

Formato para Estimaciones Clase 1 y 2:

Retos y mejoras para la industria peruana de la construcción

Ing. Civil Brenda Laura Casas
Tuanama, CCP

AACE International

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El hombre que ha cometido un error y no lo corrige,
comete otro error mayor.

Confucio



Puntos a tratar

1. Estimaciones Clase 1 y 2
2. Tipos de contratos de obra
3. Escenario para ilustrar el problema
4. Formato de estimación vs. Formato de propuesta
5. Sugerencia de formato estimación Clase 1 y 2
6. Cálculo de la tarifa all-in
7. Desglose de tarifa all-in en costos unitarios
8. Estimación en formato sugerido
9. Conclusiones

1. Estimación Clase 1 y 2



ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic			
	MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical +/- range relative to index of 1 (i.e. Class 1 estimate) [a]	PREPARATION EFFORT Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Screening or feasibility	Stochastic (factors and/or models) or judgment	4 to 20	1
Class 4	1% to 15%	Concept study or feasibility	Primarily stochastic	3 to 12	2 to 4
Class 3	10% to 40%	Budget authorization or control	Mixed but primarily stochastic	2 to 6	3 to 10
Class 2	30% to 75%	Control or bid/tender	Primarily deterministic	1 to 3	5 to 20
Class 1	65% to 100%	Check estimate or bid/tender	Deterministic	1	10 to 100

Notes: [a] If the range index value of "1" represents +10/-5%, then an index value of 10 represents +100/-50%.

[b] If the cost index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%.

Table 1 – Generic Cost Estimate Classification Matrix

2. Tipos de contratos de obra



- Suma alzada

- Precios unitarios

- Costos reemborsables

T&M

Tarifa all-in

3. Escenario para ilustrar el problema



- El capex será de obras de concreto para un Edificio administrativo.
- La estimación será Clase 2 o 1. Las cantidades no varían.
- El edificio se ubicará en la Sierra de Lima a 4000 msnm.
- El concreto y acero como material serán suministrados por el cliente.
- El encofrado será subcontrato del contratista principal.
- El cliente esta deseoso de saber cuánto será su inversión. Aún no tiene fecha de ejecución.

4. Formato de Estimación vs. formato contratista



Capex para Obras civiles Edificio administrativo

Item Description	Quantity	Unit	Man hours		Labor		Materials		Equipment		Subcontract		(E)= (A)+(B)+(C)+(D)
			Unit Man hours	Total Man hours	Labor rate (\$/MH)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)	TOTAL (\$)
DIRECT COST													
Concrete													
Concrete f'c=28 Mpa	2800	m3	3.00	8400	20.7	173,618	115.00	322,000	---	---	---	---	495,618
Formwork	20000	m2	3.30	66000	---	---	---	---	---	---	25.60	511,920	511,920
Rebar f'y=420 Mpa	346	Ton	60.00	20760	19.7	408,464	850.00	294,100	---	---	---	---	702,564
TOTAL DIRECT COST				95,160		582,083		616,100		0.00		511,920	1,710,103
INDIRECT COST													
Owner's cost													200,000
TOTAL INDIRECT COST													200,000
CONTINGENCY													191,010
TOTAL PROJECT COSTS = DIRECT COST + INDIRECT COST + CON													2,101,113



COSTO DE HORA HOMBRE EN OBRAS DE EDIFICACIÓN
(VIGENTE AL 01 DE ENERO DEL 2017)

ITEM	CONCEPTO	CATEGORÍA		
		OPERARIO	OFICIAL	PEON
1.00	REMUNERACIÓN BÁSICA VIGENTE (RB) (vigente del 01.06.2016 al 31.05.2017)	61.40	50.30	44.90
2.00	BONIFICACIÓN UNIFICADA DE CONSTRUCCIÓN (BUC) (vigente del 01.06.2016 al 31.05.2017)	19.65	15.09	13.47
3.00	LEYES Y BENEFICIOS SOCIALES SOBRE LA RB	113.28%	69.55	56.98
4.00	LEYES Y BENEFICIOS SOCIALES SOBRE EL BUC	12.00%	2.36	1.81
5.00	BONIFICACIÓN POR MOVILIDAD ACUMULADA	7.20	7.20	7.20
6.00	OVEROL (2 und anuales)	0.40	0.40	0.40
	COSTO DÍA HOMBRE (DH)	S/.	160.56	131.78
	COSTO HORA HOMBRE (HH)	S/.	20.07	16.47

4. Formato de Estimación vs. formato contratista



Presupuesto Oferta de Obras civiles Edificio administrativo

Item Description	Quantity	Unit	Unit Cost \$	Sub total \$
DIRECT COST				
Concrete f'c=28 Mpa	2800	m3	40.00	112,000
Formwork	20000	m2	30.00	600,000
Rebar f'y=420 Mpa	346	Ton	1000.00	346,000
Total direct costs				1,058,000
CONTRACTOR INDIRECT COST + PROFIT				
Contractor Indirect and Overhead costs (25% over direct costs)				264,500
Profit (7.5% over direct + contractor indirect and overhead costs)				99,188
Total indirect cost				363,688
TOTAL CONTRACTOR PROPOSAL				1,421,688

Nota: Concreto y acero a ser suministrado por cliente

4. Formato de Estimación vs. formato contratista



(A)														(B)				(C)				(D)				(E)=	
(A)+(B)+(C)+(D)																											
Item Description	Quantity	Unit	Man hours		Labor		Materials		Equipment		Subcontract		TOTAL (\$)														
			Unit Man hours	Total Man hours	Labor rate (\$/MH)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)															
DIRECT COST																											
Concrete																											
Concrete f'c=28 Mpa	2800	m3	3.00	8400	20.7	173,618	115.00	322,000	---	---	---	---	495,618														
Formwork	20000	m2	3.30	66000	---	---	---	---	---	---	25.60	511,920	511,920														
Rebar f'y=420 Mpa	346	Ton	60.00	20760	19.7	408,464	850.00	294,100	---	---	---	---	702,564														
TOTAL DIRECT COST			95,160		582,083		616,100		0.00		511,920		1,710,103														
INDIRECT COST																											
Owner's cost													200,000														
TOTAL INDIRECT COST													200,000														
CONTINGENCY													191,010														
TOTAL PROJECT COSTS = DIRECT COST + INDIRECT COST + CONTINGENCY													2,101,113														

¡Oferta de
contratista es
30% más que lo
estimado!

\$1'094,003 (de estimador)

vs.

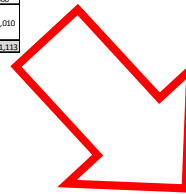
\$1'421,688 (de contratista)



5. Sugerencia de formato estimación Clase 1 y 2



Item Description	Quantity	Unit	(A) Man hours		(B) Labor		(C) Materials		(D) Equipment		(E) Subcontract		(F)= (A)+(B)+(C)+(D)+(E)
			Unit Man hours	Total Man hours	Labor rate (\$/MH)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)	Unit cost (\$/Unit)	Sub Total (\$)	
DIRECT COST													
Concrete													
Concrete f'c=28 Mpa	2800	m3	3.00	8400	20.7	173,618	115.00	322,000	---	---	---	---	495,618
Formwork	20000	m2	3.30	66000	---	---	---	---	---	---	25.60	511,920	511,920
Rebar f'y=420 Mpa	346	Ton	60.00	20760	19.7	408,464	850.00	294,100	---	---	---	---	702,564
TOTAL DIRECT COST				95,160		582,082		616,100		0.00		511,920	1,700,102
INDIRECT COST													
Owner's cost													200,000
TOTAL INDIRECT COST													200,000
CONTINGENCY													191,010
TOTAL PROJECT COSTS = DIRECT COST + INDIRECT COST + CONTINGENCY													2,100,112



				(A)						(B)				(C)		(D)=(A)+(B)+(C)
Item Description	Quantity	Unit	Man hours		INSTALATION					ADQUISITIONS BY CLIENT				TOTAL (\$)		
					Labor	Consumables	Construction Equipment	Subcontract	Unit Cost	Sub total \$	Materials		Equipment			
			Unit Man hours	Total Man hours	Unit (\$/Unit)	Unit (\$/Unit)	Unit (\$/Unit)	Unit cost (\$/Unit)			Unit cost (\$/Unit)	Sub total (\$)	Unit cost (\$/Unit)		Sub total (\$)	
DIRECT COST																
Administrative building																
Concrete																
Concrete f'c=28 Mpa	2800	m3														
Formwork	20000	m2														
Rebar f'y=420 Mpa	346	Ton														
Constructor Indirect and overhead Cost																
Profit margin																
TOTAL DIRECT COST											-		-		-	
INDIRECT COST																
Owner's cost																
CONTINGENCY																
TOTAL PROJECT COSTS = DIRECT COST + INDIRECT COST + CONTINGENCY																-

6. Cálculo de tarifa de all-in



	Description	% Quoted	Unit	Civil foreman	Carpenter	Ironworker	Concrete finisher	Qualified Helper	Laborer
DIRECT LABOR COSTS	Base wage		Soles/day	79.82	61.40	61.40	61.40	50.30	44.90
	(A) Base hourly wage		\$/hour	3.07	2.36	2.36	2.36	1.93	1.73
	(B) Fringe benefits	113.21%		3.48	2.67	2.67	2.67	2.19	1.96
	(C) Total burdenable wage (A)+(B)		\$/hour	6.55	5.04	5.04	5.04	4.12	3.68
	Bonuses								
	(D) Unified construction bonus	30%		0.92	0.71	0.71	0.71	0.58	0.52
	(E) Specialization construction bonus	2%		0.06	0.05	0.05	0.05	0.04	0.00
	(F) High specialization bonus	Variable		3.07	2.60	2.60	2.60	0.97	0.00
	(G) Bonus for working out	20%		0.61	0.47	0.47	0.47	0.39	0.35
	(H) Sub total Bonuses (D)+(E)+(F)+(G)			4.67	3.83	3.83	3.83	1.97	0.86
	(I) Social Laws over bonuses	13%		0.61	0.50	0.50	0.50	0.26	0.11
	Other bonus (do not affected by social laws)								
	(J) Bonus for working over 3000 masl	0.13	\$/hour	0.13	0.13	0.13	0.13	0.13	0.13
	(K) Bonus for risk of falling	7%		0.21	0.17	0.17	0.17	0.14	0.12
	(L) Sub total Other Bonuses (J)+(K)+(L)			0.34	0.29	0.29	0.29	0.26	0.25
INDIRECT LABOR COSTS	(M) Total cost of normal time (C)+(H)+(I)+(L)		\$/hour	12.16	9.65	9.65	9.65	6.62	4.90
	(M') Total cost of normal time (C)+(H)+(I)+(L)		\$/day	97.27	77.19	77.19	77.19	52.92	39.23
	INDIRECT LABOR COST (\$/day)								
	Medical exam		0.50						
	SCTR		2.00						
	Photocheck		0.00						
	Transport to work		0.80						
	On-site transportation		0.80						
	Feeding		13.00						
	Accommodation		3.50						
	Water (2.5 lts/day)		1.50						
	Security equipments		1.50						
	Others		1.00						
	(N) Total Indirect Labor Cost		\$/day						
	(N') Total Indirect Labor Cost		\$/hour	3.08	2.95	2.95	2.95	2.95	3.08
	(O) Total Direct + Indirect Labor Cost		\$/hour	15.23	12.60	12.60	12.60	9.57	7.98

COSTO DE HORA HOMBRE EN OBRAS DE EDIFICACIÓN (VIGENTE AL 01 DE ENERO DEL 2017)				
		CATEGORÍA		
		OPERARIO	OFICIAL	PEON
BÁSICA VIGENTE (RE)		61.40	50.30	44.90
UNIFICADA DE CONSTRUCCIÓN (BUC)				
		19.65	15.09	13.47
SOCIALES SOBRE LA RB	113.28%	69.55	56.98	50.86
SOCIALES SOBRE EL BUC	12.00%	2.36	1.81	1.62
MOVILIDAD ACUMULADA		7.20	7.20	7.20
Overol (2 unidades)		0.40	0.40	0.40
DÍA (DH)	S/.	160.56	131.78	118.45
HORA (HH)	S/.	20.07	16.47	14.81

6. Cálculo de tarifa de all-in



<u>Composite Concrete Crew</u>			
N°	Classification	Hourly Direc + Indirect Labor Cost	Extension
1	Foreman	\$15.23	\$15.23
4	Concrete finisher	\$12.60	\$50.39
3	Qualified helper	\$9.57	\$28.70
6	Laborer	\$7.98	\$47.87
14	Total		\$142.19 *
Average cost for the group:		\$ 114.66/14=	\$10.16 **
<u>Installation costs and overhead</u>			
over **	Mobilization/Demobilization	5%	0.51
over **	Temporal facilities	5%	0.51
over **	Consumables	10%	1.02
over **	Supervision & Administratives	35%	3.55
over **	Construction equipment	30%	3.05
	Total		18.79
	Profit (10% over Total)		1.88
	All-in hourly labor rate		20.67

<u>Composite Rebar Crew</u>			
N°	Classification	Hourly Direc + Indirect Labor Cost	Extension
1	Foreman	\$15.23	\$15.23
6	Iron worker	\$12.60	\$75.59
2	Qualified helper	\$9.57	\$19.13
6	Laborer	\$7.98	\$47.87
15	Total		\$157.83 *
Average cost of the group		\$125.65/15=	\$10.52 **
<u>Installation costs and overhead</u>			
over **	Mobilization/Demobilization	5%	0.53
over **	Temporal facilities	5%	0.53
over **	Consumables	10%	1.05
over **	Supervision & Administratives	35%	3.68
over **	Construction equipment	15%	1.58
	Total		17.89
	Profit (10% over total)		1.79
	All-in hourly labor rate		19.68

7. Desglose de tarifa all-in en costos unitarios



Item description: Concrete f'c=28 Mpa					
Unit	m3			Unit Cost	48.42
Efficiency	46.67 m3/day				
Productivity	3.00 MH/m3				
Day's work	10 MH/day				
Resource Description	Unit	Crew	Quantity	Unit Cost \$	Subtotal \$
Consumables					
Tooth chisel	unit	✓	0.0025	80.77	0.20
Flat chisel	unit	✓	0.0025	80.77	0.20
Boards 1"x4"x10' (3.70 p2)	unit	✓	0.0300	8.73	0.26
					0.67
Labor					
Foreman	MH	1	0.2143	12.16	2.61
Concrete finisher	MH	4	0.8571	9.65	8.27
Qualified helper	MH	3	0.6428	6.62	4.25
Laborer	MH	6	1.2856	6.64	8.54
					23.66
Construction Equipment					
Concrete vibrator	hour	4	0.8571	0.87	0.75
Drill Hilti TE-70	hour	1	0.2143	1.80	0.39
Compressor 185 CFM (6.9 bar) 62.4 kw	hour	0.9	0.1928	28.37	5.47
					6.60
Complementary works					
Concrete curing	m2	✓	1.5800	2.17	3.42
Adherent bridge application	m2	✓	0.1600	39.67	6.35
Concrete temperature control	m3	✓	1.0000	1.84	1.84
Implements for concrete air conditioning	m3	✓	1.0000	5.87	5.87
					17.49

7. Desglose de tarifa all-in en costos unitarios



Item description: Rebar f'y=420 Mpa					
Unit	Ton			Unit Cost	1168.85
Efficiency	2.50 Ton/day				
Productivity	60.00 MH/Ton				
Day's work	10 MH/day				
Resource Description	Unit	Crew	Quantity	Unit Cost \$	Subtotal \$
Consumables					
Black wire#16	kg		50	1.33	66.50
					66.50
Labor					
Foreman	MH	1	4.0000	12.16	48.63
Ironworker	MH	6	24.0000	9.65	231.56
Qualified helper	MH	2	8.0000	6.62	52.92
Laborer	MH	6	24.0000	4.90	117.69
					450.80
Construction Equipment					
Cold chisel Fo up to 1 3/8"	hour	0.6	2.4000	3.21	7.70
Bending machine Fo up to 1 3/8"	hour	0.6	2.4000	9.34	22.42
Truck Hiab	hour	1	4.0000	75.36	301.42
Hoisting equipment	hour	1	4.0000	80.00	320.01
					651.55

7. Desglose de tarifa all-in en CI y utilidades



- Costos indirectos de contratista

Installation costs and overhead	
Mobilization/Demobilization	5%
Temporal facilities	5%
Supervision & Administratives	20%
Total	30%

- Utilidad de contratista

El margen de utilidad será 10% sobre el CD, CI y costos de instalación y GG

8. Estimación en formato de sugerido



					(A)						(B)		(C)		(D)=(A)+(B)+(C)	
Item Description	Quantity	Unit	Man hours		INSTALATION				Unit Cost	Sub total \$	ADQUISITIONS BY CLIENT				TOTAL (\$)	
					Labor	Consumables	Construction Equipment	Subcontract			Materials		Equipment			
			Unit Man hours	Total Man hours	Unit (\$/Unit)	Unit (\$/Unit)	Unit (\$/Unit)	Unit cost (\$/Unit)	Unit cost (\$/Unit)	Sub total (\$)	Unit cost (\$/Unit)	Sub total (\$)				
DIRECT COST																
Administrative building																
Concrete																
Concrete f'c=28 Mpa	2800	m3	3.00	8400	23.66	0.67	6.60	17.49	48.42	135,574	115	322000	---	---	457,574	
Formwork	20000	m2	3.30	66000				18.96	18.96	379,200			---	---	379,200	
Rebar f'y=420 Mpa	346	Ton	60.00	20760	450.80	66.50	651.55		1168.85	404,422	850	294100	---	---	698,522	
					Contractor direc cost					919,196						
Constructor Indirect and overhead Cost (30% over contractor direct cost)										275,759					275,759	
Profit margin (10% over contractor direct + indirect + overhead costs)										119,496					119,496	
TOTAL DIRECT COST										1,314,451	616,100		-		1,930,551	
INDIRECT COST																
Owner's cost															200,000	
CONTINGENCY															213,055.10	
TOTAL PROJECT COSTS = DIRECT COST + INDIRECT COST + CONTINGENCY																2,343,606



\$1'314,451 (de estimador)
vs.
\$1'421,688 (de contratista)

¡Oferta de contratista varía en 8% con respecto al estimado!

9. Retos y Mejoras



Retos:

1. Te reto a visualizar si durante la ejecución cabe la posibilidad de que la modalidad del contrato cambie, ello con la finalidad de definir la tarifa all-in desde un inicio. Y sugerir a cliente que también considere esta tarifa para comparar ofertas.
2. Te reto a ser proactivo en la presentación de un formato a tu cliente o sugiere uno antes de entregar tu estimación.

9. Retos y mejoras



Mejoras:

1. A pesar de que cada firma tiene estándares de elaboración de capex, adapta los formatos considerando que en Perú la mayoría de sus contratos se realizan bajo la modalidad de costos unitarios.
2. Da un valor agregado al formato de estimación, disgrega del costo unitario y hazlo versátil de tal forma que ayudes al cliente a detectar si existen “Unbalanced bids”.
3. Asegúrate que desde un inicio el cliente entienda el concepto de la tarifa all-in y bajo ciertas premisas, limita su uso a estimaciones Clase 3.

¿PREGUNTAS?



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