

Risk Drivers

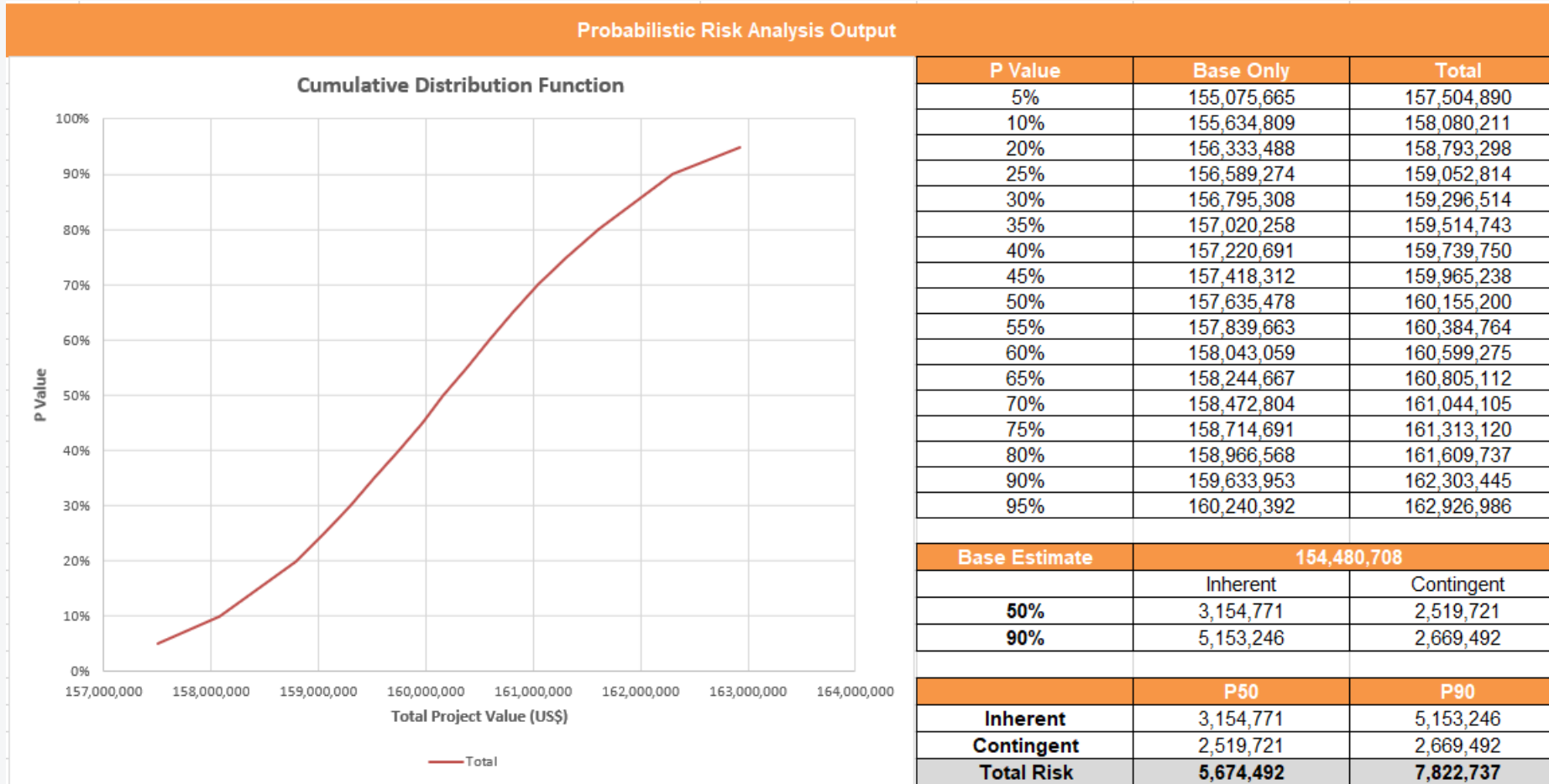
- **Identification of risk drivers that effect many cost elements** with a many-to-many relationship between risks and costs. These risk drivers are designed to address areas other than productivities in the rate uncertainty;

Correlation of like effects

- Correlation is a statistic used to describe the degree to which two variables are related. **Given the large number of estimate items** whose uncertainty is related **the use of correlation is important in the analysis of this project.**

Cost Estimate Contingency and Risk Analysis

Probabilistic Analysis Output



Further explanation

- Inherent is base only
- Total is sum of Inherent & Contingent

Fig 4 - Probabilistic Analysis Output

Cost Estimate Contingency and Risk Analysis

The following areas were not incorporated into the risk model

- **Consideration of a generalised scope growth** (including functionality or standard change).
- **Allowance for escalation.**
- **Consideration of other client risks not specific to the EPC Contractor scope of work** such as those risks on the Client's Corporate Risk Registers

Probabilistic modelling undertaken in @Risk presents a subdivision within the cost model described as:

- **Inherent Risk** - reflecting the contingency (risk) in the quantities and rates of the estimate as presented.
- **Contingent Risk** – reflecting the contingency (risk) in other general risk drivers (including the SRA impacts).

The results of the @Risk analysis are stated below:

- To achieve a P50 (50% equal chance of overrunning and underrunning the estimate within its accuracy range) the delta amount of US\$ 5.674M. This is industry practice and SMEC has reported this amount as Contingency to the Base Estimate.

Conclusions

- a. Subject to the limitations and assumptions listed in the Basis of Estimate and Basis of Schedule, **SMEC states that the requirements laid out in AACE International Practice No. 18R-97, Cost Estimation Classification System for a Class 2 estimate are met.**
- b. **The EPC cost estimate is US\$ 154,828,279** with consist of total direct cost is US\$ 91,133,117 and indirect cost is US\$ 63,695,162;
- c. **Cost Risk Analysis performed based on the information of cost variables** (price/rate, quantity, productivity/schedule) and **found P50 risk and contingency is US\$ 5,674,492 (3.67% of total base estimate EPC cost)** while **P90 is US\$ 7,822,737 (5.06% of total base estimate of EPC cost)**. SMEC adopted P50 US\$ 5,674,492.

Thank You

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Through specialist expertise,
we're challenging boundaries
to deliver advance infrastructure solutions.

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