



VI GOVERNO CONSTITUCIONAL
MINISTÉRIO DO PLANEAMENTO
E INVESTIMENTO ESTRATÉGICO



Agência de
Desenvolvimento
Nacional

INSTRUCTION

NO:.....

With the completion of the first volume:

TIMOR-LESTE STANDARD METHOD OF MEASUREMENT (TL-SMM) which contains:

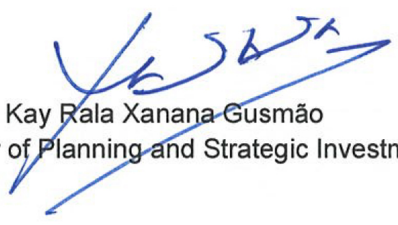
1. SMM for Building Construction (SMM-1)
2. SMM for Road and Bridge Construction (SMM-2)
3. SMM for Irrigation and River Construction (SMM-3)
4. SMM for Harbor (SMM-4)
5. SMM for Airport (SMM-5)
6. SMM for Electrical High Voltage Transmission Line and Home Installation (SMM-6)
7. Standard Coefficient of Unit Price Analysis for Civil works
8. Standard Coefficient of Productivity Analysis for Heavy Equipment
9. Standard Cost of Building Component & Standard of Consultant Fee

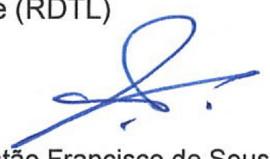
We, hereby, instruct all Government Institutions in Timor-Leste to use TL-SMM as a guide in calculating construction cost as well as design and supervision cost including budget of each Government's construction in Timor Leste.

This instruction is to be implemented accordingly and shall enter into force starting from the launch of first volume of TL-SMM book.

April 2016

Republic Democratic of Timor Leste (RDTL)


Kay Rala Xanana Gusmão
(Minister of Planning and Strategic Investment)


Gastão Francisco de Sousa
(Minister of Public Works, Transport and Communications)


Dr. Rui Maria de Araújo
(Prime Minister)

Endereço A D N : Hudi-laran Fatuhada, Dili Timor –Leste.

Email: Info@adn.gov.tl

Telefone: +670 3310289

Website A D N: adn.gov.tl



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INTRODUCTION

In first volume TL-SMM, year 2015, there were many inputs, suggestions received from stakeholders that in principle suggesting to make revision, addition, correction to the TL-SMM first volume. Therefore, in this second volume we tried our best to comply with all the necessary corrections and additions.

This document is named TIMOR-LESTE STANDARD METHOD OF MEASUREMENT second volume 2016, referred to as TL- SMM second volume 2016, a document that can serve as a guide in calculating cost of infrastructure project in Timor-Leste. It is published as a supplement to other documents that have been in effect in other ministries such as standard specification, Standard Bill of Quantity, Unit Price, etc. We hope that most, if not all, of our problems related to project costing in Timor-Leste can be addressed through this standard document.

Contents of this document are:

10. SMM for Building Construction (SMM-1)
11. SMM for Road and Bridge Construction (SMM-2)
12. SMM for Irrigation and River Construction (SMM-3)
13. SMM for Harbor (SMM-4)
14. SMM for Airport (SMM-5)
15. SMM for Electrical High Voltage Transmission Line and Home Installation (SMM-6)
16. Standard Coefficient of Unit Price Analysis for Civil works
17. Standard Coefficient of Productivity Analysis for Heavy Equipment
18. Standard Cost of Building Component & Standard of Consultant Fee

SMM-1, SMM-2, SMM-3, SMM-4, SMM-5, SMM-6 Serve as guidance for uniformity and facilitate us in measuring and calculating, including the scope of calculation which is used in calculating the quantity and the unit price of a construction activity.

Point 7 (Method of Measurement), explains about the cost structure of a project which consists of: **Total net of construction cost, Total net of Project cost, total gross of project cost**, with the purpose to breakdown each project in such a way that what is referred to as cost of a project does not just cover the physical cost of the project but already included the cost of physical construction, consultant fee, project management unit as well as tax associated with the project. Therefore, **Total gross of project cost is defined as a complete budget of the project (Orçamento) which will be presented to Parliament.**

Standard Coefficient of Unit Price Analysis for Civil Works – is created based on the standards that have been in effect and some feedbacks from contractors, consultants, and Line Ministries which can be used by all stakeholders. In this volume there are some additional new items, and some corrections to the previous items

Standard Coefficient of Productivity Analysis for heavy Equipment – serves as a guide in calculating productivity of various types of heavy equipment for various works and provides some examples of its application as well.

TIMOR-LESTE STANDARD METHOD OF MEASUREMENT (TL-SMM) First Volume presented **Calculation Unit Price Analysis using heavy equipment and with its examples.**

In the examples of these calculations **there were some typos / printing errors and still using the old equipment notation.**

Therefore on Second-Volume the **Example of unit price calculation had been corrected at the same time applying the Standard Notation Heavy Equipment for the old equipment notation** that will be applied in East Timor. In addition, in the Volume II presented as well **Example of Calculation of Unit Price to a number of other jobs that had not been presented in the volume-I.**

Standard Notation of Heavy Equipment includes:

- **General notation;**
- **Notation of type of heavy equipment;**
- **Notation of materials; and**
- **Labor notation.**

It is essential to note that the value / price list in the calculation examples **are not the absolute price**, but depends on many variables based on field conditions, equipment condition, the magnitude Unit Price, Basic wage / materials / equipment as well as the distance of quarry to Base Camp or to the work site, and other relevant conditions.

Many variables / conditions lead to differences in the value of Efficiency Factor of Equipment, thus resulting in differences in the magnitude of Equipment Productivity, which means **the magnitude of Unit Price will vary according to the condition and location of the work.**

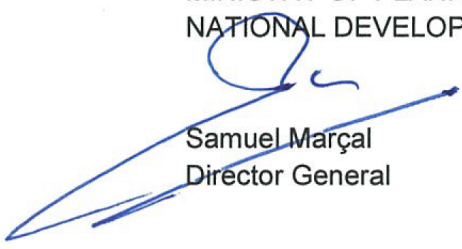
Standard Cost of Building Component & Standard of Consultant Fee – is a guide for government and private sectors to avoid any discrepancy in preparing budget for various categories of a project. In this volume there are some explanations for using the table (D) about Table for fee percentage of Prototype Design

For Standard of Construction Contract and Integrated Management System of Cost, Time and Quality (PMIS) will be prepared separately.

We would like to acknowledge that with limitation of resources, time and labor this second volume still needs improvement to meet all the necessities in preparing the project cost/budget. Therefore any comments and inputs from everyone is welcomed and since we are using two languages, any discrepancy in interpretation, Indonesian version shall prevail.

Dili, January 2016

MINISTRY OF PLANNING AND STRATEGIC INVESTMENT
NATIONAL DEVELOPMENT AGENCY



Samuel Marçal
Director General

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Standard Coefficient of Unit Price Analysis

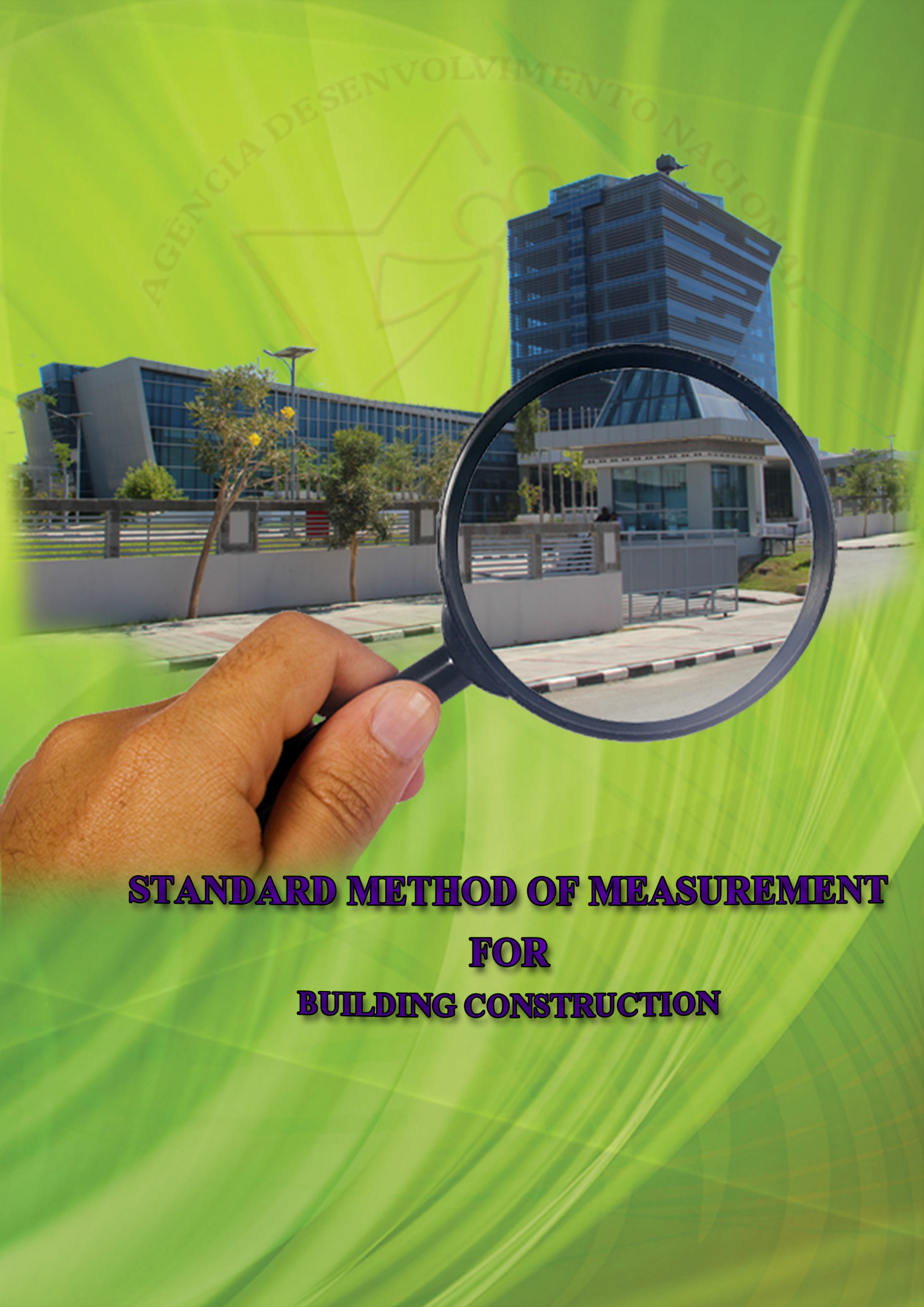
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**STANDARD METHOD OF MEASUREMENT
FOR
BUILDING CONSTRUCTION**

1.0. DOCUMENT TITLE

The title of this document is TIMOR LESTE STANDARD METHOD OF MEASUREMENT – 1 , For Building, Second Volume (January 2016), referred to TL-SMM – 1.

TL - SMM-1 is intended to be utilized in conjunction with the General Condition of Contract, General Specifications or any other relevant provisions provided elsewhere in the Contract Document.

The works shall be itemized and described in Bill of Quantities in sufficient details to enable Bidders/Tenderers to price it adequately and the method of measurement shall be stated in the Preamble to the Bill of Quantities.

The preamble shall state the methods of measurements other than TL-SMM-1, if any, which are adopted while preparing the Bill of Quantities and to be used for measurement of completed parts of the Works. Such method of measurement shall comprise those not covered by TL-SMM-2.

2.0. OBJECTIVE

The objective of TLSMM-1 is to set forth the procedure according to which the Bills of Quantities shall be prepared, priced and the quantities expressed and measured.

3.0. DEFINITIONS

- 3.1. In this document and in Bills of Quantities prepared according to the procedure set forth herein the following words and expressions have the meanings hereby assigned to them, except where the context otherwise required.
- 3.2. "Condition of Contract" means the "General Condition of Contract" as provided in the Bidding/Contract Documents prepared by Owner
- 3.3. Word and expression defined in the Condition of Contract have the same meaning herein
- 3.4. All references to clauses are references to clauses numbered in the Condition of Contract and reference to paragraphs are references to paragraphs numbered herein
- 3.5. The word "Work" includes work to be carried out, goods, materials and services to be supplied, and the liabilities, obligations and risks to be undertaken by the Contractor under the Contract
- 3.6. The expression "expressly required" means as shown on the Drawings or as described in the Specifications or as instructed by the Engineer pursuant to the relevant provisions of Condition of Contract
- 3.7. "Day work" means the method of valuing work on the basis of time spent by the workmen, the materials used and the plant employed
- 3.8. "Original Ground Surface" means the surface of ground before any work has been carried out
- 3.9. "Final Excavated Surface" means the surface indicated on the Drawings to which the final excavation is carried out
- 3.10. "Commencing Ground Surface" for an item in a Bill of Quantities means, the surface of the ground from where that particular item of work commences.
- 3.11. "Excavated Ground Surface for an item in the Bill of Quantities means, the surface to which excavation included in that particular item of work is to be carried out

4.0. GENERAL PRINCIPLES

4.1 Unit of measurement

The unit of measurement for each item shall be stated for the item in the TL-SMM-1. The unit of measurement stated against a descriptive feature in the TL-SMM-2 shall apply to all items to which that descriptive feature applies. Meter, Kilogram, Second (MKS) system of units has been adopted in this TL-SMM-1.

In describing the dimension of a certain works, its sequence should be as followed, length, width and height or thickness. Each work should be calculated its net volume, excluding its disposal, overlapping, compactness, widening etc. For all items either stated in this TL-SMM-1 or not such as transportation, warehouse, permit, loading and unloading, etc will be calculated in unit price of its work.

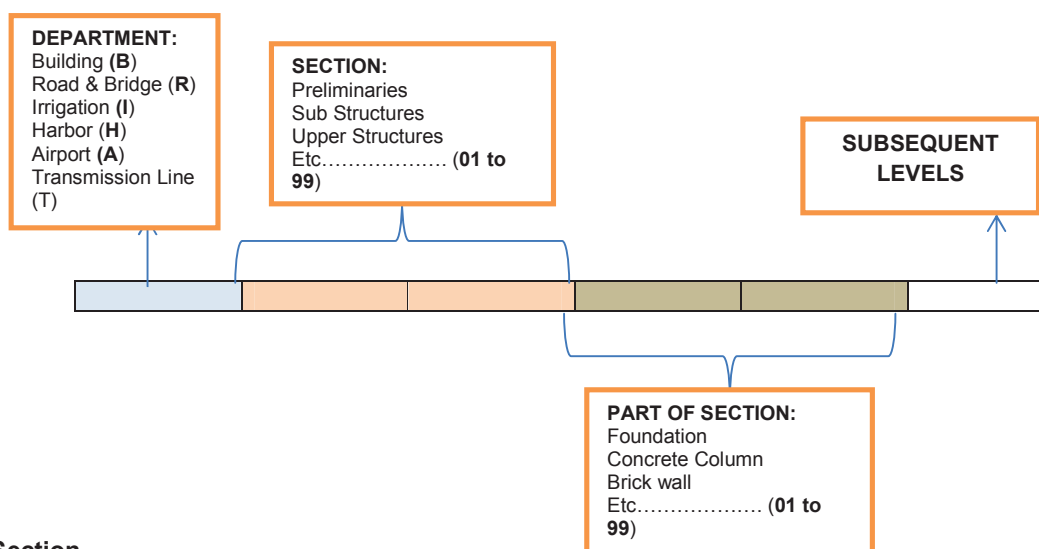
The unit of each work will followed the unit as stated in point 5.0

The volume is rounded to two (2) decimal digits, ex. 1,234.78 not 1,234.7765.

4.2. TL-SMM Codes - 1

Works are classified into various "Sections". Unique code has been allocated to each item of work for its identification and presentation in the TL-SMM – 1, Bill of Quantities and elsewhere. Coding arrangement is as given hereunder:

- . First digit represents the "Department"
- . Next two digits represent the "Section"
- . Next two digits represent the "sub Section"
- . Next digits represent the subsequent levels.



4.3 Sub Section

Each part of the Section would be defined to execute and measure for payment (Pay item).

4.4 Measurement Rules

Measurement rules set out the conditions under which work shall be measured and the method by which the quantities shall be computed. In addition to measurement rules, following general conditions shall also apply:

- a. Quantities of acceptable completed work relating to any part of specification shall be computed net using dimensions from the drawing and as per method given in this document except otherwise specified in special provisions or else in contract documents. No allowance shall be made for bulking, shrinkage or wastage.
- b. All the work to be measured related to any part of specification, if required, shall be classified and measured separately as per Bill of Quantities.

- c. The contractor is not entitled to claim difference in quantity calculated by the standard method of measurement and actual quantity as per site of a specific item except provision made herein, special provisions, or elsewhere in the contract documents.

4.5 Definition

Definition means the limitation and the function of work item represented by a word or expression used in the work classification and in the Bill of Quantities which prepared in accordance with TL-SMM –1.

4.6 Measurement Coverage

Measurement coverage provides that the work stated is deemed to be included in the appropriate items to the extent that such work is included in the Contract. In addition to coverage rules, following general conditions shall also apply:

- a. Loading, unloading and transportation of material related to any item of work
- b. All the items and activities in TL-SMM – 1 shall deem to be included all operations required to perform the work as per Contract Documents.
- c. Additional coverage rule which are necessities for complete understanding of method of measurement are given against relevant item or activity.

4.7 Additional Descriptions

Additional descriptions which are necessary for complete understanding of works/activities covered under method of measurement are provided against such particular item of work.

5.0 UNITS AND ABBREVIATION

The following units of measurement and abbreviations shall be used :

Unit	Abbreviation
Millimeter	mm
Meter	M
Square millimeter	mm ² or mm2
Square meter	M ² or M2
Hectare	Ha
Cubic meter	M ³ or M3
Kilogram	Kg
Tone	Ton
Metric Tone	M.Ton
Summary	Sum
Number	No.
Horse Power	Hp
Week	Wk
Litre	Ltr
Lump Sum	Ls
Hour	Hr
Day	Day
Man Month	Mm
Man Hour	Mh
Man Day	Md

6.0 CONVERSION TABLE

To convert	Into	Multiply
LENGTH		
Millimeter	Inch	0.03937
Inch	Millimeter	25.40005
Meter	Foot	3.28084
Foot	Meter	0.3048
Meter	Yard	1.09361
Yard	Meter	0.9144
Kilometer	Mile	0.62137
Mile	Kilometer	1.60935
MASS WEIGHT		
Kilogram	Pound	2.20462
Pound	Kilogram	0.45359
Gram	Ounce	0.03527
Ounce	Gram	28.34949
Kilogram	Quintal	0.01
Milligram	Grain	0.01543
Kilogram	Hundred Weight	0.01968
Hundred weight	Tone	0.0508
Kilogram	Tone	0.001
Kilogram	Ton	0.00098
Pound	Ton	0.00045
Tone	Ton	0.98421
Kilogram	Seer	1.01605
Kilogram	Maund	0.02679
Gram	Tola	0.08573
Kilo Newton	Ton	0.1
Ton	Kilo Newton	10
Kilo Newton	Kilogram	100
Kilogram	Kilo Newton	0.01
VOLUME		
Litre	Pint (UK)	1.75975
Litre	Gallon (imperial)	0.21997
Litre	Gallon (US)	0.26417
Litre	Cubic Foot	0.3531
Litre	Cubic Meter	0.001
Cubic Foot	Liter	28.31682
Milliliter	Fluid ounce	0.0352
Gallon Imperial	Liter	4.5461
Gallon US	Liter	3.78541
Gallon Imperial	Gallon US	1.20095
Cubic millimetre	Cubic inch	0.00006
Cubic meter	Cubic foot	35.31472
Cubic foot	Cubic meter	0.02832
Cubic meter	Cubic Yard	1.30795
Cubic yard	Cubic meter	0.76456
AREA		
Square millimeter	Square inch	0.00155
Square inch	Square millimeter	645.1613
Square meter	Square foot	10.76392
Square foot	Square meter	0.0929
Square meter	Square yard	1.19599
Square yard	Square meter	0.83613
Square meter	Acre	0.00025
Hectare	Acre	2.47105
Acre	Hectare	0.40469

Square meter	Hectare	0.0001
Square kilometer	Square mile	0.3861
Square mile	Square kilometer	2.58999
Hectare	Square mile	0.00386
Square mile	Hectare	258.9989
MASS/UNIT AREA		
Kilogram per square kilometer	Ton per square mile	0.00255
Kilogram per square meter	Pound per square foot	0.20482
Pound per square foot	Kilogram per square meter	4.88243
Kilogram per-square centimeter	Kilo Pascal	100
Kilo Pascal	Kilogram per square centimeter	0.01
Kilo Pascal	Mega Pascal (MPa)	0.001
Mega Pascal	Kilo Pascal	1000
MASS PER UNIT VOLUME		
Kilogram per cubic meter	Pound per cubic foot	0.06243
Grams per liter	Pound per cubic foot	0.06243
Pound per cubic foot	Kilogram per cubic meter	16.01845
Pound per cubic foot	Grams per liter	10.01845
Ton per cubic meter	Kilo Newton per cubic meter	10
Kilo Newton per cubic meter	Ton per cubic meter	0.1

While converting unit from one system to other system the measurement shall be taken nearest to three (3) digits for MKS system and nearest to two digits for FPS system.

7.0 METHOD OF MEASUREMENT

Section 01 : Preliminaries

Section 02 : Sub Structure

Section 03 : Upper Structure

Section 04 : Walls

Section 05 : Doors and Windows

Section 06 : Ceiling

Section 07 : Flooring

Section 08 : Roofing

Section 09 : Finishing Works

TOTAL CIVIL & ARCHITECTURAL WORK (01 to 09)..... (A)

Section 10 : Mechanical Works

Section 11 : Electrical Works

TOTAL MECHANICAL & ELECTRICAL WORK (10 to 11),..... (B)

TOTAL NET BUILDING COST, C = (A+B)

Section 12 : External Works

Section 13 : Final Site Clearing

TOTAL NET PROJECT COST ,.....D = (C+12+13)

Section 14 : Furniture

Section 15 : Equipment

Section 16 : General Expenses

Section 17 : Profit

Section 18 : Provisional sum

Section 19 : Contingency

Section 20 : Consultant Fee

Section 21 : PMU cost

Section 22 : Taxes

TOTAL GROSS PROJECT COST, E =D+(14 to 22)

EXAMPLE OF GENERAL EXPENSES DETAILS (Section:16)

1. Material Samples including Quality Testing
2. Security
3. Occupational Health and Safety
4. Project Team/Staff Fees
5. Provisional Fee for Performance Bank Quarantees, Down payment, Retention Fee, ect.
6. Work Insurance Fee, Labor Insurance Fee
7. Communication Cost
8. Inauguration Fee
9. Rental fee for Lot/house/vehicles
10. Report Fee
11. Gathering/Meeting Fee
12. Social Fee
13. Other Non-Physical Fee for each project

7.1. PRELIMINARIES : (B - 01)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-01-01	DEMOLITION	Demolition means demolishing all the existing buildings in the location of the building plan	If in the BOQ described in details the item of demolition works, then the unit price should also describe accordingly to the BOQ item, Unit is Lumpsum	All unit price analysis should include tools, equipment, labors, permit,safety and security and transportation of disposals material to determined location.
B-01-02	SITE CLEARANCE	To clean the site from all rubbish , debris, small trees diameter under 15 cm	Calculated in square meter (m ²)	Include equipment, tools, labors, permits, safety and security, and transportation to designated location.
B-01-03	MOBILIZATION	Mobilization is the first action to mobilize all the equipment, labors, facilities, permission needed, before starting the physical construction	All of the equipment, labors, facilities and permission should be described in detailsincluding specification, capacity, numbers and unit price. The unit is Lump Sum.	Unit prices of each item should include cost for transportation, holding, permission needed, rental or purchase and any others social cost.
B-01-04	DEMOBILIZATION	Demobilization is the action to demobilize all equipment, labors, facilities, after finishing the project	All of the equipment, labors, facilities and permission should be described in details include the specification, capacity, numbers and unit price. The unit is Lump Sum.	Unit price of each item should be included cost for transportation, holding, and any others social cost.
B-01-05	SITE CLEANING AND GRUBBING	To clean all the site from rubbish and debris where the building will be constructed	The quantity is calculated in square meter (m ²)	Include removing all debris and rubbish, small trees as well its roots, remove stones and fill back the holes in the area of construction site.
B-01-06	DOCUMENTATION PHOTOS	Each photo should inform the physical condition at a certain time	The unit should be in Lump Sum	Minimum should be taken from 4 same point of views, start from the beginning of 0% progress, the second photo and periodically until finish according to the specifaction
B-01-07	TEMPORARY FENCE AND GUARD	Temporary fence for site security, built in the site boundary, complete with in and	The unit is in line meter (m'), door is in square	The fence, guard house and gate should be strong enough during the

	HOUSE	out door.Guard house should be located at the entrance and at other place needed	meter (m ²). Guard house is in square meter (m ²)	construction period. The frame of Entrance door is made of wood class III size 5/7 and covers with Zinc BJLS 30. The guardhouse is made of wood class III and covers with Zinc BJLS 30
B-01-08	PROJECT SIGN BOARD	Project sign board should include description of the project, and posted in front of the project site	The quantity is measured in unit	Sign board should be done according to the drawing and specification, and should be fixed at the location that could easily be seen before the works is started until completion of the project.
B-01-09	BENCH MARK	Bench Mark (BM) is a permanent reference point +/- 0.00	The quantity is in unit	It should be protected during construction time, and should be demolished under instruction of Engineer
B-01-10	BATTER BOARD	Batter board is a supporting tool to determine the center lines of a building	The quantity should be calculated along the outside round of the building, Measured in line meter (m')	Include all necessary tools such as theodolite, specialist surveyor and material needed. It should be strong enough and maintained after all of the center lines of the building already are fixed to permanent building center line
B-01-11	TEMPORARY PROJECT SITE OFFICE	Temporary project site office is a temporary building for project staff to do their activities during construction period.	The quantity should be calculated in square meter (m ²).	Should include all furniture needed, first aid tools and medicine, record book, stationary, etc.
B-01-12	TEMPORARY BARRACK AND WAREHOUSE USE	1.Barrack will be used for workers to do their works 2. Warehouse for tools and materials	The quantity should be calculated in square meter (m ²)	Include all necessary tools needed
B-01-13	TEMPORARY WATER AND POWER SUPPLY	1.Temporary water supply for construction, cleaning, toilet, etc. 2.Temporary power supply for construction, lighting.	The quantity of temporary water and power supply should be calculated in Lump Sum (LS)	Include all tools and equipment needed, permission, operation and maintenance cost

7.2. SUB STRUCTURE: (B02)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-02-01	EXCAVATION	Excavation of foundation, drainage, septic tank, basement.	The quantity of excavation should be calculated the net quantity, based on width, and depth of foundation measured from original ground level, in cubic meter (m^3). The quantity of excavated disposal material should be calculated based on dense volume not loose volume, in cubic meter (m^3) The quantity for leveling, sloping, compacting and cleaning should be calculated separately in square meter (m^2)	Include all tools, equipment, labours needed, shoring needed, temporary deposit, and transportation to disposal area
B-02-02	BACKFILL	A work of filling back the foundation hole using the existing excavation	The volume of backfilling shall compute its rigid volume in m^3	Including work of backfilling, all equipment and tools needed.
B-02-03	EARTH FILLING	Earth filling is filled back the existing excavation for foundation, can use the existing excavated material or delivered from outside the project	The quantity should be calculated based on rigid /compacted volume (not loose volume) in cubic meter (m^3)	Include all tools, equipment and labours needed according to construction method and specification
B-02-04	TERMITE CONTROL AND WATER TIGHT	Termite control and /or water tight installed under and surround the foundation, under floor slab that directly contacts with soil	The quantity should be calculated based on the net contact area with soil, in square meter (m^2)., and should be separated its horizontal, vertical and sloping parts. If the overlapping is more than 30 cm, it should be calculated separately in square meter (m^2)	Including standard overlapping, sealant especially for membrane waterproofsheet.
B-02-05	FOUNDATION	Foundation is the main support structure of building, can be shallow foundation	a. For shallow foundation should be calculated according to the drawing and specification, in cubic meter (m^3) b. Deep foundation	a. Include all material, labours, tools and equipment. b. Include all materials, labours, tools, equipment needed,

		consist of stone, reinforced concrete, or deep foundation , like driven pile, bored pile etc., and the material can be consisted of reinforced concrete pile or steel pipe pile	should be calculated according to the drawing and specification, in unit (each). For loading test can be calculated in unit (each)	loading test, cut off head pile, ready to receive pile cap structure
B-02-06	PILE CAP	Pile cap is a part of foundation structure to distribute the column load to foundation	Pile cap consists of reinforced concrete according to drawing and specification. The quantity of concrete is not necessary to deduct with the quantity of reinforcement, and should be calculated separately between concrete, reinforcement and formwork. Concrete should be calculated in cubic meter (m^3) while Reinforcement should be calculated based on the bar bending schedule, in kg Formwork is calculated based on net contact area between concrete and formwork, in square meter (m^2)	a. For concrete include transportation of material, curing and any other supported materials like additive etc. b. For reinforcement should have included bending, cutting, wire, lean concrete support bar and steel supporting bar c. For formwork should have included assembling and installing, additive material (mud oil, plastic sheet, etc) and scaffolding
B-02-07	TIE BEAM	Tie beam is a part of foundation structure with function to tie cap pile and to distribute the load from column to cap pile	Tie beam consists of reinforced concrete according to the drawing and specification. The quantity of concrete is not necessary to deduct with the quantity of reinforcement; should be calculated separately between concrete, reinforcement and formwork. Concrete is calculated based on the length measured from edge of cap pile to cap pile, or from edge of column to edge of column, in cubic meter (m^3) Reinforcement is calculated based on bar bending schedule, in kg Formwork is calculated	For concrete include, transportation of material, curing and any other supported materials like additive etc. For reinforcement include bending, cutting, wiring, lean concrete supporting, bar and steel supporting bar. For formwork should include assembling and installing, additive material (mud oil, plastic sheet etc) and scaffolding

			based on the net contact area between concrete and formwork, in square meter (m ²)	
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7.3. UPPER STRUCTURE: (B03)

Reinforced concrete structure, BOQ of concrete, reinforcement and formwork should be calculated separately according to the quality of concrete stated in the drawing and specification. Reinforcement should be separated according to diameter and quality. The formwork also should be separated according to the type of materials and functions of the formwork. For wiremesh reinforcement, should be calculated based on net measurement without overlapping. For steel construction, the BOQ should be calculated separately according to the function and type of profile.

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-03-01	COLUMN	Column is a part of vertical structure to support horizontal structure like beam or plate.	The quantity should be measured from top edge of under floor to the top edge of upper floor. The concrete is measured in cubic meter (m ³), reinforcement is in kg, and formwork is in square meter (m ²)	For concrete include transportation of material, curing and any other supported materials like additive etc. For reinforcement should have included bending, cutting, wiring, lean concrete supporting, bar and steel supporting bar. For formwork should be included assembling and installing, additive material (mud oil, plastic sheet etc) and scaffolding
B-03-02	BEAM	Beam is a part of horizontal structure to support the wall, floor slabs and stairs of a building.	The quantity should be measured from the edge of one column to the other edge of the column. Beam height should be measured up to the top of the supported slab. The concrete is measured in cubic meter (m ³), the reinforcement is in kg. The scaffolding is in square meter (m ²) or Lumpsum.(LS).	For concrete include transportation of material, curing and any other supported material like additive etc. For reinforcement should have included bending, cutting, wiring, lean concrete supporting, bar and steel supporting bar. For formwork should be included assembling and installing, additive material (mud oil, plastic sheet etc) and scaffolding
B-03-03	FLOOR SLAB	Floor is a part of horizontal structure to support the dead load and live load.	The quantity should be measured with length and width measured from the edge of the supported beam, and the thickness according to the drawing and	For concrete include transportation of material, curing and any other supported material like additive etc. For reinforcement should have included

			specification.. Holes on the floor slab for ducting, piping etc., could not be deducted from the quantity of slab.. Only the holes more than .1 m ² should be deducted. Concrete is measured in cubic meter (m ³), reinforcement is in kg The scaffolding in square meter (m ²) or Lumpsum(LS).	bending, cutting, wiring, lean concrete supporting, bar and steel supporting bar. For formwork should be included assembling and installing, additive material (mud oil, plastic sheet etc) and scaffolding
B-03-04	STEEL STRUCTURE	The structure to support building, has similar functions with concrete structure, but consist of steel profile according to the drawing and specification.	The quantity should be calculated separately according to the function and type of profile, include joint plate measured in kg. Bolt, anchor and welding should be calculated separately. Bolt and anchor in kg, while welding is in line meter (m').	Include all material, tools, equipment needed for fabrication, holding, and installation on site. There is no difference between workshop fabricated and site fabricated
B-03-05	PRECAST CONCRETE	The structure to support building, that has similar function with concrete structure and steel structure, but consist of precast concrete structure profile according to the drawing and specification	The quantity should be calculated according to the type and function of each part, such as column, beam, slab, stair etc, in unit (each). The quantity of joint should be calculated per-each For non-structural precast concrete such as drainage, kerb, list, etc should be calculated separately.	Include all material, tools, equipment needed for fabrication, holding, installation on site
B-03-06	PRE-STRESSED CONCRETE	Pre-stressed concrete is a high quality concrete structure which have common reinforced and special stressed cable/wire strand to increase supporting power of the structure.	The quantity should be calculated in unit (each), based on to the type, drawing and specification.	Include all material, tools, equipment needed for fabrication, holding, transportation, stressing, grouting and installation on site

		Pre-stressed concrete can be done with post-tension or pre-tension		
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7.4. WALL: (B04)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-04-01	CONCRETE (BATAKO) AND BRICK WALL	Concrete /brick wall installed as a divider between internal rooms, or external walls	The net area(square meter) of walls should be based on length, width and height measured from edge of column/beam. Holes/opening for doors, windows should be deducted from the area of walls. Opening for piping, cabling could not be deducted. If reinforcement is inserted in the concrete (block) wall, it should be calculated separately in kg. If inserted glass block wall, then should be calculated separately in unit (each). For Block/brick installed as a riser or tread on stairs, should be calculated separately in line meter (m')	Include all material, tools and labours needed for mixing mortar, transportation and install the wall at right position. Include grooving that based on the specification
B-04-02	PLASTERING AND RENDERING	As a finishing work to cover the surface of block/brick wall Rendering is the finished surface of plaster ready to apply paint.	The area of plaster should be calculated in square meter (m ²), separately per-quality of mortar. The area of rendering should be calculated separately from the plaster work, in square meter (m ²) If the wall covered with ceramic or the like, the area of ceramic should be calculated separately in square meter (m ²).	Include all material, tools and labours needed for mix the mortar, transportation and install the plaster and render at right position.
B-04-03	CURTAIN WALL	Curtain wall is a glass wall with alluminium frame, installed outside wall of the building in order to protect building from heat and noise	Alluminium frame should be measured in line meter (m') for each type of profile. Glass is measured in square meter net, calculated from the opening, and according to type and thickness. For iron monger, decorative etc. should be calculated separately.	Include all tools, labours, supporting materials (sealant etc.) needed for fabrication, assembling and installing on the right position

7.5. DOORS AND WINDOWS: (B-05)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-05-01	DOORS AND WINDOWS	Doors and windows are part of room's cover that can be made of woods, glass, metal etc.	Wooden doors/windows frame should be calculated in cubic meter (m^3), according to the type and dimension Metal frame should be calculated in line meter (m') according to the type and dimension. Wooden doors/windows leaf should be calculated in square meter (m^2) according to the type and dimension. All quantities should be calculated in net area, according to drawing and specification. Glass is calculated in net area (m^2). Not allowed to calculate the overlapping/list For louvre glass should be calculated in line meter (m') For doors/windows, can also be calculated in unit (each) per-type if mentioned in the BOQ.	Include all tools and labours, supporting material needed for fabrication, assembling and installing on the right position. Iron monger should be calculated separately in unit (each), according to type, dimension and specification.
B-05-02	PARTITION	Partition is a wall divider that can be made of wooden, metal frame that covered by wooden, gypsum, glass or any other materials	In calculating the quantity of partition, should be separated between frame and covers. The wooden frame should be calculated in cubic meter (m^3) while metal frame should be calculated in line meter (m'). For wooden, glass or metal covers, should be calculated in square meter (m^2). All quantity should be calculated net, according to the drawing and specification. For skirtings should be calculated separately in line meter (m') If in the BOQ mention in unit per-type complete then it can be calculated in unit (each) per-type.	Include all tools, labour and supporting material needed for fabrication, assembling and installation on the right position

7.6. CEILING FINISHES: (B06)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-06-01	CEILING	Ceiling is a part of work to cover the upper part of a room, that made of wooden or metal frame, covered by glass, wooden, gypsum, acoustic board, plastic board etc.	In calculating the quantity of ceiling it should be separated between frame and covers. Wooden frame should be calculated in cubic meter (m^3) while metal frame should be calculated in line meter (m'). For wooden, glass, gypsum, acoustic or metal covers it should be calculated in square meter (m^2). All quantity should be calculated net, according to drawing and specification. The space for lamp, diffuser, loud speakers, sprinkler and others, should not be deducted from the ceiling area. For heat/sound insulation work, it should be calculated separately in square meter (m^2). Cornices and list should be calculated separately in line meter (m')	Include all tools, labour and supporting material needed (hangers) for fabrication, assembling and installation on right position. Ceiling trim, sound barriers, heat barriers should be calculated separately according to specification

7.7. FLOOR FINISHES: (B07)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-07-01	FLOOR	Floor is a part of work to cover the bottom part of a room/field, made of ceramic, granite, vinyl, carpet or others.	Floors should be measured in square meter (m^2) according to floor schedule, type and dimensions as mentioned in specification and drawing. Skirting, tread and riser of stairs should be measured in line meter (m')	Include all tools and labours and supporting materials, include polishing according to specification

7.8. ROOF: (B08)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-08-01	ROOF FINISHES	Roof finishes/roof covers is to protect the building from heat, rain water, dust ect. Made of singles, ceramic, zinc, concrete, etc	Roof covers should be measured in square meter (m^2). Ridge capping, gutters be measured in line meter (m') Water proofing, insulation and the like should be calculated separately, in square meter (m^2).	Include all tools and labours, and supporting materials (nail, screw and the like).
B-08-02	ROOF FRAME	Roof frame is to support the roof cover, made of	Wooden roof frame is measured in net dimension according to drawing and	Include all tools, labours, supporting materials as nails,

		concrete, steel, wood or the like	should be calculated in cubic meter (m ³), The waste should not be calculated as the quantity of the frame. Steel frame also measured in net dimension and should be calculated in line meter (m') or kg according to drawing and type /dimension of profile. Concrete frame can be calculated same with other reinforced concrete works.	anchors, rivet and the like as needed.
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7.9. FINISHING WORKS (B09)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-09-01	PAINTS, FURNISH	Painting, furnish are the finishing works on the plaster, wooden or the like to cover the surface that looks fine	The quantity should be measured in square meter (m ²). For cornice, hand rail and part that less than 30 cm wide should be measured in line meter (m').	Include all tools, labours, supporting materials, the first and second layer of base, putty and the like.
B-09-02	METAL WORKS	Include here all non structural metal work such as railing, balustrade, netting and any others artistic metal work.	The quantity should be calculated in square meter (m ²), except for cornice or the like in line meter (m')	Include all tools, labours and supporting materials for fabrication, assembling and installing on good condition, clean .

7.10. MECHANICAL WORKS: (B10)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-10-01	DIESEL GENERATING SETS	Generate power, with diesel machine as a prime mover to produce energy needed to turn the generator rotor	Measured in complete unit according to the specification.	Include all related works, installation, supporting materials, tools, equipment such as out door and indoor panel, Automatic Transfer Switch/Automatic Main Failure, testing and commissioning, operation manual
B-10-02	TRANSFORMER	Transformer is a fixed or moveable electrical machine, to change the primary electric power/tension to the secondary power/tension with constant frequency, through a pair magnetic and electromagnetic conduction.	Measured in complete unit according to the specification	Include all related works such as installation, lightning arrestor, cut – out, distribution panel, testing and commissioning, operation manual.

B-10-03	UNINTERRUPTIBLE POWER SUPPLY (UPS)	UPS is a reserve power supply tools in case of emergency	Measured in complete unit according to the specification	Include all related works such as installation, , testing and commissioning, operation manual.
B-10-04	AIR CONDITIONING (AC)	Air condition is equipment that is able to balance the temperature as needed. Compose of compressor, condenser, orife tube, evaporator, and expanse valves.	Measured in complete unit and sub unit, according to the drawing and specification	Include all related works to AC units, installations, supporting materials so that the AC would install on its position and provide temperature as needed. Including also commissioning test, operational and maintenance manual.
B-10-05	FIRE FIGHTING	Fire fighting are an associated fire fighting installation system such as : Fire hydrand with hosereel system, audio/visual advisory system, sprinkler system,gaseus extinguisher system, automatic fire alarm and & detection system, portable hand operated system, complete with installation system and control system.	Measured in unit and sub unit, according to the drawing and spesification	Include all related works, installations, and supported materials, testing and commissioning, operation manual
B-10-06	EMERGENCY FIRE FIGHTING	Emergency fire fighting is a portable fire fighting, just for emergency and small fire.	Measured in unit (each)	Include installation, and supporting materials to fix at the position stated in the drawing and specification
B-10-07	HORIZONTAL AND VERTICAL MOVEMENT SYSTEM (LIFT & ESCALATOR)	Horizontal and vertical movement system in a building is a system for movement of people, or goods/materials, in vertical or horizontal direction, such as lift, escalator, conveyor etc	Measured in complete unit (each), according to the specification and drawing.	Include all related works, supported materials to fix at the position stated in the drawing and specification, tesing and commissioning, operation manual
B-10-08	BUILDING AUTOMATION	Building Automation is an automatic associated/integrated all system in a building, reloaded to building management system.	Measured in unit and sub unit of IT, CCTV, Electrical, security, acces control system, AC system, fire system and the like	Include all related works, supported materials to fix at the position stated in the drawing and specification, tesing and commissioning, operation manual
B-10-09	FRESH WATER INSTALLATION	Fresh water installation is a system	Pipe should be measured in line	Include cutting, bending, pipe

		to accommodate the availability of fresh water in a building that meets health safety standard with certain capacity	meter (m'), including fittings length per-diameter, for pipe with diameter less than 3 inches. For pipe with diameter more than 3 inches, fittings should be calculated separately in pieces per-diameter. If the water source is from shallow/deep well or city water it should be calculated separately in unit or Lump Sum Pump and accessories should be calculated separately in unit complete	joint and fittings crossing with wall or floor. For fittings more than 3 inches diameter, the unit cost should be included in fitting's cost. For water, the cost should be included all tools, equipment and licensing. Fittings are elbow, bends, tees, unions, sockets, nipples and the like
B-10-10	WASTE WATER INSTALLATION	Waste water installation is an installation system for draining waste water in/out of the building, using pipe and fittings. Fittings are all accessories needed to connect pipes such as elbow, bends, tees, unions, sockets, nipples etc. All the pipes should be classified in types, diameter, method of connection and installations	Pipe should be measured in line meter (m'), for pipe with diameter less than 3 inches include fittings length per-diameter. For pipe with diameter more than 3 inches, fittings should be calculated separately in pieces per-diameter. For concrete/ceramic pipe, should be measured as long as the center line of pipes separately in diameter, measured in line meter (m') For sanitary fittings like elbow, bends, sockets, nipples etc. should be calculated separately in unit complete with accessories and should according to drawing and specification.	Include cutting, bending, pipe joining and fittings, crossing with wall or floor. For fittings more than 3 inches diameter, the unit cost should be included in the fitting's cost
B-10-11	(WWTP/STP)	Waste water treatment plant/ sewerage treatment plant is a complete treatment unit to process the waste water before converted to the city/public drain	Measured in complete unit and sub unit	Include all treatment installation, but not include the civil works, testing and commissioning, operation manual

7.11. ELECTRICAL WORKS: (B11)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-11-01	ELECTRICAL INSTALLATION	Electrical Installation is an installation inside the building start from main panel distribution (MDP) or main circuit breaker (MCB) to provide lighting point or power/socket point	All cables should be calculated separately in diameter and the type/kind of cables is in line meter(m') according to wiring diagram. For lamps, sockets, power switch and the like should be calculated in quantity each . For cable trunking is measured in line meter (m')	Include all insulation and supporting material, as built drawing, merger, testing and commissioning.
B-11-02	LIGHTNING ARRESTOR	Lightning arrestor is an installation to arrest the lightning by using Franklin system or any other such as radio active, etc.	Measured in a complete system in unit	Include all tools, supporting materials, earthing, testing and commissioning
B-11-03	SOUND SYSTEM	Sound system is an indoor/outdoor sound system installation	Measured in a complete unit system in unit and in accordance with design and specification	Include all accessories needed such as loud speakers, microphones, wiring, mixers etc.
B-11-04	INFORMATION AND TECHNOLOGY SYSTEM(IT)	IT system is an integrated installation system for communication and information line	Measured in a complete unit system, measured in unit.	Include all licenses needed, software, hardware, and supporting material needed. Install according to specification

7.12. EXTERNAL WORKS: (B12)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-12-01	BOUNDARY FENCE	Boundary fence is a permanent fence surround the building area for safety and aesthetic, consisting of bricks, stone or steel	The fence measured in line meter, and the door measured in unit	Include all construction aid such as foundation, paint, fabrication and transportation that install on the location according to drawing and specification.
B-12-02	INTERNAL ROAD AND PARKING	Road and parking area inside the boundary.	Measured in square meter (m ²). Kerbs measured in line meter (m')	Include traffic marking needed.
B-12-03	LANDSCAPING	All landscaping work inside the boundary	Grass should be measured in square meter, and plantation in unit (each), according to the kind of plantation	Include fertilizers, and maintenance to guarantee the proper growth of grass and

				plantation
B-12-04	FITTING AND TOOLS	Fittings and tools mean all necessary play ground, out door chairs needed in garden	Measured in unit according to the type/kind of fittings/tools	Include all necessary supporting construction/tools
B-12-05	DRAINAGE	An outside drainage system integrated with inside drainage in the building	The canal and the culvert are measured in line meter (m'), manhole and other is in unit (each)	Include excavation, filling and masonry needed

7.13. FINAL SITE CLEARING: (B13)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-13-01	GENERAL CLEANING	General cleaning outside the building but still within the boundary in order to prepare for external works like garden, parking etc.	Measured in square meter (m ²). Prepared field for external building facilities such as parking, landscaping, park etc.	Include all cleaning of debris/rubbish and throw them out of site location

7.14. FURNITURE: (B14)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-14-01	FURNITURE	All kind of furniture needed for each room	Measured in unit/pair (each) according to furniture schedule and drawing.	Include all supporting material and fix at the determined position.

7.15 EQUIPMENT: (B15)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-16-01	EQUIPMENT	All special tools or equipment not mention in other item, such as kitchen utensil, gondola, medical equipment/tools, boilers etc.	Measured in complete unit (each)	Include all supporting materials, fixing at the position, testing and commissioning

7.16. GENERAL EXPENSES: (B16)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-16-01	GENERAL EXPENSES	General expenses are all non physical cost/expences needed to support the progress of the project, such as project management cost, insurances etc	Should be described per-item, such as insurance, ceremonial cost, social cost, bank guarantee, etc, in Lump Sum	All general expenses should be described in cost structure/cost breakdown schedule and valid as a pay item

7.17. PROFIT: (B 17)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-17-01	PROFIT	Profit is a sum calculated as the profit of contractors according to the Government regulation.	Profit should be calculated as % from the Total Net Project Cost	Total Net Project Cost can be seen in item 7.0. (Method of Measurement)

7.18. PROVISIONAL SUM: (B18)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-18-01	PROVISIONAL SUM	A certain value that is reserved for a particular work but has not yet calculated its cost at the time of contract agreement.	It should be determined by owner in USD, and included in the contract amount	Can only be used upon the written order of project owner

7.19. CONTINGENCY: (B19)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-19-01	CONTINGENCY SUM	A certain value that is reserved for a particular work that has not known yet for its usage.	It should be determined by owner in USD, and include in the contract amount	Can only be used upon the written order of project owner

7.20. CONSULTANT FEE: (B 20)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-20-01	CONSULTANT FEE	Fee for design and supervision consultant.	It should be calculated based on Standard Fee for Consultant in Timor Leste	For design consultant included but limited to feasibility study, pre- design, detail design, specification, BOQ, Cost Estimate, that support the owner in the pre-bid meeting. For supervision consultant included but not limited to daily, weekly and monthly report, day by day supervise the

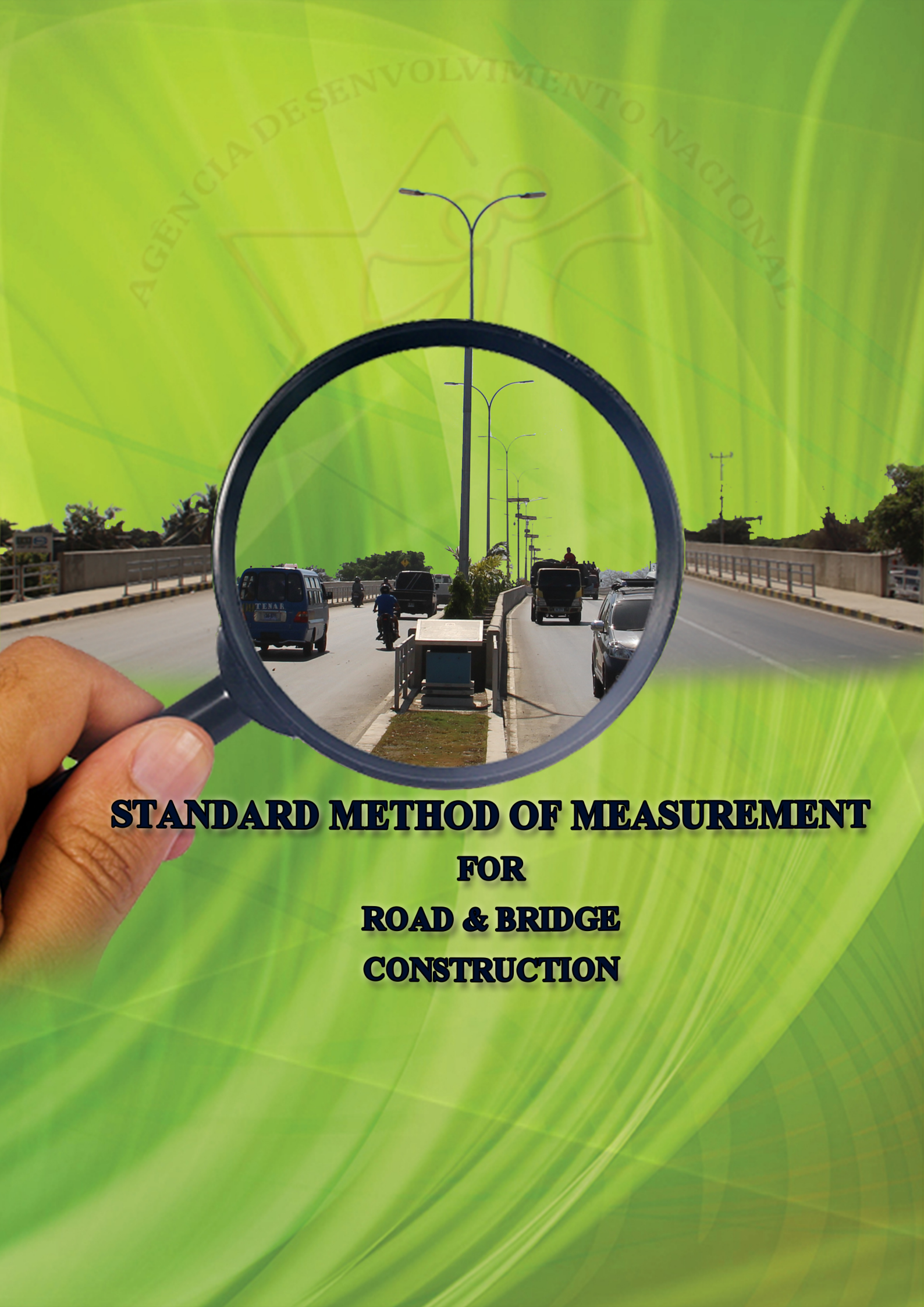
				contractor's works, approve all shop drawing, as built drawing, and final report
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7.21. PMU COST: (B21)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-21-01	PMU COST	PMU cost is a specific fund allocated to project for the purposes of Project Management Unit, in performing project management activities	PMU cost should be calculated based on the certain percentage from Total Net Project Cost. List of PMU cost for various type of building could be seen in Standard Fee for Consiltant.in Timor Leste.	Total Net Project Cost can be seen in item 7.0. (Method of Measurement)

7.22. TAX: (B22)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-22-01	TAX	The income tax according to the government of Timor Leste regulation	Calculated by a certain percentage from the Total Net Project Cost	Integrated in Total Gross Project Cost as Total Project Budget (Orsamento)



**STANDARD METHOD OF MEASUREMENT
FOR
ROAD & BRIDGE
CONSTRUCTION**

1.0. DOCUMENT TITLE

The title of this document is TIMOR LESTE STANDARD METHOD OF MEASUREMENT – 2 , For Road and Bridge, Second Volume (January 2016), which is abbreviated to TL-SMM – 2.

TL-SMM-2 is intended to be utilized in conjunction with the General Condition of Contract, General Specifications or any other relevant provisions provided elsewhere in the Contract Document.

The works shall be itemized and described in Bill of Quantities in sufficient details to enable Contractors to price it adequately and the method of measurement shall be stated in the Preamble to the Bill of Quantities. The preamble shall state the methods of measurements other than TL-SMM-2, if any, which are adopted while preparing the Bill of Quantities and to be used for measurement of completed parts of the Works. Such method of measurement shall comprise those not covered by TL-SMM-2.

2.0. OBJECTIVE

The objective of TLSMM-2 is to set forth the procedure according to which the Bill of Quantities shall be prepared, priced and the quantities expressed and measured.

3.0. DEFINITIONS

- 3.1. In this document and in Bills of Quantities prepared according to the procedure set forth herein the following words and expressions have the meanings hereby assigned to them, except where the context otherwise required
- 3.2. "Condition of Contract" means the "General Condition of Contract" as provided in the Bidding/Contract Documents prepared by Owner
- 3.3. Word and expression defined in the Condition of Contract have the same meaning herein
- 3.4. All references to clauses are references to clauses numbered in the Condition of Contract and reference to paragraphs are references to paragraphs numbered herein
- 3.5. The word "Work" includes work to be carried out, goods, materials and services to be supplied, and the liabilities, obligations and risks to be undertaken by the Contractor under the Contract
- 3.6. The expression "expressly required" means as shown on the Drawings or as described in the Specifications or as instructed by the Engineer pursuant to the relevant provisions of Condition of Contract
- 3.7. "Day work" means the method of valuing work on the basis of time spent by the workmen, the materials used and the plant employed
- 3.8. "Original Ground Surface" means the surface of ground before any work has been carried out
- 3.9. "Final Excavated Surface" means the surface indicated on the Drawings to which excavation is to be carried out
- 3.10. "Commencing Ground Surface" for an item in a Bill of Quantities means, the surface of the ground from where that particular item of work has commenced
- 3.11. "Excavated Ground Surface for an item in the Bill of Quantities means, the surface to which final excavation included in that particular item of work is to be carried out.

4.0. GENERAL PRINCIPLES

4.1. Unit of measurement

The unit of measurement for each item shall be stated for the item in the TLSMM-2. The unit of measurement stated against a descriptive feature in the TLSMM-2 shall apply to all items to which that descriptive feature applies. Meter, Kilogram, Second (MKS) system of units has been adopted in this TLSMM.

In describing the dimension of a certain works, its sequence should be as followed, length, width and height or thickness.

Each work should be calculated its net volume, excluding its disposal, overlapping, compactness, widening etc. For all items either stated in this TL-SMM-2 or not such as transportation, warehouse, permit, loading and unloading, etc will be calculated in unit price of its work.

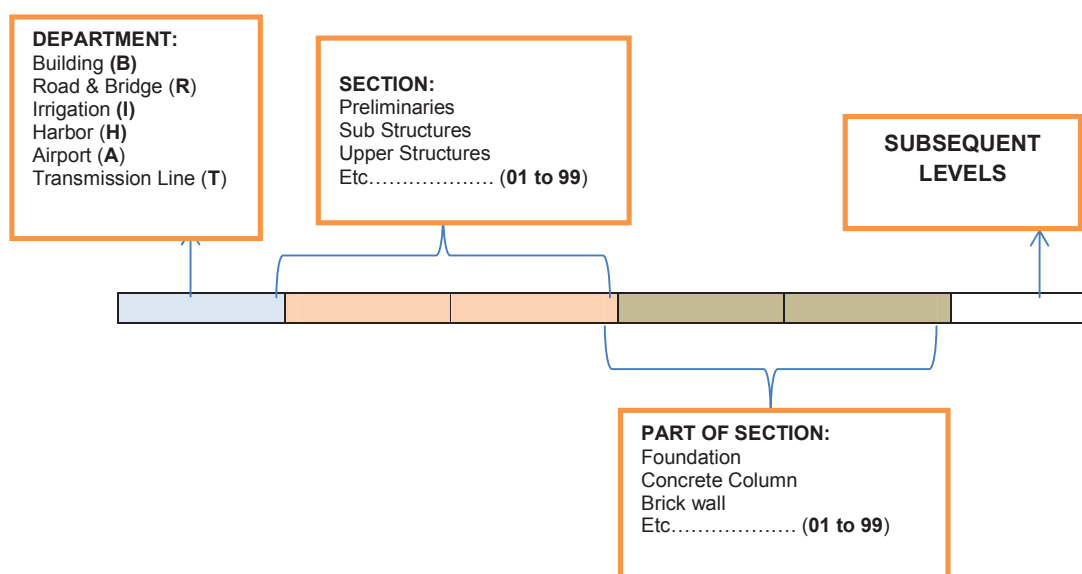
The unit of each work will follow the unit as stated in point 5.0.

The volume is rounded to two (2) decimal digits, ex. 1,234.78 not 1,234.7765.

4.2. TL-SMM Codes - 2

Works are classified into various “Sections”. Unique code has been allocated to each item of work for its identification and presentation in the TL-SMM – 2, Bill of Quantities and elsewhere. Coding arrangement is as given hereunder:

- . First digit represents the “Department”
- . Next two digits represent the “Section”
- . Next two digits represent the “sub Section”
- . Next digits represent the subsequent levels



4.3 Sub Section

Each part of the Section would be defined to execute and measure for payment.

4.4 Measurement Rules

Measurement rules set out the conditions under which work shall be measured and the method by which the quantities shall be computed. In addition to measurement rules, following general conditions shall also apply:

- a. Quantities of acceptable completed work relating to any part of specification shall be computed net using dimensions from the drawing and as per method given in this document except otherwise specified in special provisions or else in contract documents. No allowance shall be made for bulking, shrinkage or wastage.
- b. All the work to be measured related to any part of specification, if required, shall be classified and measured separately as per Bill of Quantities.
- c. The contractor is not entitled to claim difference in quantity calculated by the standard method of measurement and actual quantity as per site of a specific item except provision made herein, special provisions, or elsewhere in the contract documents.

4.5 Definition

Definition rules define the extent and limits of the item of work represented by a word or expression used in the work classification and in the Bill of Quantities prepared in accordance with TLSMM – 2.

4.6 Measurement Coverage

Measurement coverage provides that the work stated is deemed to be included in the appropriate items to the extent that such work is included in the Contract. In addition to coverage rules, following general conditions shall also apply :

- a. Loading, unloading and transportation of material related to any item of work
- b. All the items and activities in TLSMM – 2 shall deem to be included all operations required to perform the work as per Contract Document.
- c. Additional coverage rule which are necessary for complete understanding of method of measurement are given against relevant item or activity.

4.7 Additional Descriptions

Additional descriptions which are necessary for complete understanding of works/activities covered under method of measurement are provided against such particular item of work.

5.0 UNITS AND ABBREVIATIONS

The following units of measurement and abbreviations shall be used:

Unit	Abbreviation
Millimeter	Mm
Meter	M
Square millimeter	mm ² or mm2
Square meter	M ² or M2
Hectare	Ha
Cubic meter	M ³ or M3
Kilogram	Kg
Tone	Ton
Metric Tone	M.Ton
Summary	Sum
Number	No.
Horse Power	Hp
Week	Wk
Litre	Ltr
Lump Sum	Ls
Hour	Hr
Day	Dy

6.0 CONVERSION TABLE

To convert	Into	Multiply
LENGTH		
Millimeter	Inch	0.03937
Inch	Millimeter	25.40005
Meter	Foot	3.28084
Foot	Meter	0.3048
Meter	Yard	1.09361
Yard	Meter	0.9144
Kilometer	Mile	0.62137

Mile	Kilometer	1.60935
MASS WEIGHT		
Kilogram	Pound	2.20462
Pound	Kilogram	0.45359
Gram	Ounce	0.03527
Ounce	Gram	28.34949
Kilogram	Quintal	0.01
Milligram	Grain	0.01543
Kilogram	Hundred Weight	0.01968
Hundred weight	Tone	0.0508
Kilogram	Tone	0.001
Kilogram	Ton	0.00098
Pound	Ton	0.00045
Tone	Ton	0.98421
Kilogram	Seer	1.01605
Kilogram	Maund	0.02679
Gram	Tola	0.08573
Kilo Newton	Ton	0.1
Ton	Kilo Newton	10
Kilo Newton	Kilogram	100
Kilo gram	Kilo Newton	0.01
VOLUME		
Litre	Pint (UK)	1.75975
Litre	Gallon (imperial)	0.21997
Litre	Gallon (US)	0.26417
Litre	Cubic Foot	0.3531
Litre	Cubic Meter	0.001
Cubic Foot	Liter	28.31682
Milliliter	Fluid ounce	0.0352
Gallon Imperial	Liter	4.5461
Gallon US	Liter	3.78541
Gallon Imperial	Gallon US	1.20095
Cubic millimeter	Cubic inch	0.00006
Cubic meter	Cubic foot	35.31472
Cubic foot	Cubic meter	0.02832
Cubic meter	Cubic Yard	1.30795
Cubic yard	Cubic meter	0.76456
AREA		
Square millimeter	Square inch	0.00155
Square inch	Square millimeter	645.1613
Square meter	Square foot	10.76392
Square foot	Square meter	0.0929
Square meter	Square yard	1.19599
Square yard	Square meter	0.83613
Square meter	Acre	0.00025
Hectare	Acre	2.47105
Acre	Hectare	0.40469
Square meter	Hectare	0.0001
Square kilometer	Square mile	0.3861
Square mile	Square kilometer	2.58999
Hectare	Square mile	0.00386
Square mile	Hectare	258.9989
MASS/UNIT AREA		
Kilogram per square kilometer	Ton per square mile	0.00255
Kilogram per square meter	Pound per square foot	0.20482
Pound per square foot	Kilogram per square meter	4.88243

Kilo gram per centimeter square	Kilo Pascal (kPa)	100
Kilo Pascal (kPa)	Kilo gram per centimeter square	0.01
Kilo Pascal	Mega Pascal (MPa)	0.001
Mega Pascal (MPa)	Kilo Pascal	1000
MASS PER UNIT VOLUME		
Kilogram per cubic meter	Pound per cubic foot	0.06243
Grams per liter	Pound per cubic foot	0.06243
Pound per cubic foot	Kilogram per cubic meter	16.01845
Pound per cubic foot	Grams per liter	10.01845
Ton per meter cubic foot	Kilo newton per meter cubic	10
Kilo newton per meter cubic	Ton per meter cubic	

In converting unit from one system to other system the measurement shall be taken nearest to three digits for MKS system and nearest to two digits for FPS system.

7.0 METHOD OF MEASUREMENT

Section 01: General

Section 02: Drainage

Section 03: Earth Work

Section 04: Pavement widening and Shoulder

Section 05: Granular sub-base and base

Section 06: Soil and Granular Material Stabilization

Section 07: Bituminous Pavement

Section 08: Structure

Section 09: Reinstatement of Existing Structure and Minor Works

Section 10: Day Work

Section 11: Routine Maintenance

TOTAL NET CONSTRUCTION COST, (A)

Section 12: Cleaning

TOTAL NET PROJECT COST, (B = A + 12)

Section 13: General Expenses

Section 14: Profit

Section 15: Provisional Sum

Section 16: Contingency

Section 17: Consultant Fee

Section 18: PMU Cost

Section 19: Tax

TOTAL GROSS PROJECT COST, C = B+(13+14+15+16+17+18+19)

EXAMPLE OF GENERAL EXPENSES DETAILS (Section:13)

1. Material Samples including Quality Testing
2. Security
3. Occupational Health and Safety
4. Project Team/Staff Fees
5. Provisional Fee for Performance Bank Quarantees, Down payment, Retention Fee, ect.
6. Work Insurance Fee, Labor Insurance Fee
7. Communication Cost
8. Inauguration Fee
9. Rental fee for Lot/house/vehicles
10. Report Fee
11. Gathering/Meeting Fee
12. Social Fee
13. Other Non-Physical Fee for each project

7.1. GENERAL: (R-01)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-01-01	MOBILIZATION	Mobilization is a primary activity done by contractor to mobilize personnel, construction equipment, quality testing facilities and other facilities and license before project is started	Each personnel, construction equipment, quality testing facility and license shall be specified in detailed their types and specifications to facilitate the calculation of mobilization cost. Unit of measurement is Lumpsum .	In calculating mobilization cost shall include transportation, shipping, loading/unloading, license, rental/purchase fee and other social costs.
R-01-02	DEMOBILIZATION	Demobilization is final activities done by the contractor to demobilize personnel, construction equipment, and other facilities that are no longer used for project.	Each personnel, construction equipment, quality testing facility and license shall be specified in detailed their types and specifications to facilitate the calculation of mobilization cost. Unit of measurement is Lumpsum .	In calculating of demobilization cost, shall include transportation, shipping, loading/unloading, license, rental/purchase and other social cost.
R-01-03	LAND PROVISIONING FOR BASE CAMP	Land provisioning for base camp is an activity done by the contractor to purchase or rent land for constructing base camp with its area in accordance with contract	The area of land purchased or rented should be as required The measurement is in Lumpsum	Provisioning of land for base camp shall include renting fees and licensing fee as needed.
R-01-04	BASE CAMP CONSTRUCTION	Base camp is a temporary facility that shall be constructed by the contractor for project implementation in accordance with contract, include: a. Field Office; b. Accommodation; c. Quality Laboratory; d. Workshop; e. Warehouse; f. Crushing Plant; g. Asphalt Mixing Plant; h. Batching Plant; i. Casting yard, and j. Access Road	Each facility should be detailed: a. Field Office (m ²); b. Accommodation (m ²); c. Quality Laboratory (m ²); d. Workshop (m ²); e. Warehouse (m ²); f. Crushing Plant (unit); g. Asphalt Mixing Plant (unit); h. Batching Plant (unit); i. Casting yard (unit), and j. Access Road (m ²). The Measurement unit is in Lumpsum .	Include furniture, tools and necessary accessories.

R-01-05	DEMOLITION	Demolition is contractor activity to demolish the existing building which locates within the corridor of planned area for construction	Measurement of demolition shall comply as stated in BOQ and the payment shall be in Lumpsum .	Unit price of demolition work shall include equipment, manpower, license, pacification, and disposal hauling to decided location.
R-01-06	RELOCATION OF UTILITY	Relocation of utility is an activity that shall be done by the contractor to move obstructed utilities which will hamper work implementation in the decided location. Relocation of utilities shall include: - Electrical Pole and cable - Telephone pole and cable - water supply pipe - gas supply pipe - underground cable - traffic light - traffic sign - fences	Specified in detailed and shall be paid in Lumpsum .	Including transportation, accommodation and necessary Permit fee.

7.2. DRAINAGE: (R-02)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-02-01	SIDE DITCH AND DRAINAGE CHANNEL	Side ditch is a channel to canal the runoff surface water. Drainage channel is a channel to canal and hold water coming from side ditch.	Quantity measurement of side ditches and drainage channel is in m³ .	Including transporting disposal material to decided location.
R-02-02	MORTARED STONE WORKS	Mortared stone work is lining the side wall and bottom of the channel, constructing aprons and entry pits with mortar cement stone in accordance with design and specified materials.	The measurement of the work volume is in m³	a. Mortared stone work include: - Both side of the channel. - Bottom of the channel. b. Mortar side work is excluded from excavation works.
R-02-03	CULVERT	Culvert is water crossing channel beneath road surface with type, shape	Work volume of culvert is calculated in linear meter (lin.	Including: installing and joining the

		and dimension in accordance with design, which has function to channeling water from one side to other side of the road. The types of culverts are as follow: a. plain concrete pipe b. reinforced concrete pipe c. corrugated steel pipe d. reinforce concrete plate on stone masonry channel e. reinforced concrete box	m)	culvert.
R-02-04	SUB - SURFACE DRAINAGE	Sub-surface drainage is a drainage system constructed under the surface of the road with type, shape, dimension and depth shall be in accordance with drawing and its material shall comply with specifications	Quantity of sub-surface drainage is calculated per item of material used with the following rules: • Backfill : (m ³) • Granular Material: (m ³). • Geotextile : m ²) • perforated pipe : (linear m)	Including: installation of perforated pipe, compaction of granular and backfill material but excluding the excavation and disposal hauling.

7.3. EARTH WORK: (R-03)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-03-01	EXCAVATION	Excavation is digging of soil, rock, mud, and existing pavement with geometric, shape and dimension in accordance with drawings	Calculated in M3	Excavation work shall include hauling of disposal to decided location
R-03-02	EMBANKMENT	Embankment is heaping up materials based on the specification and drawing plan	Quantity measurement of embankment work is in m³	Embankment work include: a. Material hauling, spreading and compacting. b. Quality testing of material and field density of embankment
R-03-03	SUBGRADE PREPARATION	Preparation of subgrade is preparing, sacrificing and compacting subgrade surface for placement of aggregate	Quantity measurement of subgrade preparation work is in unit of m² .	Subgrade preparation work shall include: a. Leveling and profiling

		sub-base, unsealed road base, soil cement base in those areas of the carriage way with dimension, line and grade as shown in drawing.		b. Quality testing of material
R-03-04	CLEARING AND GRUBBING	Is clearing and grubbing the surface ground with thickness as specified.	Quantity measurement is calculated along corridor of road length (ROW) in m^2	Clearing and grubbing work include: a. Grubbing stumps as well as grass and trees with less than 15 cm in diameter. b. Hauling of disposal to decided location.
R-03-05	TREE REMOVAL	Tree removal is removing of all trees measuring 15 cm or more in diameter which grow within corridor of road length RIDE OF WAY (ROW)	Quantity of tree removal shall be calculated by each classified diameter as below: - diameter 15-30 cm - diameter 30 – 50 cm - diameter 50 – 75 cm In principal the diameter of tree is measured at 1.m above the surface level. Except for local palm tree in which its diameter is measured at 0.30 m above the ground surface.	Tree removal work shall include hauling of disposal to decided location.

7.4. PAVEMENT WIDENING AND SHOULDER: (R-04)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-04-01	PAVEMENT WIDENING	This work of extending width of existing pavement based on the drawing.	Measurement of quantity shall be based on the following: a. excavation of bituminous pavement : (m^2) b. excavation of granular base : (m^3) c. construction of new granular base : (m^3)	Pavement widening work shall include: a. excavation of the existing pavement b. disposing materials resulting from excavation to decided location

			d. construction of new bituminous pavement : (m ²) e. spraying bituminous tack coat and prime coat : (m ²)	c. compacting subgrade d. spreading and compacting new granular base e. spraying bituminous prime coat f. spreading and compacting new bituminous layer g. Spraying bituminous tack coat. h. quality testing of materials
R-04-02	SHOULDER	Shoulder is part of the road located along outer edge of pavement with dimension, line and grade shown in the drawing. There are two types of shoulder, i.e.: a. Granular Shoulder, b. Bituminous paved shoulder	Quantity measurement of the shoulder shall be based on the following: a. granular shoulder: m3 b. Bituminous paved shoulder: m2	Include: a. Granular shoulder Provisioning, hauling, spreading, and compacting of material b. Bituminous paved shoulder Provisioning, mixing, hauling, spreading, and compacting and also spraying of prime coat. c. quality testing of material and field quality control.

7.5. GRANULAR SUB-BASE AND BASE (R-05)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-05-01	SUB-BASE COURSE	Sub-base course is part of the pavement on prepared subgrade with thickness, dimension, line, and grade as shown on the drawing and use material that comply with specifications.	Quantity measurement of subbase shall be in m ³	Sub-base course work shall include: a. Provisioning, hauling, spreading and compacting b. quality testing of materials and field quality

				control
R-05-02	BASE COURSE	Base course is a part of the pavement on prepared subbase with thickness, dimension, line and grade as shown on the drawing and use material that comply with the specifications	Work volume of base course is calculated in m³	This work includes: a. Provisioning, hauling, spreading, and compacting. b. Quality testing material and field quality control.
R-05-03	GRANULAR PAVEMENT	Granular pavement is construction of aggregate pavement without bituminous cover according to the specification and drawings.	The quantity measurement of the granular pavement shall be in m³	Granular pavement work shall include: a. Provisioning, hauling, spreading, and compacting; b. Quality test of material and field quality control.

7.6 SOILS AND GRANULAR MATERIAL STABILIZATION (R-06)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-06-01	SOIL CEMENT BASE	Soil cement base is base course using soil or aggregate mixed with certain portion of Portland cement, with thickness, dimension, line and grade as shown in the drawing and shall have compressive strength in accordance with the specifications after compacted	Quantity measurement of soil cement base are as follow: a. soil or aggregate : m³ b. Portland cement ; tons	Soil cement base shall include: a. Provisioning and hauling of materials, mixing, spreading and compacting. b. Quality testing of material and field quality control.
R-06-02	CEMENT TREATED BASE	Cement treated base is base course using Portland cement aggregate mixture with thickness, dimension, line and grade as shown on the drawing and the composition of material shall comply with specifications	The following rules shall applied for quantity measurement of cement treated base: a. aggregate material : m³ b. Portland cement : tons	Soil treated base shall include : a. provisioning and hauling of materials, mixing, spreading, and compacting b. quality testing of materials and field quality control
R-06-03	SOIL-LIME STABILIZATION	Soil-lime stabilization is base or subbase using lime-soil mixture with	The following rules shall be applied for quantity	Soil-lime base work shall include:

		thickness, dimension, line and grade as shown on the drawing and the mixture composition shall comply with specifications	measurement a. soil : m^3 b. lime : tons	a. provisioning, and hauling of materials, mixing, spreading, and compacting b. quality testing of material and field quality control
R-06-04	BITUMINOUS STABILIZATION	Bituminous stabilization is base course using granular material mixed with bituminous material with composition shall comply with specification and the thickness, dimension, line and grade as shown on the drawing.	The following rule shall be applied for quantity measurement: a. granular material : m^3 b. Bituminous materials : tons	Include: a. provisioning and hauling of materials, mixing, spreading and compacting b. quality testing of materials and field quality control
R-06-05	CHEMICAL STABILIZATION	is soil mixed specified chemical substance by certain composite on to improve its performance and strength as to improved subgrade, subbase and base course	Quantity measurement of chemical stabilization is calculated in m^3	Chemical stabilization shall include: a. Provisioning, hauling, mixing, spreading and compacting. b. Quality testing of materials and field quality control

7.7 BUTIMINOUS PAVEMENT: (R-07)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-07-01	PRIME COAT	Prime coat is bituminous binder will be sprayed homogenously on dust free and dry surface of granular base course, before spreading asphaltic layer.	Quantity measurement is in m^2	Prime coat work shall include: a. removing loose dirt and other objectionable material from surface of granular base b. spraying prime coat materials evenly throughout the surface based on the

				specification c. quality testing of prime coat and field spraying test
R-07-02	TACK COAT	Tack coat is bituminous binder sprayed homogenously and uniformly on dust free and fully dry surface of asphaltic layer, before spreading next asphaltic layer.	Measured in unit of m^2	Tack coat work shall include: a. Cleaning the whole surface. b. Spraying tack coat evenly to whole surface. c. quality testing of tack coat and field spraying test
R-07-03	SAND SHEET	Sand sheet is thin layer of wearing course with thickness, dimension, lines and grade as shown on drawing, consist of sand and bituminous material, mixed, spreaded and compacted in hot condition at a certain temperature in accordance with specifications	Measured in m^2	Sand sheet work shall include: a. Provisioning, mixing, spreading, and compacting. b. Prior to spreading conducting the surface compaction. 1. Clearing, 2. Spreading tack coat. 3. Material quality testing and field quality control.
R-07-04	HOT ROLLED SHEET	Hot rolled sheet is wearing course or base course with thickness, dimension, line and grade as shown on drawing, consist of granular materials mixed, spreaded and compacted in hot condition at a temperature and composition in accordance with specification. The thickness of Hot rolled sheet is 40mm	Quantity of hot rolled sheet work shall be measured in m^2	Hot rolled sheet work shall include: a. Surface Provisioning: • Cleaning • Tack Coat b. Material Provisioning, Mixing, spreading, and compacting. c. Quality testing of materials and field control
R-07-05	HOTMIX ASPHALTIC	Hotmix asphaltic concrete is constructing or	The work volume of hotmix Asphaltic	AC-BASE work shall include:

	CONCRETE	assembling rigid asphaltic layer on its rigid base. Its composition are : course aggregate, fine aggregate, filler, asphalt which then mixed, spreaded and compacted in hotmix in accordance with drawing .	concrete is calculated in unit: • AC-base (m^3) • AC-Binder (m^2) • AC wearing (m^2)	a. Provisioning materials, mixing, spreading, and compacting. b. Quality testing of material and field quality control
R-07-06	ASPHALT TREATED BASE = ATB, AND ASPHALT TREATED SUB BASE = ATSB)	ATB is hot mix of aggregate bituminous mixtures as base or subbase, with thickness, dimension, lines and grades as shown in drawing, quality of material and composition should be in accordance with specification	Asphalt treated base is measured in m^3	AC-BC work shall include: a. Provisioning, hauling, mixing, spreading and compacting b. Quality test of materials and field quality control.
R-07-07	BITUMINOUS COLD MIX	Bituminous coldmix is pavement with thickness, dimension, lines and grades as shown on drawing; consist of aggregate and bituminous material, mixed, stored, spreaded and compacted in cold condition	Quantity of bituminous cold mix shall be measured in m^3 as approved by Engineer.	Bituminous coldmix shall include: a. Provisioning, hauling, mixing, storage, spreading, and compacting b. Quality test of material and field quality control
R-07-08	PENETRATION MACADAM	Penetration Macadam is a regulating course of stabilized aggregate bitumen with thickness, dimension, line and grade as shown on drawing; consist of course aggregate, key aggregate and cover aggregate in accordance with specifications. Penetration on macadam may function as base.	Quantity of penetration macadam is measured in m^3 as agreed by the project owner	Penetration macadam pavement shall include: a. Provisioning and hauling of materials, spreading, compacting. Bituminous spraying on every surface that has been compacted. c. Quality test of materials and field quality control.
R-07-09	SURFACE	a. Surface dressing is:	The volume of	Surface dressing

	DRESSING	Installation of the thin layer on the rough surface on the existing road by spraying hot liquid asphalt, then overlay with chipping in accordance with specification. b. There are 2 types of surface dressing structure: • Single Surface Dressing. • Double Surface Dressing.	surface dressing work is calculated in: (m^2).	work include: a. Cleaning the asphalt surface to be overlaid. b. Provisioning of materials c. Spraying hot liquid asphalt. d. Overlaying and chipping. e. Quality test of materials and field quality control.
R- 07-10	SANDING	Sanding is a maintenance work of the existing pavement surface by spraying bitumen binder on the surface and dry cleaned sand	Quantity of sanding is measured in m^2	Sanding work shall include: a. Provisioning, bitumen heating, and spraying and spreading of sand. b. Quality test of materials and field quality control.

7.8. STRUCTURE: (R-08)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-08-01	CEMENT CONCRETE	Cement concrete is construction of all concrete structures, including reinforced, plain concrete, cast in place or precast and composite with thickness, dimension, lines, level and grade as shown on the drawing.	Quantity of concrete structure is measured in m^3	Construction of cement concrete includes: a. Provisioning material, mixing, Pouring, compacting, and curing • Lean Concrete • Reinforced Concrete • Pre Cast and cast in situ prestressed concrete b. Quality test of materials and field quality

				control.
R-08-02	PRESTRESSED CONCRETE	Prestressed concrete is constructing of structures with shape, dimension, line, and grade as shown on drawing. By using precast, prestressed, cast in place, either post tension or pre-tension and shall use materials in accordance with specification	Quantity of prestressed concrete structure is measured with following rules: a. Precast prestressed concrete girder : each b. diaphragm : m³ c. stressing wire : kg	Prestressed concrete structure shall include: a. fabrication, transportation/ship ping, storage, joint and erection/ launching b. Quality test of materials and field quality control
R-08-03	REINFORCING STEEL	Reinforcing steel is furnishing and placing reinforced steel with type, shape, diameter, length and quality based on the specification.	Quantity of reinforcing steel is measured in kg	Reinforcing steel shall include: a. Furnishing, transportation, and storage b. Fabrication (cutting and bending) c. installation d. Quality test of materials and field quality control.
R-08-04	STRUCTURAL STEEL	Structural steel is construction steel girder with type, shape, dimension, level , lines and grade as shown on drawing and the steel quality is in accordance with specifications.	Quantity of structural steel shall be measured in Kg	Structural steel work shall include: a. Provisioning, transporting, fabricating and storage b. Erecting/ launching.
R-08-05	STEEL TRUSSES BRIDGE	Steel trusses bridge is a construction of bridge by using steel trusses with type, shape, dimension, level, lines and grade as shown on drawing and the steel quality is in accordance with specification	Quantity of steel truss bridge is measured in Kg	Structural steel work shall include: a. Provisioning, transporting, fabricating and storage b. Erection/ launching.
R-08-06	PILE FOUNDATION	Pile foundation is construction of foundation	Quantity of construction of	Construction of pile

		to support bridge structures, consisting of timber, reinforced concrete, prestressed concrete and steel pile, with shape, dimension, length and configuration as shown on drawing and the quality shall be in accordance with specifications. There are two types of pile foundation: a. Driven Pile - Timber Pile - steel pile - reinforced concrete - prestressed concrete b. Cast in place - Bore pile	pile foundation is measured as follow: a. furnishing timber pile : m^3 b. furnishing of reinforced concrete pile : lin. m c. Furnishing of prestress concrete : lin. m d. furnishing steel pile: lin. m e. driving pile: lin. m f. construction of bore pile: lin.m g. construction of concrete sheet pile: m^2 h. construction of steel sheet pile : m^2	foundation shall include: a. Furnishing, transporting, storing, precast concrete casting, boring and driving. b. Quality test of material and field quality control.
R-08-07	OPEN CAISSON FOUNDATION /WELL FOUNDATION	Open caisson foundation is a construction of open caisson to support bridge structures, with shape, dimension, elevation and depth as shown on the drawing and the quality of materials should be in accordance with specification.	Quantity of open caisson foundation is measured in lin. m	Construction of caisson foundation shall include: a. Provisioning of caisson wall : • Segmental precast • Cast in situ b. installing caisson wall
R-08-08	MORTAR CEMENT	Cement mortar is producing and applying mortar cement to use in various work, consisting of Portland cement and sand mixed with water in composition and quality as stated in specification.	Quantity of cement mortar work is measured in m^3	Cement mortar shall include: a. Provisioning and mixing of material and finishing. b. Quality test of materials
R-08-09	STONE MASONRY	Stone masonry is construction of structure with shape, dimension, lines and grades as shown on the drawing, consisting of stone with diameter 10-20 cm and mortar cement in accordance with specifications.	Quantity of stone masonry work is measured in m^3	Construction of stone masonry structure shall include: a. supplying of materials; b. stone assembly with mortar cement c. Quality test of

				material and field quality control. Excavation and lean concrete laying are excluded from construction of stone masonry.
R-08-10	RIP RAP	Riprap is constructing of surface scour protection composed of erodible material that consist of stone formation with 40-50 cm in diameter with shape, dimension, level, lines and grade as shown on the drawing.	Quantity of riprap is measured in m³	Construction of riprap shall include: a. Provisioning materials b. Stone assembly
R-08-11	GABION	Gabion is construction of scour protection or retaining wall with type, shape, dimension as shown on drawings, consisting of wire mesh boxes filled with stone 10-20 cm in diameter.	Quantity of gabion is measured in m³	Construction of gabion shall include: a. Material provision b. Structure installation
R-08-12	BLINDING STONE	Blind stone is a construction underlying of foundation base consisting of stone grouted with mortar cement with thickness, dimension, lines and grades as shown on drawing.	Quantity of blinding stone is measured in m³	Construction of blinding stone shall include: a. Preparation of soil bed surfaces. b. Supplying and installing
R-08-13	EXPANSION JOINT	Expansion joint is supplying and installing metallic or elastomeric deck joints, fillers, sealers, and joint structures in accordance with drawing and specification.	Quantity of expansion joint is measured in lin.m as agreed by project owner.	Construction of expansion joint shall include: a. supplying and installing of materials b. Quality test of materials.
R-08-14	BRIDGE BEARING	Bridge bearing is the furnishing and erecting metal or elastomeric bearing to support deck beams and slabs as indicated on the drawings	Quantity of bridge bearing is measured as follow: a. Elastomeric bearing : each b. strip bearing : lin.m	Bridge bearing shall include: a. Preparation of surface for direct setting of bearing, preparation of bedding. b. Quality test of materials
R-08-15	BRIDGE RAILING	Bridge railing is a construction of rail along both side of the bridge,	Quantity of bridge railing is measured in lin.meter	Construction of bridge railing shall include: provision

		such as galvanized and reinforced concrete with type, shape, dimension, lines and grades as shown on the drawing		materials, fabrication, and installation.
R-08-16	BRIDGE NAME BOARD	Bridge name board is the furnishing and installation of bridge name plate based on the drawing	Quantity of bridge name plate is measured in unit of : Each	Bridge name board shall include: Installing at location that agreed by project owner.
R-08-17	DEMOLITION OF EXISTING STRUCTURE	Demolition of existing structure is removing totally or in part and then disposes the existing bridge culvert, head wall, and aprons, building, walls and other structure.	Quantity of demolition of existing structure is measured as follows: a. Demolition of stone masonry : m³ b. demolition of reinforced and prestressed concrete: m³ c. demolition of building: m³ d. demolition of timber bridge: lin. m e. Hauling the excess : m³/KM f. Wood bridge structure (m²)	Demolition of existing structure shall include: a. Removal of structure b. Disposal hauling
R-08-18	CEMENT CONCRETE PAVEMENT	Portland cement concrete pavement is a construction of concrete pavement with thickness, dimension, lines and grade as shown on drawing and the quality of materials in accordance with specification	Quantity of Portland cement concrete pavement is measured as follows: a. concrete : m³ b. steel tie bar and dowels: Kg c. Joint sealant : Meter	Construction of concrete pavement shall include: a. Provisioning materials, mixing, compacting and curing. b. Installing of dowels bar and tie bar c. Cutting and sealing of expansion/construction joint. d. Quality test of materials and performance
R-08-19	LEAN CONCRETE	Lean concrete is construction of leveling layer with thickness, lines and granular as shown on the drawing. Composed of fine, coarse aggregate, Portland cement and water that mixed	Quantity of lean concrete is measured in m³	Construction of lean concrete shall include: a. Provisioning materials, mixing, compacting and curing.

		homogenously and laid well on prepared ground surface.		b. Quality test of materials and performance
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7.9. REINSTATEMENT OF EXISTING STRUCTURE AND MINOR WORKS: (R-09)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-09-01	REINSTATEMENT OF EXISTING PAVEMENT	Reinstatement of existing pavement is repairing of minor works, consisting of pot holes, line crack, corrugation, rutting, deformation and other minor failure to provide driving quality.	Quantity of reinstatement of existing pavement is measured as follows: a. Base aggregate A for minor work : m^3 b. subbase aggregate B for minor work : m^3 c. Aggregate pavement : m^3 d. waterbound macadam for minor works : m^2 e. hotmix asphaltic concrete : m^3 f. Penetration macadam : m^3 g. coldmix asphaltic concrete : m^3 h. Asphalt Dressing: m^2	Reinstatement of existing pavement shall include: a. Minor works on aggregate base b. Minor works on water bound macadam c. Minor works on hotmix asphalt. d. Minor works with penetration on macadam. e. Minor works with coldmixing. f. Minor works on surface dressing.
R-09-02	REINSTATEMENT OF EXISTING DRAINAGE	Reinstatement of existing drainage is repairing work of existing drainage, consisting minor repairing of lining, and sediment cleaning and other minor work	Quantity of reinstatement of existing drainage is measured in: a. Widening/deepening of drainage canal in m b. Repairing wall/bed of drainage canal : m	Reinstatement of existing drainage shall include: a. Material provisioning b. Widening and deepening the channel base c. Repairing the wall and base of the channel.
R-09-03	REINSTATEMENT OF SHOULDERS	Reinstatement of shoulder is repairing and other minor works of shoulder on both sides along the existing road	Quantity of reinstatement of shoulder is measured as follows: a. Cleaning and removal of vegetation: m^2 b. Minor excavation:	Reinstatement of shoulders shall include: a. Clearing Vegetation b. Minor Excavation c. overlay of additional aggregate d. Tree removal

			m^3 c. Overlay of additional aggregate: m^3 d. Tree removal: each	
R-09-04	REINSTATEMENT OF EXISTING ROAD SIDE	Reinstatement of existing road side is minor work to reconditioning the existing road side, including embankment slope and cutting slope	Quantity of reinstatement of existing road side is measured as follows: a. repairing minor embankment slope : m^3 b. Repairing minor cutting slope : m^3 c. Grass sodding : m^2	Recondition work of road side shall include: a. provisioning, spreading and compacting b. Disposal hauling
R-09-05	REINSTATEMENT OF EXISTING ROAD ACCESSORIES AND TRAFFIC CONTROL DEVICES	Reinstatement of existing road accessories and traffic control devices is repairing, replacement, and other minor work of road accessories and traffic control devices.	Quantity of reinstatement of road accessories and traffic control devices is measured as follow: a. Installation for road marking with thermoplastic paint : m^2 b. Traffic sign : each c. Guide post : each d. Kilometer Post : each e. Guide Rail : Lin. Meter f. Precast concrete curb : lin. Meter	Reinstatement of existing road furniture and traffic control devices shall include : a. Provisioning and transporting, b. Installing c. Traffic Management
R-09-06	REINSTATEMENT OF EXISTING BRIDGES	Reinstatement of existing bridge is repairing and other minor works of existing bridge, including temporary bridge to extend its service life	Quantity of repairing and other minor work is measured as follow: a. Repairing concrete bridge deck : m^2 b. Repairing timber bridge deck : m^2 c. surface of steel structure : m^2 d. Railing : lin. Meter	Repairing of existing bridge shall include: a. Minor repair on bridge deck b. Repairing surface of steel structure c. Railing improving

R-09-07	REINSTATEMENT OF EXISTING CONCRETE CURB OF LANE DIVIDER	Reinstatement of existing concrete curb is repairing and/or replacing of concrete curb	Quantity of reinstatement of concrete curb shall be measured in : lin Meter	Reinstatement of existing curb shall include: a. Provisioning and installing curb b. quality test of material
R-09-08	REINSTATEMENT OF EXISTING ROAD LIGHTING	Reinstatement of existing road lighting is repairing lighting system according to the drawing and specification.	Quantity of reinstatement of existing road lighting is measured in : unit/each	Reinstatement of existing road lighting shall include : a. Supplying and installing b. Licensing/coordinating with related institutions.
R-09-09	REINSTATEMENT OF EXISTING PEDESTRIAN FENCE	Reinstatement of pedestrian fence is repairing work according to the drawing and specification.	Quantity of reinstatement of pedestrian fences is measured in: linear Meter.	Reinstatement of existing pedestrian fences shall include: Supplying, fabricating, and installing

7.10. DAY WORKS: (R-10)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-10-01	DAY WORKS	Day work is an approved and instructed operation work not originally envisaged during design process and not included in original BoQ but in which it becomes apparent during construction phase as being necessary for satisfactory execution and completion of the project	Quantity of day works is measured as follow: a. Actual materials quantity delivered by suppliers and approved daily work recorded as regulation in part 1 to 9 b. Actual construction equipment approved in day work record in : hour c. Actual number of day work labor approved in day works record : hour	Day work shall include : a. additional drainage work b. additional excavation, filling, and stabilization work c. restitution of existing pavement line d. testing e. additional overlay f. additional structure works

7.11. ROUTINE MAINTENANCE (R-11)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-11-01	ROUTINE MAINTENANCE OF EXISTING ROAD AND ITS ACCESSORIES	Routine maintenance of existing road is a routine maintenance work to ensure that the pavement, shoulder, drainage, road accessories and bridges are maintained at all times in serviceable condition to the satisfaction for road user.	Quantity of maintenance works for payment in monthly installment from the lumpsum bid for various works elements is measured in Lumpsum	Routine maintenance work shall include: a. Routine maintenance of pavement b. Routine maintenance of shoulder c. Routine maintenance of drainage canal d. Routine maintenance of road accessories
R-11-02	ROUTINE MAINTENANCE OF ADJACENT ROAD AND BRIDGE	Routine maintenance of adjacent road and bridge is a maintenance work to ensure that during the project execution, all of the existing roads and bridges either adjacent to or leading to the work site that are traversed by the construction plant and equipment are kept open for traffic and are maintained safely and in usable condition	Quantity of maintenance of adjacent road and bridges shall be measured in lumpsum	Routine maintenance of adjacent road and bridge shall include : • access road and detour including bridge maintenance during project construction; ensure the smoothness of the traffic • Bridge strengthening at access road, detour in order for vehicles to pass safely.

7.12 CLEANING: (R12)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-12-01	CLEANING	Cleaning is project cleaning along corridor of the road and/or project site consist of removing and hauling all of the materials resulting by contractor activity during project execution	Measured in : Lumpsum	Clearing work shall include: Hauling of all disposal and other materials resulting by the contractor activities

7.13. GENERAL EXPENSES: (R13)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-13-01	GENERAL EXPENSES	General expenses are costs incurred in addition to the physical cost of the project so that the project can run smoothly during the project implementation period.	Should clearly outline all of the costs, i.e. Insurance fee inauguration costs, social fee, security fee, bank guarantee fee, and other necessary fees.	All of the general cost should be stated clearly in the structure of project cost and should be stated as a pay item.

7.14. PROFIT: (R 14)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-14-01	PROFIT	The profit of service provider of the construction whose value is set by the Government.	Calculated profit is certain % multiplied by the total net of the project cost	TOTAL NET of the project cost can be found in 7.0. method of Measurement

7.15. PROVISIONAL SUM: (R15)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-15-01	PROVISIONAL SUM	A certain value that is reserved for a particular work but has not yet calculated its cost at the time of contract agreement.	Set by the owner in terms of USD, it includes in the total contract value	Can only be used upon the written order by the owner.

7.16. CONTINGENCY : (R16)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-16-01	CONTINGENCY	A certain value that is reserved for a particular work that has not known yet for its usage.	Set by the owner in terms of USD, it includes in the total contract value	Can only be used upon the written order by the owner

7.17. CONSULTANT FEE: (R17)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-17-01	CONSULTANT FEE	Consultant fee for design and/or consultant fee for supervision in which its value is specified in the contract.	Calculated based on the standard fee for consultant.	For designer consultant , starts from the feasibility study, pre-design, detail design, specification, BoQ, details drawing, cost estimate, and mentoring during pre-bid meeting For supervision consultant, it includes daily, weekly, and monthly

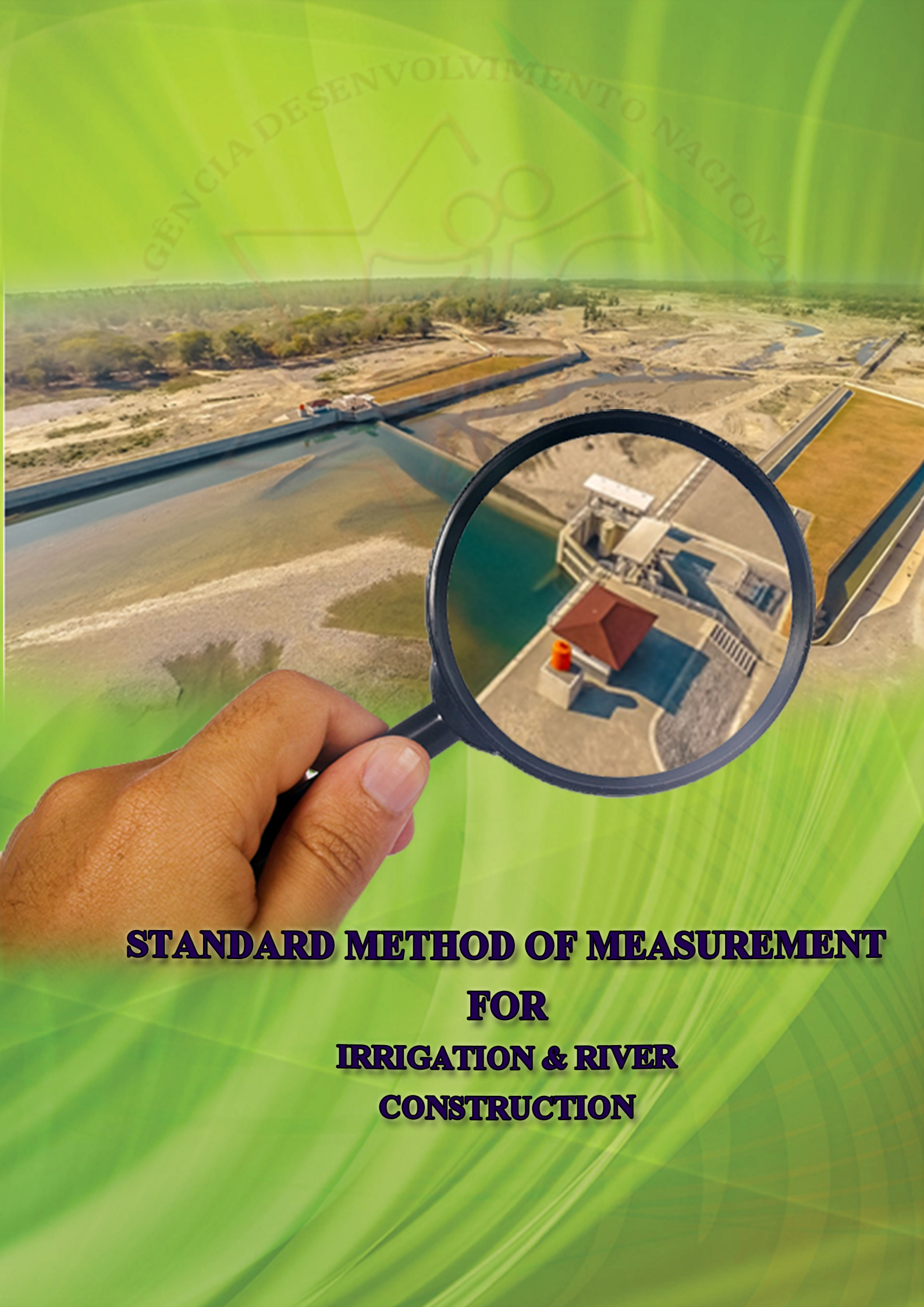
				supervision report, checking all of the working drawings, as-built drawing, and final report.
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7.18. PMU COST: (R 18)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
R-18-01	PMU COST	PMU cost is a specific fund allocated in the project for the purpose of the Project Management Unit, in performing project management activities	PMU cost is calculated based on a certain percentage multiplied by Total Net of the project cost. List of PMU cost percentage for various types of buildings can be found in the STANDARD FEE for CONSULTANT	TOTAL NET of the project cost can be found in 7.0. method of Measurement

7.19. TAX: (R19)

CODE NO	PART NAME	DEFINITION RULES	MEASUREMENT RULES	COVERAGE RULES
R-19-01	TAX	In this context, tax is referred to the income tax which is in accordance with government of Timor-Leste regulation	Calculated as one unit (integrated) in total gross of the project cost.	Includes the total gross of the project cost which will be stated as total budget of the project (Orsamento).



**STANDARD METHOD OF MEASUREMENT
FOR
IRRIGATION & RIVER
CONSTRUCTION**

1.0. DOCUMENT TITLE

The title of this document is TIMOR LESTE STANDARD METHOD OF MEASUREMENT – 3 , For Irrigation and River, Second Volume (January 2016), referred to TL-SMM – 3.

TL-SMM-3 is intended to be utilized in conjunction with the General Condition of Contract, General Specifications or any other relevant provisions provided elsewhere in the Contract Document.

The works shall be itemized and described in Bill of Quantities in sufficient details to enable contractors to price it adequately and the method of measurement shall be stated in the Preamble to the Bill of Quantities. The preamble shall state the methods of measurements other than TL-SMM-3, if any, which are adopted while preparing the Bill of Quantities and to be used for measurement of completed parts of the Works. Such method of measurement shall comprise those not covered by TL-SMM-3.

2.0. OBJECTIVE

The objective of TL-SMM-3 is to set forth the procedure according to which the Bill of Quantities shall be prepared, priced and the quantities expressed and measured.

3.0. DEFINITIONS

- 3.1. In this document and in Bill of Quantities prepared according to the procedure set forth herein the following words and expressions have the meanings hereby assigned to them, except where the context otherwise required.
- 3.2. "Condition of Contract" means the "General Condition of Contract" as provided in the Bidding/Contract Documents prepared by Owner
- 3.3. Word and expression defined in the Condition of Contract have the same meaning herein
- 3.4. All references to clauses are references to clauses numbered in the Condition of Contract and reference to paragraphs are references to paragraphs numbered herein
- 3.5. The word "Work" includes work to be carried out, goods, materials and services to be supplied, and the liabilities, obligations and risks to be undertaken by the Contractor under the Contract
- 3.6. The expression "expressly required" means as shown on the Drawings or as described in the Specifications or as instructed by the Engineer pursuant to the relevant provisions of Condition of Contract
- 3.7. "Day work" means the method of valuing work on the basis of time spent by the workmen, the materials used and the plant employed
- 3.8. "Original Ground Surface" means the surface of ground before any work has been carried out
- 3.9. "Final Excavated Surface" means the surface indicated on the Drawings to which excavation is to be carried out
- 3.10. "Commencing Ground Surface" for an item in a Bill of Quantities means, the surface of the ground from where that particular item of work has commenced
- 3.11. "Excavated Ground Surface for an item in the Bill of Quantities means, the surface to which excavation included in that particular item of work is to be carried out.

4.0. GENERAL PRINCIPLES

4.1. Unit of measurement

The unit of measurement for each item shall be stated for the item in the TL-SMM-3. The unit of measurement stated against a descriptive feature in the TL-SMM-3 shall apply to all items to which that descriptive feature applies. Meter, Kilogram, Second (MKS) system of units has been adopted in this TL-SMM-3.

In describing the dimension of a certain works, its sequence should be as followed, length, width and height or thickness.

Each work should be calculated its net volume, excluding its disposal, overlapping, compactness, widening etc. For all items either stated in this TL-SMM-3 or not such as transportation, warehouse, permit, loading and unloading, etc will be calculated in unit price of its work.

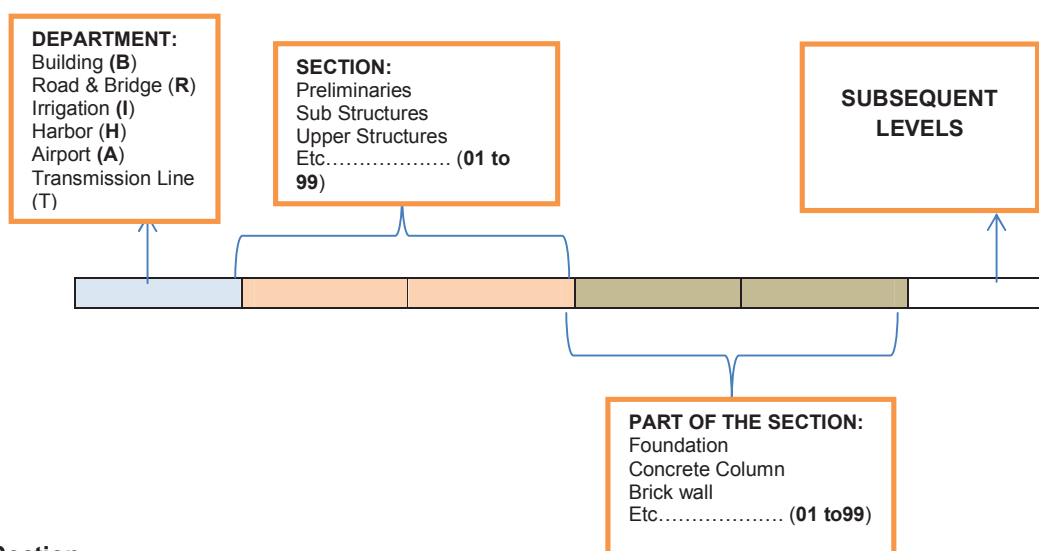
The unit of each work will follow the unit as stated in point 5.0

The volume is rounded to two (2) decimal digits, ex. 1,234.78 not 1,234.7765.

4.2. TL-SMM Codes - 3

Works are classified into various "Sections". Unique code has been allocated to each item of work for its identification and presentation in the TL-SMM –3, Bill of Quantities and elsewhere. Coding arrangement is as given hereunder:

- . First digit represents the "Department"
- . Next two digits represent the "Section"
- . Next two digits represent the "Sub Section"
- . Next digits represent the subsequent levels



4.3 Sub Section

Each part of the Section would be defined to execute and measure for payment.

4.4 Measurement Rules

Measurement rules set out the conditions under which work shall be measured and the method by which the quantities shall be computed. In addition to measurement rules, following general conditions shall also apply:

- a. Quantities of acceptable completed work relating to any part of specification shall be computed net using dimensions from the drawing and as per method given in this document except otherwise specified in special provisions or else in contract documents. No allowance shall be made for bulking, shrinkage or wastage.
- b. All the work to be measured related to any part of specification, if required, shall be classified and measured separately as per Bill of Quantities.

- c. The contractor is not entitled to claim difference in quantity calculated by the standard method of measurement-3 and actual quantity as per site of a specific item except provision made herein, special provisions, or elsewhere in the contract documents.

4.5 Definition

Definition rules define the extent and limits of the item of work represented by a word or expression used in the work classification and in the Bill of Quantities prepared in accordance with TL-SMM – 3.

4.6 Measurement Coverage

Measurement coverage provides that the work stated is deemed to be included in the appropriate items to the extent that such work is included in the Contract. In addition to coverage rules, following general conditions shall also apply:

- a. Loading, unloading and transportation of material related to any item of work
- b. All the items and activities in TL-SMM – 3 shall deem to be included all operations required to perform the work as per Contract Documents.
- c. Additional coverage rule which are necessary for complete understanding of method of measurement are given against relevant item or activity.

4.7 Additional Descriptions

Additional descriptions which are necessary for complete understanding of works/activities covered under method of measurement are provided against such particular item of work.

5.0 UNITS AND ABBREVIATIONS

The following units of measurement and abbreviations shall be used:

Unit	Abbreviation
Millimeter	mm
Meter	M
Square millimeter	mm ² or mm2
Square meter	M ² or M2
Hectare	Ha
Cubic meter	M ³ or M3
Kilogram	Kg
Tone	Ton
Metric Tone	M.Ton
Summary	Sum
Number	No.
Horse Power	Hp
Week	Wk
Litre	Ltr
Lump Sum	Ls
Day	Dy
Hour	Hr
Kilo pascal	Kpa
Mega paskal	Mpa
Kilo newon	Kn

6.0 CONVERSION TABLE

To convert	Into	Multiply
LENGTH		
Millimeter	Inch	0.03937
Inch	Millimeter	25.40005
Meter	Foot	3.28084
Foot	Meter	0.3048
Meter	Yard	1.09361
Yard	Meter	0.9144
Kilometer	Mile	0.62137
Mile	Kilometer	1.60935
MASS WEIGHT		
Kilogram	Pound	2.20462
Pound	Kilogram	0.45359
Gram	Ounce	0.03527
Ounce	Gram	28.34949
Kilogram	Quintal	0.01
Milligram	Grain	0.01543
Kilogram	Hundred Weight	0.01968
Hundred weight	Tone	0.0508
Kilogram	Tone	0.001
Kilogram	Ton	0.00098
Pound	Ton	0.00045
Tone	Ton	0.98421
Kilogram	Seer	1.01605
Kilogram	Maund	0.02679
Gram	Tola	0.08573
Kilo Newton	Ton	0.1
Ton	Kilo Newton	10
Kilo Newton	Kilogram	100
Kilo gram	Kilo Newton	0.01
VOLUME		
Litre	Pint (UK)	1.75975
Litre	Gallon (imperial)	0.21997
Litre	Gallon (US)	0.26417
Litre	Cubic Foot	0.3531
Litre	Cubic Meter	0.001
Cubic Foot	Liter	28.31682
Milliliter	Fluid ounce	0.0352
Gallon Imperial	Liter	4.5461
Gallon US	Liter	3.78541
Gallon Imperial	Gallon US	1.20095
Cubic millimetre	Cubic inch	0.00006
Cubic meter	Cubic foot	35.31472
Cubic foot	Cubic meter	0.02832
Cubic meter	Cubic Yard	1.30795
Cubic yard	Cubic meter	0.76456
AREA		
Square millimeter	Square inch	0.00155
Square inch	Square millimeter	645.1613
Square meter	Square foot	10.76392
Square foot	Square meter	0.0929
Square meter	Square yard	1.19599
Square yard	Square meter	0.83613
Square meter	Acre	0.00025
Hectare	Acre	2.47105
Acre	Hectare	0.40469
Square meter	Hectare	0.0001

Square kilometer	Square mile	0.3861
Square mile	Square kilometer	2.58999
Hectare	Square mile	0.00386
Square mile	Hectare	258.9989
MASS/UNIT AREA		
Kilogram per square kilometer	Ton per square mile	0.00255
Kilogram per square meter	Pound per square foot	0.20482
Pound per square foot	Kilogram per square meter	4.88243
Kilo gram per centimeter squae	Kilo Pascal (kPa)	100
Kilo Pascal	Kilo gram per centi meter square	0.01
Kilo Pascal	Mega Pascal (MPa)	0.001
Mega Pascal	Kilo Pascal	1000
MASS PER UNIT VOLUME		
Kilogram per cubic meter	Pound per cubic foot	0.06243
Grams per liter	Pound per cubic foot	0.06243
Pound per cubic foot	Kilogram per cubic meter	16.01845
Pound per cubic foot	Grams per liter	10.01845
Ton per cubic meter	Kilo Newton per cubic meter	10
Kilo Newton per cubic meter	Ton per cubic meter	0.1

While converting unit from one system to other system the measurement shall be taken nearest to three digits for MKS system and nearest to two digits for FPS system.

7.0 METHOD OF MEASUREMENT

Section 01: Preliminaries

Section 02: Excavation

Section 03: Filling

Section 04: Dewatering

Section 05: Stone Masonry

Section 06: Weephole

Section 07: Concrete

Section 08: Sodding

Section 09: WaterGate

Section 10: Trash Rack

Section 11: Gabion

Section 12: Geotextile

Section 13: Piling

Section 14: Break water/ Wave Water Equipment

Section 15: Staff Gauge

Section 16: Embankment

Section 17: Groin

Section 18: Waterstop

TOTAL NET OF CONSTRUCTION COST A

Section 19: Field Clearing

TOTAL NET OF PROJECT COST,..... B = A+19

Section 20: General Expenses

Section 21: Profit

Section 22: Provisional sum

Section 23: Contingency

Section 24: Consultant Fee

Section 25: PMU cost

Section 26: Taxes

TOTAL GROSS OF PROJECT COST C = B +(20+21+22+23+24+25+26)

EXAMPLE OF GENERAL EXPENSES DETAILS (Section:20)

1. Material Samples including Quality Testing
2. Security
3. Occupational Health and Safety
4. Project Team/Staff Fees
5. Provisional Fee for Performance Bank Quarantees, Down payment, Retention Fee, ect.
6. Work Insurance Fee, Labor Insurance Fee
7. Communication Cost
8. Inauguration Fee
9. Rental fee for Lot/house/vehicles
10. Report Fee
11. Gathering/Meeting Fee
12. Social Fee
13. Other Non-Physical Fee for each project

7.1 PRELIMINARIES WORK

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-01	PREPARATION WORK			
I-01-01	MOBILISATION	Mobilization is an initial activity to mobilize equipment, workforce, facility, and required permission, before the project begun physically.	Each type of equipment, workforce, facility and permit should be broken down its quantity as well as its specification in such a way to facilitate the calculation of price/cost of mobilization. The unit is Lump Sum .	In calculating mobilization price/cost of each item, should have already included transportation fee, loading and unloading fee, permit fee, rent/purchase fee as well as other social fees.
I-01-02	DEMOBILISATION	Demobilization is a final activity to demobilize equipment, workforce, and facility that is no longer used for the project	Each type of equipment, workforce, facility and permit should be broken down its quantity as well as its specification in such a way to facilitate the calculation of price/cost	In calculating demobilization cost of each item, should have included transportation cost, loading and unloading fee, permit fee, rent/purchase costs, as well as other social fees.

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-01-03	ACCESS ROAD	access road (driveway) is an activity of making new road or make use of an existing road or improve the functionality of existing road for the purpose of entrance and exit road to project location including its maintenance	Access road (driveway) has to be in accordance with the terms stated in the contract documents, and, planning design & technical specification. Unit of measurement is length (Km)	All of the items of access road work and its maintenance. Includes: permit, land acquisitions, land clearing, stripping sewers, bridges, side drain, etc.
I-01-04	SIGNBOARD	Signboard contains information about the work that to be carried out. the content of information are: the name of the work, the owner of the project, costs, start & end date of Project, name of the contractor, name of the supervision consultant and contract number.	Signboard must correspond to that indicated on the technical specifications. The unit of measurement is unit .	Installation, permits & supporting Equipment.

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-01-05	LAND CLEARING	Is the work of clearing the land from trees (diameter ≤ 15 cm), shrub-scrub, grass that are grown in the planned location of the building	The clearing area land should be done in accordance with technical specifications. unit of measurement is m^2	-Including dumping of garbage in the disposal area. -Supporting equipment.
I-01-06	STRIPPING	stripping the top surface including leveling the ground.	The stripping area should be cleaned and aligned in accordance with technical specification, unit is m^2	- Including dumping of garbage in the disposal area. - Supporting equipment.
I-01-07	RELOCATION PUBLIC FACILITY	Relocation of utilities and other available services is an activity to move the entire underground installation network which is affected by the construction of new road or widening of the existing road in accordance with terms and planning design.	Measurement of work volume done on a lumpsum, i.e a. relocation of telephone utility (lumpsum) b. relocation electric utility (lumpsum) c. relocation clean water utility (lumpsum) d. relocation of gas utility (lumpsum) e. Relocation of other utility	Scope of the work: Relocate underground network, including: clean water distribution pipes, electrical wiring, telephone wiring. Relocate electrical pole, telephone pole, street light pole, traffic pole and traffic signs

7.2 EXCAVATION

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-02	EXCAVATION	excavations on ground layer that can be excavated with hoe	- should be in accordance with planning design, vertical profile & horizontal profile, - Unit of Measurement is M^3 .	- Dumping of digging material in the disposal area, - Supporting Equipment for ground excavation.
I-02-01	GROUND EXCAVATION			
I-02-02	ROCKSOIL EXCAVATION	Excavation on rock soil that can be done using breaker equipment.	- should be in accordance with planning design, vertical profile & horizontal profile, - Unit of Measurement is M^3 .	- dumping of digging material in the disposal area, - Supporting Equipment for rock soil excavation
I-02-03	HARDROCK EXCAVATION	Excavation on hard rock that can be done by breaker equipment	- should be in accordance with planning design, vertical profile &	- dumping of digging material in the disposal area, - Supporting

I-02-04			horizontal profile, - Unit of Measurement is M ³ .	Equipment for hard rock excavation.
	MUD EXCAVATION	Is ground excavation on soft and aqueous soil	- should be in accordance with planning design, vertical profile & horizontal profile, - Unit of Measurement is M ³ .	- Dumping of digging material in the disposal area, - Supporting Equipment for mud digging.
I-02-05	RIVER DEPOSIT EXCAVATION	excavation on the river or certain areas in the river in which its digging materials consist of rock soil, sand and gravel	- should be in accordance with planning design, vertical profile & horizontal profile, - Unit of Measurement is M ³ .	- Dumping of material to the disposal area, - Supporting Equipment for river deposit excavation.

7.3 FILLING

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-03	FILLING			
I-03-01	SOIL FILLING	Work of Filling using required ordinary soil.	- should be in accordance with planning design, vertical profile & horizontal profile, - Unit of Measurement is M ³ .	- preparation of filling materials, spreading, and compacting - Supporting equipment for filling soil.
I-03-02	SELECTED MATERIAL FILLING	Filling using selected material with certain parameter and transported from borrow area in accordance with required technical specifications.	- should be in accordance with planning design, vertical profile & horizontal profile, - Unit of Measurement is M ³ .	- preparation of filling materials, spreading, and compacting - Supporting equipment for filling of selected material

7.4 DEWATERING

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-04	DEWATERING	Rechanneling water from excavated area for construction in the river bed or in the area containing water in order to provide the construction site free of water(dry) before and during the construction.	- Unit of measurement is lumpsum .	- equipment for dewatering - other components of supporting equipment

7.5 STONE MASONRY

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-05	STONE MASONRY	Rip-rap is installing the stone without coating with mortar, arranged in such a way in a specific location as protector from water flow as required in technical specifications	- The measurement of rip-rap should be in accordance with planning design, - Unit of measurement is M^3.	- Provisioning, transporting, placement and assembly
I-05-01	(RIP-RAP)			
I-05-02	STONE MASONRY (Cleave Stone)	Stone masonry is placing/assembling the stones that are already cleaved (not oval/Round Rock) using particular mortar according to the required technical specifications.	- Based on required technical specification. - Unit of measurement is M^3.	- Provisioning, transporting, placement and assembly.
I-05-03	SURFACE MASONRY	Surface masonry is a part of installing structural rock, arranged in such a way that looks aesthetic as required in technical specifications.	- Unit of measurement is M^3.	Stone selection and its installation
I-05-04	PLASTERING	Plaster is part of work covering brick/concrete and brick/concrete wall. stucco is as part of smoothing the surface of the plaster to be ready for the priming	Plaster is calculated in meter square (m^2), and separate its item according to the quality of each mixture. Stucco is separated from plastering and calculated in meter square (m^2).	Including all the necessary equipment and labor for stirring mortar, transporting and installing plaster in its position based on the design.
I-05-05	ADHESIVE MORTAR	A masonry work, overhang the mounted as thick as 1- 2 cm, on gaps between stones.	Unit of measurement is M^2 .	Stripping of assembly on gaps between rocks for lining
I-05-06	FLOOR WORK	The work of spreading certain mortar/lean concrete evenly along the foundation prior to constructing the	- Unit is m^3.	- Ground leveling, - floor installation

		foundation with thickness and elevation in accordance with planning design.		
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7.6 WEEPHOLE

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-06-01	WEEPHOLE	Is a work of installing waste water pit absorption on stone retaining wall and/or concrete retaining wall. Its base mounted to filter. Functioned to escape water pressure material. The placement should be in accordance with the technical specifications and planning design.	- Measured in Unit.	- Set up goods/materials for filtration

7.7 CONCRETE WORK

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-07	CONCRETE WORK	An assembly that consists of stone mixture and concrete with composition of 60% stone and 40% concrete. Stone diameter and concrete quality should be in accordance with technical specification.	- Unit of measurement is M ³ .	Assembling and other components of supporting equipment.
I-07-01	CONCRETE CYCLOP			
I-07-02	CONCRETE	Cement concrete structure is construction of cement concrete for bridge structure retaining walls and other concrete structures with shapes and dimensions in accordance with design and should use materials that meet specification	The measurement of work volume are as follow: a. <i>Concrete</i> , Measured based on design, unit of measurement is m ³ b. <i>formwork</i> is measured based on design and the work method with its net area is measured	The scopes are: a. Preparation and storage of materials that are based on the specification. b. Formulating Job Mix Formula. c. Construction of formwork using waterproof material; shape, dimensions, elevation and the location should be based on the drawing.

			from contact area with concrete in m^2 c. <i>Reinforce</i> is calculated in kg, and calculated separately per-diameter. The length of reinforce include bending and the joint (distribution length)	d. Mixing of components materials is according to JMF and casting mixture with its procedure should be based on the specifications. e. Concrete treatment procedure should be in accordance with its specification. f. Formwork discharge.
I-07-03	REINFORCEMENT	Reinforce is the work of provisioning, transporting, fabricating and installing of steel reinforcement with diameter and quality steel should be in accordance with specifications.	Steel reinforcement is calculated in kg unit, and calculated separately per-diameter. The length of reinforcement include bending and joint (distribution length) For steel reinforcement wire mesh should calculate its net area without overlapping, the unit, in m^2. if there is any welding work, it is calculated in m^1	The scopes are as follow: a. Provisioning, transporting and storing of steel reinforcement with a diameter and quality should be in accordance with specifications. b. The diameter, length, shape and amount of fabricated reinforce should be in accordance with specification. c. installation of reinforce at location, configuration distance, the amount of the reinforce should be based on drawing
I-07-04	FORMWORK	Formwork is a reference form of concrete that can be constructed from wood, iron or others	The area of formwork is the contacted area between concrete and formwork measured in m^2 unit. The hole in the formwork which is less than $1 m^2$ is not counted as deduction of the area.	Including all supporting construction so that the formwork is strong, rigid and clean from dirt until attached to its position.

7.8 SODDING

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-08-01	SODDING	Work of assembling, sodding on ground channel wall, cliff wall as an effort to prevent soil erosion	- The quality and sodding area should be based on technical specification and detail planning design. - unit is m²	Transporting, fertilizing, planting, nurturing, until they grow and other components of supporting equipment

7.9 WATERGATE

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-09-01	WATER GATE	Installing and building water gate for the purpose of controlling water flow based on its function.	- Measured in Unit	- DED, constructing, transporting, installing, and field testing. - door components accessories, - Door protective coating.

7.10 TRASH RACK

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-10-01	TRASH RACK	Build and install formwork, as a filter on inlet; its function is to hold trash as to keep them from going into irrigation canal and should be based on the detail design planning.	Measured in Unit.	Building, transporting, and trash rack installation including its component and supporting equipment.

7.11 GABION

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-11-01	GABION	A box that is made of woven stainless wire with certain diameter, hexagonal-shaped wicker, with a minimum of 3 wire coils which are made manually or fabricated. Gabion box is filled with rocks, wire diameter, hole dimension and the dimensions of the stones should be in accordance with technical specifications.	- the measurement of gabion construction should be in accordance with detail planning design, - Unit of measurement is M³.	Constructing, transporting and installing the construction including its component and supporting equipment.

7.12 GEOTEXTILE

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-12-01	GEOTEXTILE	Installing/spreading geotextile coat at specified location in the detail planning design. One of geotextile functions is to hold grains while allowing water to flow through.	- calculated area is the net area based the on technical specification and detail design planning - unit of measurement is M^2	Including transportation, installation, necessary overlapping connection and other necessary supporting equipment.

7.13 PILING

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-13-01	PILING	Piling foundation is a foundation to support structure (pillar, abutment, retaining wall) and other structures, consist of wooden pile, pre-fabricated concrete pile, steel pile or cast in place by using materials which meet specifications and dimensions. number and length should be as specified in the design.	The quantity of piling foundation is calculated in unit as follow: a. Supply of wood pile (m^3). b. Supply of prefabricated reinforces concrete pile: (m^3). c. Supply of prefabricated prestress concrete beam: (m^3). d. Preparation of steel beam piling : Kg e. Driving the Pile : Meter (m) f. cast in Place pile: (m) g. timber and concrete revetment: (m^2) h. steel revetment (m^2)	The scope include: a. preparation of material and piling materials for cast in Place b. quality test of materials and services.

7.14 WATER BREAKER/WAVE BREAKER EQUIPMENT

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-14-01	WAVE BREAKER) / WAVE BREAKER EQUIPMENT	Building and setting up construction to break and weaken the influence, concentration and wave energy so as to reduce sea erosion and abrasion. Dimension, shape and its number should be in	- Dimension, shape and type of wave breaker should be in accordance with detail planning design and technical specification. - Material from natural rock is	Building, transporting, installation of wave breaker materials in place and other components of supporting equipment.

		accordance as specified in detail planning design. The wave breaker material can be made from armor and reinforce concrete	measured in m ³ . - Material from concrete, its unit is unit.	
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7.15 STAFF GAUGE

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-15-01	STAFF GAUGE	Installing staff gauge at a specific location to find out water surface elevation.	- quality, number and installation location of staff gauge should be in accordance with technical specification and detail planning design, - Measured in unit.	Transporting, installing and other components of supporting equipment

7.16 EMBANKMENT

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-16-01	EMBANKMENT	Build a construction to withstand water surge which could be made from heap of soil, rocks, stone masonry, concrete, etc.	- Dimension, location, and material should be in accordance with detail planning design and technical specification, - Unit is M ³	Transporting, spreading material, compacting, building and other components of supporting equipment.

7.17 GROIN

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-17-01	GROIN	Building a construction to direct and reduce speed of riverflow. Type of construction can be made of stone masonry, concrete, gabion and pile.	- Dimension, location, and materials should be in accordance with detail design planning and technical specification. - Unit of measurement should be based on type of construction (Concrete, stone masonry, gabion is in m ³ , pile is in m).	Transporting, building, and other components of supporting equipment.

7.18 WATERSTOP

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-18-01	WATERSTOP	Setting up waterstop (holding water material) on joint of concrete casting to avoid water infiltration on the referred joint.	- The quality, dimension and location of waterstop installation are determined in technical specification and details planning design. - unit of measurement is M	Installation, overlapping waterstop and other components of supporting equipment.

7.19 FIELD CLEARING

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-19-01	FIELD CLEARING	A cleaning activity after irrigation or river construction is completed	Measured in lumpsum.	Includes all the remaining dirt and debris along irrigation/river construction that must be removed and cleaned

7.20 GENERAL EXPENSE

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-20-01	GENERAL EXPENSE	General expense is costs incurred in addition to the physical cost of the project so that the project can run smoothly during the project implementation period.	Should clearly outline all of the costs, i.e. Insurance fee inauguration costs, social fee, security fee, bank guarantees fee, and other necessary fees.	All of the general cost should be stated clearly in the structure of project cost and should be stated as a pay item.

7.21 PROFIT

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-21-01	PROFIT	Profit is a sum calculated as the profit of contractors according to the Government regulation.	Calculated profit is a certain % multiplied by the total net of the project cost	TOTAL NET of the project cost can be found in 7.0. method of Measurement

7.22 PROVISIONAL SUM

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-22-01	PROVISIONAL SUM	A certain value that is reserved for a particular work but	Set by the owner in terms of USD, it includes in the total	Can only be used upon the written orders by the owner.

		has not yet calculated its cost at the time of contract agreement.	contract value	
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7.23 CONTINGENCY

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-23-01	CONTINGENCY	Is a certain value that is reserved for a particular work that has not known yet for its usage.	Set by the owner in terms of USD, it includes in the total contract value	Can only be used upon the written orders by the owner

7.24 CONSULTANT FEE

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-24-01	CONSULTANT FEE	Consultant fee for planning and/or consultant fee for supervision in which its value is specified in the contract.	Calculated based on the standard fee for consultant.	For planner consultant , it starts from the feasibility study, pre-design, detail design, specification, BoQ, details drawing, cost estimate, and mentoring during pre-bid meeting For supervisory consultant, it includes daily, weekly, and monthly supervision report, checking all of the working drawings, drawing as built, and final project report.

7.25 PMU COST

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-25-01	PMU COST	PMU cost is a specific funds allocated in the project for the purposes of the Project Management Unit, in performing project management activities	PMU cost is calculated based on a certain percentage multiplied by Total Net of the project cost. List of PMU cost percentage for various types of buildings can be found in the STANDARD FEE for CONSULTANT	TOTAL NET of the project cost can be found in 7.0. method of Measurement

7.26 TAX

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
I-26-01	TAX	In this context, tax is referred to the income tax which is in accordance with government of Timor-Leste regulation	Calculated as one unit (integrated) in total gross of the project cost.	Includes the total gross of the project cost which will be stated as total budget of the project (Orsamento).



**STANDARD METHOD OF MEASUREMENT
FOR
HARBOR CONSTRUCTION**

1.0 TITLE OF THE DOCUMENT

The title of this document is TIMOR LESTE STANDARD METHOD OF MEASUREMENT – 4, For Harbor, Second Volume (January 2016), which is abbreviated to TL-SMM – 4.

TL-SMM-4 is intended to be utilized in conjunction with the General Condition of Contract, General Specifications or any other relevant provisions provided elsewhere in the Contract Document.

The works shall be itemized and described in Bill of Quantity in sufficient details to enable Contractors to price it adequately and the method of measurement shall be stated in the Preamble to the Bill of Quantity.

The preamble shall state the method of measurement other than TL-SMM-4, if any, which are adopted while preparing the Bill of Quantity and to be used for measurement of completed parts of the Works. Such method of measurement shall comprise those not covered by TL-SMM-4.

2.0 OBJECTIVE

The objective of TL-SMM-4 is to set forth the procedure according to which the Bill of Quantity shall be prepared, priced and the quantities expressed and measured.

3.0 DEFINITION

- 3.1. In this document and in Bill of Quantity prepared according to the procedure set forth herein the following words and expressions have the meanings hereby assigned to them, except where the context otherwise required.
- 3.2. “Condition of Contract” means the “General Condition of Contract” as provided in the Bidding/Contract Documents prepared by Owner
- 3.3. Word and expression defined in the Condition of Contract have the same meaning herein.
- 3.4. All references to clauses are references to clauses numbered in the Condition of Contract and reference to paragraphs are references to paragraphs numbered herein
- 3.5. The word “Work” includes work to be carried out, goods, materials and services to be supplied, and the liabilities, obligations and risks to be undertaken by the Contractor under the Contract agreement.
- 3.6. The expression “expressly required” means as shown on the Drawings or as described in the Specifications or as instructed by the Engineer pursuant to the relevant provisions of Condition of Contract
- 3.7. “Day work” means the method of valuing work on the basis of time spent by the workman, the materials used and the plant employed on the site work.
- 3.8. “Original Ground Surface” means the surface of ground before any work has been carried out
- 3.9. “Final Excavated Surface” means the surface indicated on the Drawings to which excavation is to be carried out
- 3.10. “Commencing Ground Surface” for an item in a Bill of Quantities means, the surface of the ground from where that particular item of work has commenced
- 3.11. “Excavated Ground Surface for an item in the Bill of Quantity means, the surface to which excavation included in that particular item of work is to be carried out.

4.0 GENERAL PRINCIPLES

4.1 Unit of Measurement

The unit of measurement for each item shall be aligned with the item stated in the TL-SMM-4. The unit of measurement stated against a descriptive feature in the TL-SMM-4 shall apply to all items to which that descriptive feature applies. Meter, Kilogram, Second (MKS) units system has been adopted in this TL-SMM-4.

In describing the dimension of a certain works, its sequence should be as followed, length, width and height or thickness.

Each work should be calculated its net volume, excluding its disposal, overlapping, compactness, widening etc. All items either stated in this TLSMM-4 or otherwise such as transportation, warehouse, permit, loading and unloading, etc will be calculated in unit price of its work.

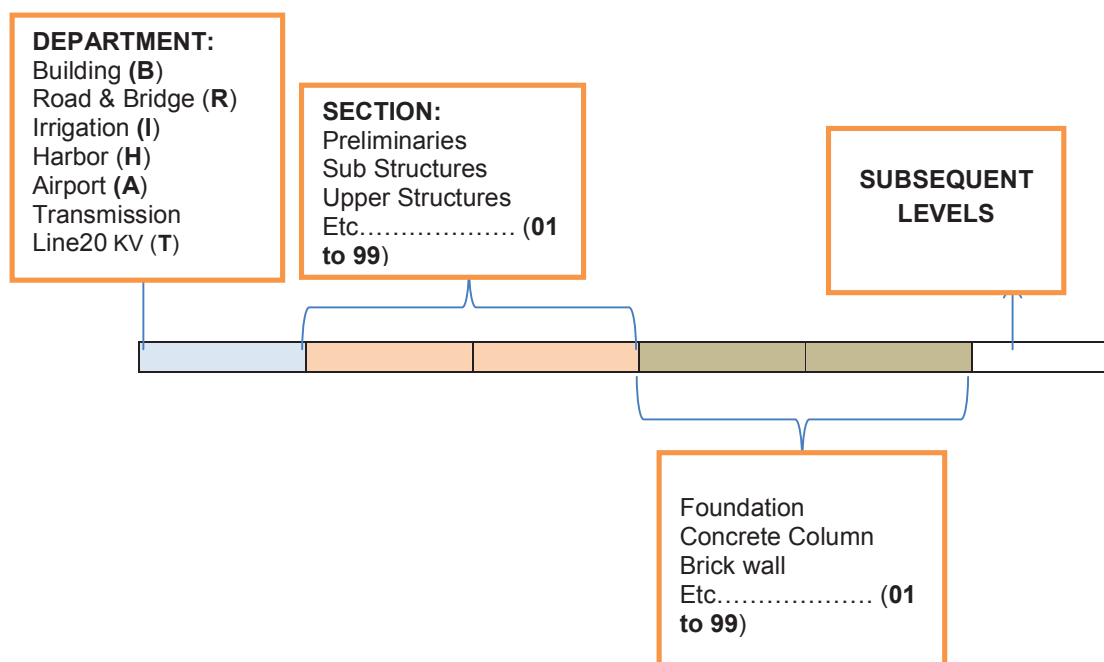
The unit of each work will follow the unit as stated in point 5.0.

The volume is rounded to two (2) decimal digits, ex. 1,234.78 not 1,234.7765

4.2 TL-SMM – 4 CODING

Works are classified into various “Sections” which further classified into “sub-sections” Unique code has been allocated to each item of work for its identification and presentation in the TLSMM –4, Bill of Quantity and elsewhere. Coding arrangement is as given hereunder:

- . First digit represents the “Department”
- . Next two digits represent the “Section”
- . Next two digits represent the “Sub Section”
- . Next digits represent the subsequent levels



4.3. Sub Section

Works included in the sub section is to execute and measure for payment (pay item).

4.4. Measurement Rules

Measurement rules set out the conditions under which work shall be measured and the method by which the quantities shall be computed. In addition the following general conditions shall also apply:

- a. Quantities of acceptable completed work relating to any part of specification shall be computed using net dimensions from the drawing with method given in this document except otherwise

specified in special provisions or else in contract documents. No allowance shall be made for bulking, shrinkage or wastage.

- b. All works shall be measured according to drawing and specification, if required, shall be classified and measured separately as per Bill of Quantity.
- c. The contractor is not entitled to claim difference in quantity calculated using TLSMM-4 and actual quantity as per site of a specific item except provision made herein, special provisions, or elsewhere in the contract documents.

4.5. Definition

Definition means the extent and limits of the item of work represented by a word or expression used in the work classification and in the Bill of Quantity prepared in accordance with TLSMM-4

4.6. Measurement Coverage

Measurement coverage provides that the work stated is deemed to be included in the appropriate items to the extent that such work is included in the Contract. In addition, following general conditions shall also apply:

- a. Loading, unloading and transportation of material related to any item of work
- b. All the items and activities in TLSMM –4 shall deem to be included all operations required to perform the work as per Contract Documents.
- c. Additional measurement coverage which is necessary to grasp in details the method of measurement is given against relevant item or activity.

4.7. Additional Descriptions

Additional descriptions which are necessities for complete understanding of works/activities covered under method of measurement are provided against such particular item of work.

5. UNITS AND ABBREVIATIONS

The following units of measurement and abbreviations shall be used:

Unit	Abbreviation
Millimeter	Mm
Meter	M
Square millimeter	mm ² or mm2
Square meter	M ² or M2
Hectare	Ha
Cubic meter	M ³ or M3
Kilogram	Kg
Tone	Ton
Metric Tone	M.Ton
Summary	Sum
Number	No.
Horse Power	Hp
Week	Wk
Litre	Ltr
Lump Sum	Ls
Hour	Hr

Day	Day
KiloPascal	KPa
MegaPascal	Mpa
KiloNewton	KN

6.0 CONVERSION TABLE

To convert	Into	Multiply
LENGTH		
Millimeter	Inch	0.03937
Inch	Millimeter	25.40005
Meter	Foot	3.28084
Foot	Meter	0.3048
Meter	Yard	1.09361
Yard	Meter	0.9144
Kilometer	Mile	0.62137
Mile	Kilometer	1.60935
MASS WEIGHT		
Kilogram	Pound	2.20462
Pound	Kilogram	0.45359
Gram	Ounce	0.03527
Ounce	Gram	28.34949
Kilogram	Quintal	0.01
Milligram	Grain	0.01543
Kilogram	Hundred Weight	0.01968
Hundred weight	Tone	0.0508
Kilogram	Tone	0.001
Kilogram	Ton	0.00098
Pound	Ton	0.00045
Tone	Ton	0.98421
Kilogram	Seer	1.01605
Kilogram	Maund	0.02679
Gram	Tola	0.08573
VOLUME		
Litre	Pint (UK)	1.75975
Litre	Gallon (imperial)	0.21997
Litre	Gallon (US)	0.26417
Litre	Cubic Foot	0.3531
Litre	Cubic Meter	0.001
Cubic Foot	Liter	28.31682
Milliliter	Fluid ounce	0.0352
Gallon Imperial	Liter	4.5461
Gallon US	Liter	3.78541
Gallon Imperial	Gallon US	1.20095
Cubic millimeter	Cubic inch	0.00006
Cubic meter	Cubic foot	35.31472
Cubic foot	Cubic meter	0.02832
Cubic meter	Cubic Yard	1.30795
Cubic yard	Cubic meter	0.76456
AREA		
Square millimeter	Square inch	0.00155
Square inch	Square millimeter	645.1613
Square meter	Square foot	10.76392
Square foot	Square meter	0.0929
Square meter	Square yard	1.19599

Square yard	Square meter	0.83613
Square meter	Acre	0.00025
Hectare	Acre	2.47105
Acre	Hectare	0.40469
Square meter	Hectare	0.0001
Square kilometer	Square mile	0.3861
Square mile	Square kilometer	2.58999
Hectare	Square mile	0.00386
Square mile	Hectare	258.9989
Kilogram	Kilo Newton	
Kilo Newton	Kilogram	
Ton	Kilo Newton	10
Kilo Newton	Ton	0.1
MASS/UNIT AREA		
Kilogram per square kilometer	Ton per square mile	0.00255
Kilogram per square meter	Pound per square foot	0.20482
Pound per square foot	Kilogram per square meter	4.88243
MegaPascal	KiloPascal	1000
KiloPascal	MegaPascal	0.001
KiloPascal	Kilogram per sq.cm	0.01
Kilogram per Sq.cm	KiloPascal	100
Ton per Cubic Meter	KiloNewton per Cu.m	
KiloNewton per Cubic Meter	Ton per Cubic Meter	
MASS PER UNIT VOLUME		
Kilogram per cubic meter	Pound per cubic foot	0.06243
Grams per liter	Pound per cubic foot	0.06243
Pound per cubic foot	Kilogram per cubic meter	16.01845
Pound per cubic foot	Grams per liter	10.01845

In converting unit from one system to other system the measurement shall be taken nearest to three digits for MKS system and nearest to two digits for FPS system.

7. METHOD OF MEASUREMENT

Section 01: Preparation Work

Section 02: Excavation Work

Section 03: Piling Work

Section 04: Dewatering

Section 05: Stone Masonry

Section 06: Concrete Works

Section 07: Gabion Works

Section 08: Geotextile Works

Section 09: Harbor Work (on Dry land)

Section 10: Harbor Work (on Shore)

TOTAL NET CONSTRUCTION COST, (A)

TOTAL NET PROJECT COST, (B = A)

Section 11: General Expenses

Section 12: Profit

Section 13: Provisional Sum

Section 14: Contingency

Section 15: Consultant Fee

Section 16: PMU Cost

Section 17: Tax

TOTAL GROSS PROJECT COST, C = B+(11+12+13+14+15+16+17)

EXAMPLE OF GENERAL EXPENSES DETAILS (Section:11)

1. Material Samples including Quality Testing
2. Security
3. Occupational Health and Safety
4. Project Team/Staff Fees
5. Provisional Fee for Performance Bank Quarantees, Down payment, Retention Fee, ect.
6. Work Insurance Fee, Labor Insurance Fee
7. Communication Cost
8. Inauguration Fee
9. Rental fee for Lot/house/vehicles
10. Report Fee
11. Gathering/Meeting Fee
12. Social Fee
13. Other Non-Physical Fee for each project

1. PREPARATION WORK (H-01)

CODE	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-01-01	MOBILIZATION	Mobilization is the act of deployment required manpower, goods, equipment, facilities, as planned which will be utilized either simultaneously or arranged based on time, quantity and types of works so as to initiate the work (in this context harbor works).	-Each type of equipment, labors, goods, supporting facilities should be specified its quantity, classification and types. -Unit of measurement is Lumpsum .	Measurement coverage to calculate the work price of mobilization is the breakdown of each equipment, labor, goods, and supporting facility. It should include transportation fees, loading and unloading fees, permit fee, tax, rent fee, and other social fees.
H-01-02	DEMOBILIZATION	Demobilization is the act of returning the labors, goods, equipment, facility that are no longer required and used as planned, either simultaneously or arranged based on time, quantity and types of works upon terminating the works.	- Each type of equipment, labors, goods, supporting facilities should be specified its quantity, classification and types. - Unit of measurement is Lumpsum .	Measurement coverage to calculate the work price of mobilization is the breakdown of each equipment, labor, goods, and supporting facility. It should include transportation fees, loading and unloading fees, permit fee, tax, rent fee, and other social fees.
H-01-03	ACCES ROAD	access road (driveway) is a work of making new road or make use of an existing road or improve the functionality of existing road for the purpose of entrance and exit into the project location including its maintenance	-Access road width is measured in m . - The type of materials, overlay thickness should be in accordance with design planning and technical specification. -Unit of measurement is Km .	Measurement coverage to compute the cost of access road works is the breakdown of each equipment, labor, goods, supporting facility; should have included transportation fee, loading and unloading fees, permit fee, tax, rent fee, and other social fees.
H-01-04	SIGNBOARD	Signboard is an information board that provides work description to be executed. Things to be stated in signboard are Project Name, Owner of the Project, Project Cost, Start and Finish Date as indicated in contract document. Contractor identification	-Measurement rules of signboard are type of materials, signboard dimension, signboard post, should be in accordance with design planning and technical specification. -Measured in Unit.	Measurement coverage to compute the cost of signboard works is the breakdown of each equipment, labor, goods, supporting facility; should include transportation fee, loading and unloading fees,

		(Name, Address, Cellphone Number), Supervision Consultant Identification (Name, Address, Cellphone Number) and Contract Number.		permit fee, tax, rent fee, and other social fees.
H-01-05	FIELD CLEANING	Field cleaning is the clearing of field from trees, shrubs, grasses, and other objects that are in the work site.	-The measurement rule for field cleaning is that the field of construction plan should be cleaned based on the agreement between supervisor and project owner. -Measured in m^2 .	Measurement coverage to compute the cost of field cleaning works is the labors, supporting equipment, and it should include as well the cost of transporting waste to the disposal area as specified and other social fees.
H-01-06	STRIPPING AND GRUBBING	Stripping and grubbing is an activity of stripping ground surface with thickness as specified including leveling the work plan location.	-The measurement rule for stripping and grubbing is that the work plan location should be cleaned in accordance with the agreement between supervisor and project owner. -Unit of measurement is m^2 .	Measurement coverage to compute the cost of stripping and grubbing works is labors, supporting equipment, and it should include as well cost of transporting waste to the disposal area as specified and other social fees.
H-01-07	TREE CUTTING	Cutting and uprooting trees including the cleaning as specified in work plan location	- The Owner of the project should have classified the type, diameter, and quantities of the trees that need to be cut and uprooted - The measurement rule of tree cutting should be in accordance with the agreement between supervisor and project owner. - Unit of measurement is per tree .	Measurement coverage to compute the cost of tree cutting works is the labors, supporting equipment, and it should include as well cost of transporting the waste to the disposal area as specified and other social fees.
H-01-08	DEMOLITION OF BUILDING	Demolishing the existing building located in the construction plan location.	-measurement rule for each type of building to be demolished should separate each unit price in accordance with Bill of Quantity (BOQ) -Should be in accordance with the agreement between supervisor and project owner.	Measurement coverage to compute the cost of building demolition works is the labors, supporting equipment, and should include as well cost of transporting the waste to the disposal area as specified and other social fees.

			- Unit of measurement is lumpsum .	
H-01-09	TEMPORARY FENCE OF WORK LOCATION	Temporary fence is built to surround the work location serves as border to the location and other vicinity area which furnished with entrance gate.	-Fence length is measured in meter unit , -Fence height is measured in Meter , -Door length and width is measured in Meter , -Type of materials, length, fence height, door dimension, wood quality for door should be based on the agreement between the supervisor and owner.	Measurement coverage to compute the cost of temporary fence is the labor, fence material, wood quality and dimension for door and other supporting equipment.
H-01-10	GUARD HOUSE	Guard house is a building constructed to accommodate security staff that secure work location.	-Measurement rule for guard house is the building width. -Material used for building guard house should be based on the agreement between the supervisor and the owner. - Unit of measurement is m ² .	Measurement coverage to compute the cost of guard house is the labor, wood quality and dimension and other supporting equipment.
H-01-11	TEMPORARY OFFICE	Temporary office is a temporary place where all staff perform their duties.	-Measurement rule for temporary office is the building width. -Unit of measurement is m ²	Measurement coverage to compute the cost of temporary office is the labor, goods and materials, furniture, office stationary, first aid, and other supporting equipent.
H-01-12	WAREHOUSE	Warehouse is a temporary building to store all of the equipment and construction materials.	-Measurement rule for temporary office is the building width. -Unit of measurement is m ² .	Measurement coverage to compute the cost of warehouse is the labor, wood quality and dimension and other supporting equipment.
H-01-13	ELECTRIC POWER SUPPLY AND GENERATOR	Electric power supply and generator are facilities used for lighting and for other activities that require electric power and generator.	-Generator Capacity should be agreed upon by the owner. -Generator supply is measured in unit. -Electric power supply is measured in LS	Measurement coverage to compute the cost of electric power supply and generator is goods, materials, including permit fee, supporting equipment and other social fee.
H-01-14	CLEAN WATER	Clean water supply is an activity to provide clean	-measurement rule for clean water	Measurement coverage to compute

	SUPPLY	water to all staff for drinking, washing, showering, etc .	supply is the water pump measured in Unit, -Pipe is measured in Piece -Pipe connectors and other accessories are in Unit. -Pipe adhesive, tape and the like is in lumpsum. -Pump capacity, pipe diameter, and location should be agreed upon by the owner.	the cost of supplying clean water is goods and material, including permit fee, supporting equipment and other social fee.
H-01-15	RELOCATION OF PUBLIC FACILITY	Is to relocate all public facilities installation network that are in the work location which directly or indirectly affected by the ongoing project construction.	Measurement rule of relocating public facility is to clear the construction site from public facility installation network. Unit of measurement is in lumpsum .	Measurement coverage to compute the cost of relocating of public facility is labor, goods and materials, including permit fee, supporting equipment and other social fee.
H-01-16	DOCUMENTATION	Documentation work is to capture a certain physical event, construction or important event in the form of photos and/or videos.	Measurement rule for documentation is the series pictures/videos captured of physical condition, construction field or an important event prior to work execution, during and after the construction. Measurement unit for photos and Video is in Lumpsum .	Measurement coverage to compute the cost of documentation is goods and material which is related to documentation activity.

2. EXCAVATION WORK (H-02)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-02-01	EXCAVATION	The work of excavating soil volume (rock soil, hard soil, sandy soil and mud soil) based on the specified volume using manual tools or mechanical tools.	-The excavation volume should be based on the requirement specified in the contract document, design, drawing, and technical specification. -Measured in m³ .	Measurement coverage to compute excavation cost is each item of labor's activity, tools, loading and unloading fee, permit fee, insurance fee, transporting of digging waste to disposal area, supporting equipment and other social fees.

3. PILING WORK (H-03)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-03-01	ORDINARY SOIL PILING	Is to move the volume of the ordinary soil due to elevation difference. Should be based on required volume and type of materials, using manual and mechanical tools	Piling volume and type of materials used should be based on requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement is m ³ .	Measurement coverage to compute the cost of ordinary soil piling includes each item of piling material, labor's activity, tools and equipment, loading and unloading fee, insurance fee, supporting equipment, and other social fees.
H-03-02	SELECTED MATERIAL PILING	Is to move the volume of the selected material for certain purposes with certain parameter and from certain location (borrow area) using manual and mechanical tools.	Measurement rules for selected material piling is the piling volume and type of selected materials. Should be based on requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement is m ³ .	Measurement coverage to compute the piling cost of selected material includes each item of piling material, labor's activity, tools, loading and unloading fee, permit fee, insurance fee supporting equipment, and other social fees.

4. DEWATERING (H-04)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-04-01	DEWATERING	Dewatering is the work of controlling ground water/ surface water from work location in order not to hamper the ongoing construction especially for ground construction.	Measurement rules for dewatering is the work location should be dry or away from water submerge that may hamper the construction process Unit of measurement is lumpsum.	Measurement coverage to compute the cost of dewatering includes, labor's activity, tools, supporting equipment, and other social fees.

5. STONE MASONRY (H-05)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-05-01	STONE MASONRY (SPLIT STONE)	Stone masonry work is laying or placing the split stone (not round or oval stone) using mortar of certain mixture composition.	Measurement rules for stone masonry should be in accordance with requirement specified in the contract document, design, drawing, and technical specification.	Measurement coverage to compute the cost of stone masonry work is each item of labor activity, tools, supporting equipment, and other social fee.

			Unit of measurement is m^3 .	
H-05-02	SURFACE MASONRY	Surface masonry work is placing or arranging the stone in surface wall in such a way that look aesthetic	Measurement rules for surface masonry should be in accordance with requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement is m^2 .	Measurement coverage to compute the cost of surface masonry work is each item of labor activity, tools and supporting equipment,
H-05-03	ARMOUR ROCK	Armour rock is to construct a physical construction from stone arrangement for certain needs with diameter/dimension should be based on specified requirement without laying any mortar.	Measurement rule for armour rock is to lay or place the stone with dimension/diameter should be in accordance with requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement is m^3 .	Measurement coverage to compute the cost of armor rock work is each item of labor activity, tools, transportation fee, loading and unloading fee, permit fee, supporting equipment, and includes other social fees.
H-05-04	RIP-RAP	Rip-rap work is to place or lay the stone in a certain way in the project construction with diameter/dimension should be based on specified requirement without laying any mortar.	Measurement rule of rip-rap is to lay or place the stone with dimension/diameter should be in accordance with requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement is m^3 .	Measurement coverage to compute the cost of rip rap work is each item of labor activity, tools, transportation fee, supporting equipment, and other social fees.
H-05-05	PLASTERING	Plastering is part of work covering brick/concrete, brick/concrete wall surface. Rendering is as part of smoothing the surface of the plastered layer to be ready for priming	Calculated in meter square (m^2), and separate its item according to the quality of each mixture. Stucco is separated from plastering and calculated in meter square (m^2).	Including all the necessary equipment and labour for stirring mortar, transporting and installing plaster in its position based on the design.
H-05-06	GROOVE (ADHESIVE MORTAR)	A masonry work, overhang the mounted as thick as 1- 2 cm, on gaps between stones.	Unit of measurement is M^2 .	Stripping of assembly on gaps between rocks for lining
H-05-07	FLOOR WORK	The work of spreading certain mortar/lean	- Unit is m^3 .	Set up goods/materials for

		concrete evenly along the foundation post to constructing the foundation with thickness and elevation in accordance with planning design.		filtration
H-05-08	WEEPHOLE	A work of installing waste water pit absorption on stone retaining wall and/or concrete retaining wall. On its base mounted the filter, Its function is to escaping water pressure material, and the placement should be in accordance with the technical specifications and planning design.	Measured in Unit.	Filter installation.

6. CONCRETE WORKS (H-06)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-06-01	CONCRETE CYCLOP	An assembly that consists of mixture of stone and concrete with composition 60% stone and 40% concrete. Stone diameter and concrete quality should be in accordance with technical Specification.	Unit of measurement is M^3 .	Assembling and other components of supporting equipment.
H-06-02	CEMENT CONCRETE	Cement concrete structure is construction of cement concrete for bridge structure retaining walls and other concrete structures with shapes and dimensions in accordance with design and should use materials that meet specification	The measurement of work volume are as follow: a. <i>Concrete</i> measured based on design and its unit of measurement is m^3 b. <i>formwork</i> is measured based on design and the work method with its net area is measured from contact area with concrete in m^2 c. <i>Reinforce</i> is calculated in kg , and calculate separately per diameter. The length of the reinforce should have included bending and the joint (length distribution)	The scopes are: a. Preparation and storage of materials that are based on the specification. b. Formulating Job Mix Formula. c. Construction of formwork by using waterproof material; shape, dimensions, elevation and location should be based on the drawing. d. Mixing of components materials is according to the JMF and casting mixture with its procedure should be based on the specification. e. Concrete treatment procedure should be in accordance with its

				specification. f. Formwork discharge.
H-06-03	REINFORCEMENT	Reinforce is the work of provisioning, transporting, fabricating and installing of steel reinforcement with diameter and quality steel should be in accordance with specification.	Steel reinforcement is calculated in kg unit, should be calculated separately per-diameter. The length of reinforcement should have included bending and joint (length distribution) For steel reinforcement wire mesh. Calculating its net area without overlapping, the unit is m^2 . if there is any welding work, it's calculated in m^1	The scopes are as follow: a. Provisioning, transporting and storing of steel reinforcement with a diameter and quality should be in accordance with specifications. b. The diameter, length, shape and amount of fabricated reinforce should be in accordance with specification. c. installation of reinforced at distance configured location, the amounts of reinforced should be based on drawing
H-06-04	FORMWORK	Formwork is a reference form of concrete that can be constructed from wood, iron or others	The area of formwork is the contacted area between concrete and formwork measured in m^2 unit . The hole in the formwork which is less than $1 m^2$ is not counted as deduction of the area.	Including all supporting construction so that the formwork is strong, rigid and clean from dirt until attached to its position.

7. GABION WORKS (H-07)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-07-01	GABION WORKS	A box that is made of woven stainless wire with certain diameter, hexagonal-shaped wicker, with a minimum of 3 wire coils which are made manually or fabricated and filled with rocks, wire diameter, hole dimension and the dimensions of the stones should be in accordance with technical specifications.	-The measurement of gabion construction should be in accordance with detail planning design, -Unit of measurement is M^3 .	Constructing, transporting and installing, including its component and Supporting equipment.

8. GEOTEXTILE (H-08)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-08-01	GEOTEXTILE	Installing/spreading geotextile coat at specified location in	- The calculated area is the net area based on	Including transportation, installation,

		detail planning design. One of the geotextile functions is to hold grains while allowing water to flow through.	technical specification and detail design planning. - Unit of measurement is m ²	necessary overlapping connection and other necessary supporting equipment.
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9. SEAPORT WORKS (ON DRY LAND) – (H-09)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-09-01	OFFICE BUILDING	Office Building Work is the construction of a building to provide workplace shelter that meets occupational health standard and other minimum requirement that can perform its duty and function.	Measurement rules for office building construction includes types of material, building dimension, room dimension, building structure shape, which should be in accordance with the requirement specified in the contract documents, design, drawing, and technical specification. Unit of measurement for: -Room in m ² , -water Furniture is unit, -AC in unit, -Computer set in unit, -CCTV in unit, -TV in unit, -Sound system in unit, -Electric Network in unit,	Measurement coverage to compute the cost of office building work is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.
H-09-02	PASSANGER WAITING ROOM	Is the work of constructing a building that meets occupational health standard and other minimum requirement to provide waiting room for on and off board passenger	Measurement rules for waiting room construction includes types of material, building dimension, room dimension, building structure shape, which should be in accordance with requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement for: -Room in m ² , -water Furniture is unit,	Measurement coverage to compute the cost of waiting room is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and should have included other social fee.

			-AC in unit, -Computer set in unit, -CCTV in unit, -TV in unit, -Sound system in unit, -Electric Network in unit,	
H-09-03	CLINIC ROOM	To construct a building/a room that meet occupational health standard as well as other requirements to facilitate/accommodate sick passenger.	Measurement rules for clinic room construction includes types of material, building dimension, room dimension, building structure shape, which should be in accordance with the requirement specified in the contract documents, design, drawing, and technical specification. Unit of measurement for: -Room in m ² , -water Furniture is unit, -AC in unit, -Computer set in unit, -CCTV in unit, -TV in unit, -Sound system in unit, -Electric Network in unit, -Medical equipment in unit,	Measurement coverage to compute the cost of clinic roomwork is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.
H-09-04	INSPECTION ROOM	To construct a building or a room that meet safety standard and other requirements so as to facilitate the inspection of passenger's carrying stuffs for safety and security measured.	Measurement rules for inspection room construction includes types of material, building dimension, room dimension, building structure shape, which should be in accordance with the requirement specified in the contract documents, design, drawing, and technical specification. Unit of measurement for: -Room in m ² , -Scanner Equipment in unit, -X-ray Equipment in unit,	Measurement coverage to compute the cost work of inspection room is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.

			-water Furniture is unit, -AC in unit, -Computer set in unit, -CCTV in unit, -TV in unit, -Sound system in unit, -Electric Network in unit,	
H-09-05	COOLER ROOM	To build an isolated building/room in order to store certain product/goods using controlled temperature so as to preserve the products/goods and to keep the product meeting health safety standard	Measurement rules for cooler room construction should be in accordance with the requirement specified in the contract documents, design, drawing, and technical specification. Unit of measurement for: -Cooler room in m ² , -AC in unit, -Freezer in unit, -Electric network in unit,	Measurement coverage to compute the cost work of cooler room is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.
H-09-06	WAREHOUSE	To build a shielded building/room to store goods/products from shipping and before loading to ship so that they can meet technical and health safety standard requirement. There are several types of warehouse such as: general cargo warehouse, cold storage warehouse, harmful goods warehouse, organic seeds warehouse and mining goods warehouse.	Measurement rules for warehouse construction should be in accordance with the requirement specified in the contract documents, design, drawing, and technical specification. Unit of measurement for: -Cooler room in m ² , -AC in unit, -Freezer in unit, -Heater in Unit, -Electric network in unit,	Measurement coverage to compute the cost warehouse work is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.
H-09-07	CONTAINER YARD	To build a spacious floor structure that withstand heavy load so as to store, accumulate container before loading and unloading them into the ship and to keep the container temporarily before transferring to other places including to provide accessibility of heavy vehicles that transport the container.	Measurement rules for container yard construction includes types of material, building dimension, room dimension, building structure shape, which should be in accordance with the requirement specified in the contract documents, design, drawing, and technical specification.	Measurement coverage to compute the cost container yard construction is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.

			Unit of measurement for: - Yard foundation is m ³ , - Yard Compaction is m ³ ,	
H-09-08	PARKING LOT	To build a spacious floor structure that withstand heavy load (static and moving load) for parking, boarding, off boarding, loading and unloading goods which equipped with safety facilities.	Measurement rules for parking lot construction includes types of material, building dimension, room dimension, building structure shape, which should be in accordance with the requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement for: - foundation is m ³ -Compaction is m ³ , -Traffic signal is unit.	Measurement coverage to compute the cost of parking lot construction is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.
H-09-09	TERMINAL	To construct a building structure that firm and withstand heavy load for parking, boarding, off boarding, loading and unloading goods/container including the movement of heavy vehicles that transport the goods and container that equipped with safety facilities.	Measurement rules for terminal construction includes types of material, building dimension, room dimension, building structure shape, which should be in accordance with the requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement for: -Terminal building is m ² , -Foundation is m ³ -Compaction is m ³ , -Traffic signal is unit.	Measurement coverage to compute the cost terminal construction is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.
H-09-10	WEIGH BRIDGE	To put or install a set of mechanical or digital tools used to scale vehicle weight and goods in which it will be installed firmly or can be moved around in order to observe and administer the weight of the vehicle and its loading.	Measurement rules for weigh bridge construction include type of materials, dimension, and structure shape, mechanical and digital tools which should be in accordance with the requirement specified in the	Measurement coverage to compute the cost weighing bridge construction is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee,

			contract document, design, drawing, and technical specification. Unit of measurement for: -Foundation is m³, -Compaction m³, -Scaling device is unit, Traffic signal is unit.	supporting equipment and other social fee.
H-09-11	ELECTRIC NETWORK	To install electrical network in order to channel and distribute electric power based on the needs and requirement of the harbor	Measurement rules for electric network installation include type of materials, dimension, and types of electric network distribution tools which should be in accordance with the requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement for: -Panel/Incoming Cubicle is unit, -Generator set is unit, - Transformator is unit, -Distribution Panel is unit, - Cable Network is m³, - Stabilizer is unit, - Step up/step down is unit.	Measurement coverage to compute the cost electric network installation is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.
H-09-12	FUEL STORAGE	is to store, to build a network to distribute fuel based on the needs and the requirement of the harbor and the ships	Measurement rules for fuel storage construction include type of materials, dimension, and types of fuel distribution network equipment which should be in accordance with the requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement for: -Fuel pump is unit, -Fuel storage tank is	Measurement coverage to compute the cost of fuel storage construction is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.

			m^3 , - Pipe network is m, - Pipe Connector is unit, - Fuel Faucet is unit, - Electric Network is unit, - Other supporting equipment is unit.	
H-09-13	CLEAN WATER SUPPLY	To install pipe network in order to distribute clean water based on the needs and requirement of the harbor and ships	Measurement rules for clean water supply works include type of materials, dimension, and types of water distribution network equipment which should be in accordance with the requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement for: - Water pump is unit, - Water Tank storage is m^3 , - Water filter is unit, - Pipe network is m, - Pipe Connector is unit, - T, knee, socket, is unit, - Water Tap is unit, - Pipe Adhesive is unit, - Water storage is unit, - Electric network is unit, - Other supporting equipment is unit.	Measurement coverage to compute the cost clean water supply is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.
H-09-14	QUARANTINE ROOM	To build spaces or rooms for prevention purpose of the contamination and spreading of pests and diseases or harmful organisms from outside of the country or into the country or from one area to another area.	Measurement rules for quarantine room construction include types of material, dimension, structure shape which should be in accordance with the requirement specified in the contract documents, design, drawing, and technical specification. Unit of measurement for: - Cooler room is m^2 , - AC is unit,	Measurement coverage to compute the cost quarantine room is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.

			-Freezer is unit, -Electric network is unit, -Other supporting equipment is unit.	
H-09-15	GUARD HOUSE	To construct a building including its furniture for the usage of maintaining securing, safety and ordering of vehicles, people and environment around harbor.	Measurement rule for guard house construction is the type of material, dimension, structure shape of the building and its furniture which should be in accordance with the requirement specified in the contract document, design, drawing, and technical specification. Unit of measurement is m ²	Measurement coverage to compute the cost of guard house construction is each of labor's activity, goods and materials, equipment, transportation, loading and unloading, permit fee, insurance fee, supporting equipment and other social fee.

10. SEAPORT WORKS (ONSHORE) – (H-10)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-10-01	PORTS	The port is a place which consists of land surrounding particular restricted water as place of economic and Government activities in which used as a docking place, berthing, boarding and off boarding passengers, loading and unloading of goods as well as a place for intra and inter transport; equipped with safety shipping facilities.		
H-10-02	PORTS POND (Dredging, bathymetry)	To build a place for ships and vessels that load and unload goods and materials, board and off board passenger docking safely. Dimension of port's pond (length, width and depth) should be based on the technical principals of wave, ocean and shipping	Measurement rules for port's pond is the width, depth, structure, shape of port's pond, which should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in unit.	Measurement coverage to compute the cost of ports' pond includes each item of labor's activity, tools, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-03	PIER	Constructing of pier at port for docking and mooring of ships or vessel that loads and unloads goods and boarding and off boarding passenger.	Measurement rules for pier are the dimension, strength and the quality of construction to dock ships and vessel that load and unload	Measurement coverage to compute the cost of pier construction includes each item of labor's activity, tools, transportation,

			goods and materials, board and off board passengers, in which it should be in accordance with specified requirement in the contract document, design drawing, and technical specification.	loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-04	PIER FLOOR	Floor construction at the port used to accommodate loading-unloading traffic, and boarding and off boarding passenger traffic. Materials used for flooring are reinforced concrete and special quality timber.	Measurement rules for pier floor includes dimension, structure shape, quality of the concrete and surface elevation which should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measurement unit for: -Reinforced concrete is m^3 , -Timber special quality is m^3 .	Measurement coverage to compute the cost of pier floor construction includes each item of labor's activity, tools, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-05	CONCRETE PIER	Concrete pier works is to build, put up the pillars of reinforced concrete pier which is appropriately arranged with dimensions, shape, distance, depth and surface elevation based on design plan. which function to dock ship on both sides.	Measurement rules for concrete pier should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measurement unit for: -Reinforced concrete is m^3 , -concrete cyclops is m^3 ,	Measurement coverage to compute the cost of concrete pier construction includes each item of labor's activity, tools, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-06	STEEL PIER	Steel pier works is to build, put up the pillars of steel pier which is appropriately arranged with dimensions, shape, distance, depth and surface elevation based on design planning. With function to dock ship on both sides.	Measurement rules for steel pier should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measurement unit for: -steel pier is in unit,	Measurement coverage to compute the cost of steel pier construction includes each item of labor's activity, tools, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well

				as other social fees.
H-10-07	WOOD PIER	Wood pier works is to build, put up the pillars of wood pier which is appropriately arranged with dimensions, shape, distance, depth and surface elevation based on design planning. With function to dock ship on both sides.	Measurement rules for wood pier should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in m ³ .	Measurement coverage to compute the cost of wood pier construction includes each item of labor's activity, tools, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-08	WAVE BREAKER	To build an infrastructure that breaks the wave by absorbing some of the wave energy. wave breaker materials are made of reinforced concrete, concrete cyclops, and armour rock	Measurement rules for wave breaker should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measurement unit for: -reinforced concrete is m ³ , -Concrete cyclops is m ³ , -Armour rock is m ³	Measurement coverage to compute the cost of wave breaker construction includes each item of labor's activity, tools, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-09	SEA WALL	The work of constructing seafront protection in order to protect the coast or other buildings from window wave Construction material of sea walls are stone masonry, reinforced concrete (with special treatment) and durable steel sheet pile.	Measurement rules for sea wall should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measurement unit for: -reinforced concrete is m ³ , -Concrete cyclops is m ³ , -stone masonry is m ³ .	Measurement coverage to compute the cost of sea walls construction includes each item of labor's activity, tools, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-10	GROIN	Groin works is the work to build coastal safety structure relatively	Measurement rules for groin should be in accordance with	Measurement coverage to compute the cost of groin

		perpendicular to the direction of the coast that protrudes into the sea to withstand sediment transport so that it can stop/hold the influx of sediment to port or river mouth. Groin materials compose of reinforced concrete, concrete cyclops, steel, concrete pipe and armour rock.	specified requirement in the contract document, design drawing, and technical specification. Measurement unit for: -reinforced concrete is m^3, -Concrete cyclops is m^3 -steel is in unit, -concrete pipe is unit, -Armour rock is m^3,	construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-11	FENDER	Fender is the work to install device pads placed in the dock used to muffle/absorb collision energy that occurs when the ship will be docked to pier or at the time when ship moored by shaken wave or current which make ship collide with the pier. Fender materials are made of wood, rubber (elastic) and steel.	Measurement rules for fender should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in Unit.	Measurement coverage to compute the cost of fender construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-12	FASTENING TOOL SYSTEM	To install or attach something or other supporting tools to tie/grip the ship anchor so as to prevent ship from shaking during wave, current or wind. Fastening tool system can be placed in docking area and in the water.	Measurement rules for fastening tool system should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in unit.	Measurement coverage to compute the cost of fastening tool system construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-13	FASTENING TOOL SYSTEM (BOLDER)	To install or put up bolder of anchor ship by tying the rope that attach on bow, stern and body of the ship to the dock.	Measurement rules for bolder should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in unit.	Measurement coverage to compute the cost of fastening tool system-bolder construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-14	FASTENING	To install or put up	Measurement rules	Measurement

	TOOL SYSTEM (DOLPHIN)	fasteningtool system-dolphin during ship anchoring. This dolphin is widely used in loading and unloading of bulk goods.	for fasteningtool system-dolphin should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in unit.	coverage to compute the cost of fasteningtoolsystem-dolphin construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-15	BREASTING DOLPHIN	Breasting dolphin work is the work to build, install breasting dolphin equipped with fender to dock the ship during anchoring in order to withstand collision, install also with bolder in order to place rope.	Measurement rules for breasting dolphin should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in unit.	Measurement coverage to compute the cost of tool fastening system-breasting dolphin construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-16	MOORING DOLPHIN	Mooring dolphin work is the work to build, install something in order to dock the ship and equipped with bolder.	Measurement rules for mooring dolphin should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in unit.	Measurement coverage to compute the cost of tool fastening system-mooring dolphin construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-17	MOORING BUOY	To put, install anchored ship buoy in order to keep the ship anchoring. Fastening buoy system is placed in the port's pool or in the middle of the sea. The ship that will loads and unloads goods may not always be directly docked in the dock because piers are used, full or being repaired	Measurement rules for mooring buoys should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measured in unit.	Measurement coverage to compute the cost of fasteningtool system-mooring buoys construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well

				as other social fees.
H-10-18	JETTY	The work of constructing the structure of the building perpendicular to the coast which protrude into the sea. Construction materials of jetty are armour rock, reinforced concrete, which should be in accordance with design.	Measurement rules for jetty should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measurement unit for: -Armour rock is m ³ , -Concrete made based on the design measured in unit.	Measurement coverage to compute the cost of jetty construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.
H-10-19	BREAKWATER	The work of constructing structure of the building parallel the coast at a certain distance from the coastline to break and weaken the wave energy in order to reduce erosion and abrasion. The structural materials of the breakwater can be reinforced concrete, and armour rock.	Measurement rules for breakwater should be in accordance with specified requirement in the contract document, design drawing, and technical specification. Measurement unit for: -Armour rock is m ³ , -Concrete made based on the design measured in unit.	Measurement coverage to compute the cost of breakwater construction includes each item of labor's activity, tools, goods and materials, transportation, loading and unloading fee, permit fee, insurance fee, supporting equipment, as well as other social fees.

11. GENERAL EXPENSES (H-11)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-11-01	GENERAL EXPENSES	General expenses are all non-physical cost / expenses needed to support the progress of the project, such as project management cost, insurances etc	Should be breakdown per item, such as insurance, ceremonial cost, social cost, bank guarantee, etc, calculated in LumpSum	All general expenses should be described in cost structure/costbreakdown schedule and valid as a pay item

12. PROFIT (H-12)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-12-01	PROFIT	Profit is a sum calculated as the profit of contractors according to the Government regulation.	Profit should be calculated as % from the Total Net Project Cost	Total Net Project Cost can be seen in item 7.0. (Method of Measurement)

13. PROVISIONAL SUM (H-13)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-13-01	PROVISIONAL	A certain value that is	It should be	Can only be

	LSUM	reserved for a particular work but has not yet calculated its cost at the time of contract agreement.	determined by owner in USD, and included in the contract amount	used upon the written order of the owner
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14. CONTINGENCY SUM (H-14)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-14-01	CONTINGENCY SUM	A certain value that is reserved for a particular work that has not known yet for its usage.	It should be determined by owner in USD, and included in the contract amount	Can only be used upon the written order of the owner

15. CONSULTANT FEE (H-15)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-15-01	CONSULTANT FEE	Fee for design and supervision consultant,	It should be calculated based on Standard Fee for Consultant in Timor Leste	For design consultant include but limited to feasibility study, pre-design, detail design, specification, BOQ, Cost Estimate, and support the owner in the pre-bid meeting. For supervision consultant include but not limited to daily, weekly and monthly report, daily supervision of the contractor's works, approve all shop drawing and as built drawing, and final report

16. PMU COST (H-16)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-16-01	PMU COST	PMU cost is a specific fund allocated in the project for the purposes of the Project Management Unit, in performing Project management activities	PMU cost should be calculated based on the certain percentage from Total Net Project Cost. List of PMU cost for various type of building could be seen in Standard Fee for Consultant in Timor Leste.	Total Net Project Cost can be seen in item 7.0. (Method of Measurement)

17. TAX (H-17)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
H-17-01	TAX	The income tax according to the government of Timor Leste regulation	Calculated by a certain percentage from the Total Net Project Cost	Integrated in Total Gross Project Cost as Total Project Budget (Orsamento)

AGENCIA DESENVOLVIMENTO NACIONAL



STANDARD METHOD OF MEASUREMENT FOR AIRPORT CONSTRUCTION

1.0. TITLE OF THE DOCUMENT

The title of this document is TIMOR LESTE STANDARD METHOD OF MEASUREMENT-5, For Airport, Second Volume (January 2016), which is abbreviated to TLSMM – 5.

TL-SMM-5 is intended to be utilized in conjunction with the General Condition of Contract, General Specifications or any other relevant provisions provided elsewhere in the Contract Document.

The works shall be itemized and described in Bill of Quantity in sufficient details to enable Contractors to price it adequately and the method of measurement shall be stated in the Preamble of Bill of Quantity.

The preamble shall state the method of measurement other than TL-SMM-5, if any, which are adopted while preparing the Bill of Quantity and to be used for measurement of completed parts of the Works. Such method of measurement shall comprise those not covered by TL-SMM-5.

2.0. OBJECTIVE

The objective of TLSMM-5 is to set forth the procedure according to which the Bill of Quantity shall be prepared, priced and the quantities expressed and measured.

3.0. DEFINITION

- 3.1. In this document and in Bill of Quantity prepared according to the procedure set forth herein the following words and expressions have the meanings hereby assigned to them, except where the context otherwise required.
- 3.2. "Condition of Contract" means the "General Condition of Contract" as provided in the Bidding/Contract Documents prepared by Owner.
- 3.3. Word and expression defined in the Condition of Contract have the same meaning herein.
- 3.4. All references to clauses are references to clauses numbered in the Condition of Contract and reference to paragraphs are references to paragraphs numbered herein.
- 3.5. The word "Work" includes work to be carried out, goods, materials and services to be supplied, and the liabilities, obligations and risks to be undertaken by the Contractor under the Contract agreement.
- 3.6. The expression "expressly required" means as shown on the Drawings or as described in the Specifications or as instructed by the Engineer pursuant to the relevant provisions of Condition of Contract.
- 3.7. "Day work" means the method of valuing work on the basis of time spent by the workman, the materials used and the plant employed on the site work.
- 3.8. "Original Ground Surface" means the surface of ground before any work has been carried out.
- 3.9. "Final Excavated Surface" means the surface indicated on the Drawings to which excavation is to be carried out.
- 3.10. "Commencing Ground Surface" for an item in a Bill of Quantities means, the surface of the ground from where that particular item of work has commenced.
- 3.11. "Excavated Ground Surface for an item in the Bill of Quantity means, the surface to which excavation included in that particular item of work is to be carried out.

4.0. GENERAL PRINCIPLES

4.1. Unit of Measurement

The unit of measurement for each item shall be aligned for the item stated in the TL-SMM-5. The unit of measurement stated against a descriptive feature in the TL-SMM-5 shall apply to all items to which that descriptive feature applies. Meter, Kilogram, Second (MKS) units system has been adopted in this TL-SMM-5.

In describing the dimension of a certain works, its sequence should be as followed, length, width and height or thickness.

Each work should be calculated its net volume, excluding its disposal, overlapping, compactness, widening etc. All items either stated in this TL-SMM-5 or otherwise such as transportation, warehouse, permit, loading and unloading, etc will be calculated in unit price of its work.

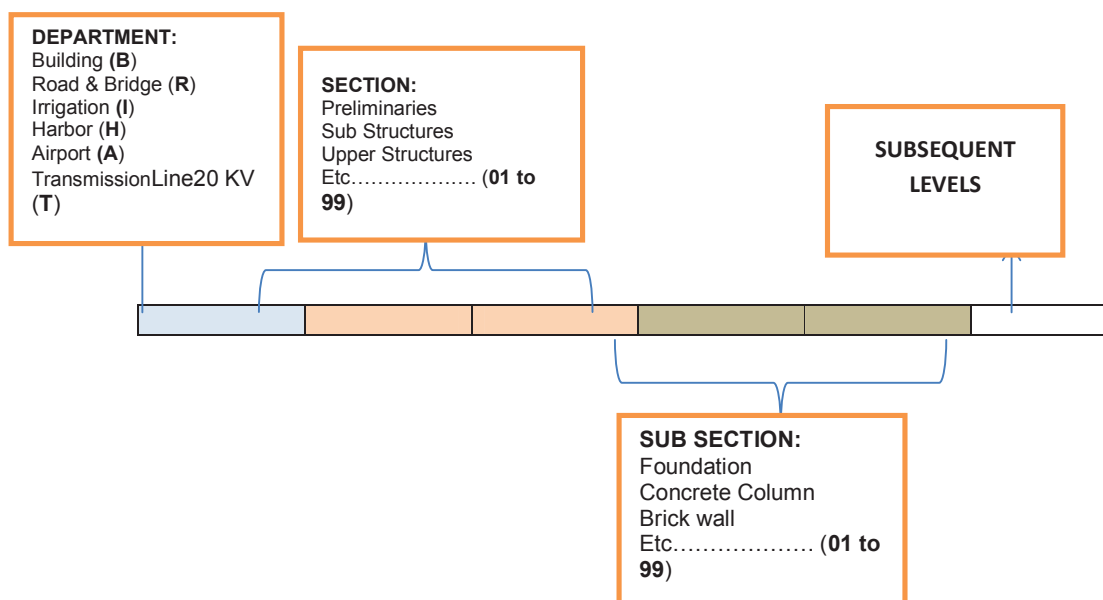
The unit of each work will follow the unit as stated in point 5.0.

The volume is rounded to two (2) decimal digits, ex. 1,234.78 not 1,234.7765

4.2. TL-SMM – 5 CODING

Works are classified into various “Sections” which further classified into “sub-sections” Unique code has been allocated to each item of work for its identification and presentation in the TL-SMM –5, Bill of Quantity and elsewhere. Coding arrangement is as given hereunder:

- . First digit represents the “Department”
- . Next two digits represent the “Section”
- . Next two digits represent the “Sub Section”
- . Next digits represent the subsequent levels



4.3. Sub Section

Works included in the sub section is to execute and measure for payment (pay item).

4.4. Measurement Rules

Measurement rules set out the conditions under which work shall be measured and the method by which the quantities shall be computed. In addition the following general conditions shall also apply:

- a. Quantities of acceptable completed work relating to any part of specification shall be computed using net dimensions from the drawing with method given in this document except otherwise specified in special provisions or in contract documents. No allowance shall be made for bulking, shrinkage or wastage.
- b. All works shall be measured according to drawing and specification, if required, shall be classified and measured separately as per Bill of Quantity.
- c. The contractor is not entitled to claim difference in quantity calculated using TLSMM-5 and actual quantity as per site of a specific item except provision made herein, special provisions, or elsewhere in the contract documents.

4.5. Definition

Definition means the extent and limits of the item of work represented by a word or expression used in the work classification and in the Bill of Quantity prepared in accordance with TLSMM-5

4.6. Measurement Coverage

Measurement coverage provides that the work stated is deemed to be included in the appropriate items to the extent that such work is included in the Contract. In addition, following general conditions shall also apply:

- a. Loading, unloading and transportation of material related to any item of work
- b. All the items and activities in TLSMM –5 shall deem to be included all operations required to perform the work as per Contract Documents.
- c. Additional measurement coverage which is necessary to grasp in details the method of measurement is given against relevant item or activity.

4.7. Additional Descriptions

Additional descriptions which are necessary for complete understanding of works/activities covered under method of measurement are provided against such particular item of work.

5.0. UNITS AND ABBREVIATIONS

The following units of measurement and abbreviations shall be used:

Unit	Abbreviation
Millimeter	Mm
Meter	M

Square millimeter	mm ² or mm2
Square meter	M ² or M2
Hectare	Ha
Cubic meter	M ³ or M3
Kilogram	Kg
Tone	Ton
Metric Tone	M.Ton
Summary	Sum
Number	No.
Horse Power	Hp
Week	Wk
Litre	Ltr
Lump Sum	Ls
Hour	Hr
Day	Day
KiloPascal	KPa
MegaPascal	Mpa
KiloNewton	KN

6.0 CONVERSION TABLE

To convert	Into	Multiply
LENGTH		
Millimeter	Inch	0.03937
Inch	Millimeter	25.40005
Meter	Foot	3.28084
Foot	Meter	0.3048
Meter	Yard	1.09361
Yard	Meter	0.9144
Kilometer	Mile	0.62137
Mile	Kilometer	1.60935
MASS WEIGHT		
Kilogram	Pound	2.20462
Pound	Kilogram	0.45359
Gram	Ounce	0.03527
Ounce	Gram	28.34949
Kilogram	Quintal	0.01
Milligram	Grain	0.01543
Kilogram	Hundred Weight	0.01968
Hundred weight	Tone	0.0508
Kilogram	Tone	0.001
Kilogram	Ton	0.00098
Pound	Ton	0.00045
Tone	Ton	0.98421
Kilogram	Seer	1.01605
Kilogram	Maund	0.02679
Gram	Tola	0.08573
VOLUME		
Litre	Pint (UK)	1.75975
Litre	Gallon (imperial)	0.21997

Litre	Gallon (US)	0.26417
Litre	Cubic Foot	0.3531
Litre	Cubic Meter	0.001
Cubic Foot	Liter	28.31682
Milliliter	Fluid ounce	0.0352
Gallon Imperial	Liter	4.5461
Gallon US	Liter	3.78541
Gallon Imperial	Gallon US	1.20095
Cubic millimeter	Cubic inch	0.00006
Cubic meter	Cubic foot	35.31472
Cubic foot	Cubic meter	0.02832
Cubic meter	Cubic Yard	1.30795
Cubic yard	Cubic meter	0.76456
AREA		
Square millimeter	Square inch	0.00155
Square inch	Square millimeter	645.1613
Square meter	Square foot	10.76392
Square foot	Square meter	0.0929
Square meter	Square yard	1.19599
Square yard	Square meter	0.83613
Square meter	Acre	0.00025
Hectare	Acre	2.47105
Acre	Hectare	0.40469
Square meter	Hectare	0.0001
Square kilometer	Square mile	0.3861
Square mile	Square kilometer	2.58999
Hectare	Square mile	0.00386
Square mile	Hectare	258.9989
Kilogram	Kilo Newton	
Kilo Newton	Kilogram	
Ton	Kilo Newton	10
Kilo Newton	Ton	0.1
MASS/UNIT AREA		
Kilogram per square kilometer	Ton per square mile	0.00255
Kilogram per square meter	Pound per square foot	0.20482
Pound per square foot	Kilogram per square meter	4.88243
MegaPascal	KiloPascal	1000
KiloPascal	MegaPascal	0.001
KiloPascal	Kilogram per sq.cm	0.01
Kilogram per Sq.cm	KiloPascal	100
Ton per Cubic Meter	KiloNewton per Cu.m	
KiloNewton per Cubic Meter	Ton per Cubic Meter	
MASS PER UNIT VOLUME		
Kilogram per cubic meter	Pound per cubic foot	0.06243
Grams per liter	Pound per cubic foot	0.06243
Pound per cubic foot	Kilogram per cubic meter	16.01845
Pound per cubic foot	Grams per liter	10.01845

In converting unit from one system to other system the measurement shall be taken nearest to three digits for MKS system and nearest to two digits for FPS system.

7.0. METHOD OF MEASUREMENT

Section 01: General
Section 02: Earth Work
Section 03: Drainage
Section 04: Pavement widening and Shoulder
Section 05: Granular sub-base and base
Section 06: Soil and Granular Material Stabilization
Section 07: Bituminous Pavement
Section 08: Structure
Section 09: Wall
Section 10: Doors and Windows
Section 11: Roofing
Section 12: Ceiling
Section 13: Floor Finishes
Section 14: Finishing Works
Section 15: Mechanical Works
Section 16: Electrical Works
Section 17: External Works
Section 18: Scanner and X-rays
Section 19: Instrument Landing System
Section 20: Baggage Transfer Equipment
Section 21: Air Traffic Control
Section 22: Day Works

TOTAL NET CONSTRUCTION COST, (A)

Section 23: Final Site Clearing
Section 24: Furniture and Tools

TOTAL NET PROJECT COST, (B = A + 23 + 24)

Section 25: General Expenses
Section 26: Profit
Section 27: Provisional Sum
Section 28: Contingency
Section 29: Consultant Fee
Section 30: PMU Cost
Section 31: Tax

TOTAL GROSS PROJECT COST, C = B + (25+26+27+28+29+30+31)

EXAMPLE OF GENERAL EXPENSES DETAILS (Section:25)

1. Material Samples including Quality Testing
2. Security
3. Occupational Health and Safety
4. Project Team/Staff Fees
5. Provisional Fee for Performance Bank Quarantees, Down payment, Retention Fee, ect.
6. Work Insurance Fee, Labor Insurance Fee
7. Communication Cost
8. Inauguration Fee
9. Rental fee for Lot/house/vehicles
10. Report Fee
11. Gathering/Meeting Fee
12. Social Fee
13. Other Non-Physical Fee for each project

7.1. GENERAL: (A-01)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-01-01	MOBILIZATION	Mobilization is a primary activity done by contractors to mobilize personnel, construction equipment, quality testing facilities, other facilities and license before project is started	Each personnel, construction equipment, quality testing facility and licenses shall be specified their types and specifications in details to facilitate the calculataion of mobilization cost Measured in Lumpsum	In computing mobilization cost, shall include transportation fee, shipping fee, loading and unloading fee, license, rental / purchase fee and other social fees.
A-01-02	DEMOBILIZATION	Demobilization is final activities done by the contractor to demobilize personnel, construction equipment, and other facilities that are no longer used for project.	Each personnel, construction equipment, quality testing facility and license should be specified their types and specifications in details to facilitate the calculataion of mobilization cost Measured in Lumpsum	In computing mobilization cost, shall include transportation fee, shipping fee, loading and unloading, license, rental / purchase fee and other social fees.
A-01-03	LAND PROVISIONING FOR BASE CAMP	Land provisioning for base camp is an activity done by the contractors to purchase or rent land to construct base camp and its surrounding area as specified in the contract document.	The area of land purchased or rented should be as required Measured in Lumpsum.	Provisioning of land for base camp shall include rent fees, and permit fee as needed.
A-01-04	BASE CAMP	Base camp is a temporary facility constructed by contractors for project implementation in accordance with contract, include: a. Field Office; b. Accommodation; c. Quality Laboratory; d. Repair shop; e. Warehouse; f. Crushing Plant; g. Asphalt Mixing Plant; h. Batching Plant; i. Casting yard, and	Each facility should be breakdown as follwos: a. Field Office (m ²); b. Accommodation (m ²); c. Laboratory (m ²); d. Repair shop (m ²); e. Warehouse (m ²); f. Crushing Plant (unit); g. Asphalt Mixing Plant (unit); h. Batching Plant (unit); i. Casting yard (unit), and	Include furniture, tools and other necessary accessories.

		j. Access Road	j. Access Road (m ²). Measurement unit is in Lumpsum .	
A-01-05	DEMOLITION	Demolition is an activity to demolish the existing building which locates within the corridor of construction planned area	Measurement of demolition shall comply to what is stated in BOQ and the payment shall be in Lumpsum .	Unit price of demolition work shall include equipment, manpower, permit fee, pacification, and disposal of waste to the decided location.
A-01-06	RELOCATION OF UTILITY	Relocation of utility is an activity that shall be done by contractor to move obstructed utilities that will hamper the work implementation in site location. The following utilities shall be relocated: a. Electrical Pole and cable b. Telephone pole and cable c. water supply pipe d. gas supply pipe e. underground cable f. traffic light g. traffic sign h. fences	Should be pecified in detailed and paid in Lumpsum .	Including transportation, accommodation and necessary permit fees.
A-01-07	PHOTO DOCUMENTATION	Each photo should describe the physical condition of the work in a certaintime	The unit should be in LumpSum	It should be taken from 4 Minimum points of view, first taken starts from 0% progress, the second photos should be taken periodically until work completion based on the specifaction
A-01-08	TEMPORARY FENCE AND GUARD HOUSE	Temporary fence is for securing the site, built within the boundary of site, equipped with entrance and exit gate. Guard house should be placed at entrance and at the other place needed.	The unit of fence is in line meter (m'), the door in square meter (m ²). Guard house is in square meter (m ²)	The fence, guard house and the gate should be strong enough throughout construction period. The entrance door frame is made wood class III size 5/7 and wall with Zinc BJLS 30. The guardhouse is made of wood class III and wall with Zinc BJLS 30
A-01-09	PROJECT SIGN BOARD	Project sign board should include description of the project, and posted in front of project site	The quantity is measured in unit	Sign board should be done according to the drawing and specification, and should be fixed at the

				location that could be seen easily before the works is started until the completion of the project.
A-01-10	BENCH MARK	Bench Mark (BM) is a permanent reference point +/- 0.00	The quantity is in unit	It should be protected during the construction time, and can be demolished under instruction of the Engineer
A-01-11	BATTER BOARD	Batter board is a helping tool to determine the center lines of the building	The quantity should be calculated along the outside round of building, in line meter (m')	Include all necessary tools such as theodolite, the specialist surveyor and the material needed. It should be strong enough and maintained after all of the center line of building already fixed to the permanent building center line
A-01-12	TEMPORARY WATER AND POWER SUPPLY	1. Temporary water supply for construction, cleaning, toilet, etc 2. Temporary power supply for construction, lighting, etc.	The quantity of temporary water and power supply should be calculated in Lumpsum (LS)	Include all tools and equipment needed, permit and operation and maintenance fees

7.2. EARTH WORK: (A-02)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-02-01	EXCAVATION	Excavation is digging of soil, rock, mud, and existing pavement with geometric, shape and dimension in accordance with drawings.	Calculated in M³	Excavation work shall include hauling of disposal to the decided location
A-02-02	EMBANKMENT	Embankment is heaping up of materials based on the specification and drawing plan	Quantity measurement of embankment work is in m³	Embankment work include: a. Material hauling, spreading and compacting. b. Quality testing of material and field density of embankment
A-02-03	SUBGRADE PREPARATION	This work is served to lay subgrade structure, runway, taxi way and apron	Unit of measurement is m²	Subgrade preparation work shall include: a. Leveling and profiling b. Material Quality testing

A-02-04	CLEARING AND GRUBBING	Clearing and grubbing the surface ground with thickness as specified.	Clearing and grubbing are calculated as wide as project site, including access road.	Clearing and grubbing work shall include: a. Grubbing stumps as well as grass and trees with less than 15 cm in diameter. b. Hauling of disposal to decided location.
A-02-05	TREE REMOVAL	Tree removal is removal of all trees measuring 15 cm or more in diameter which grow within the corridor of road length RIDE OF WAY (ROW)	Quantity of tree removal shall be calculated by each classified diameter as below: □ diameter 15-30 cm □ diameter 30 – 50 cm □ diameter 50 – 75 cm In general the diameter of tree is measured at 1meter above the surface ground. Except for <i>palm tree</i> in which its diameter is measured 0.30 m above the surfaceground.	Tree removal work shall include hauling of disposal to decided location.

7.3. DRAINAGE: (A-03)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-03-01	DRAINAGE SYSTEM	Drainage system is the water channels that constructed along both sides of runway, taxiway, plane parking area and at the buildings in order to facilitate rain water flows faster to dumping area.	Quantity measurement is in m³ .	Including hauling of disposal material to the decided location.
A-03-02	MORTARED STONE WORKS	Mortar stone work is lining the side wall and bottom channel and aprons, entry pits with mortared cement stone in accordance with design and specified materials.	The measurement of work volume is in m³	a. Mortared stone work include: □ Both side of the channel. □ Bottom of the channel. b. Mortar sidewalk is excluded from excavation works.
A-03-03	CULVERT	Culvert is water crossing channel beneath road surface with type, shape and dimension in	Work volume of culvert is calculated in meter	Including: assembling and joining the culvert.

		accordance with design that has function to channelling water from one side to other side of the road. Types of culverts are as follow: a. plain concrete pipe b. reinforced concrete pipe c. corrugated steel pipe d. reinforce concrete plate on stone masonry channel e. reinforced concrete box		
A-03-04	SUB - SURFACE DRAINAGE	Sub-surface drainage is a drainage system constructed under the surface of the road with type, shape, dimensions and depth shall be in accordance with drawing and its material shall comply with specifications	Quantity of sub-surface drainage is calculated per item of material used with the following rules: ☐ Backfill : (m³) ☐ Granular Material: (m³). ☐ Geotextile : m²) ☐ perforated pipe :linear m	Including: installation of perforated pipe, compaction of granular and backfill material but excluding the excavation and hauling of disposal materials.

7.4. PAVEMENT WIDENING AND SHOULDER: (A-04)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-04-01	PAVEMENT WIDENING	is extending the width of existing pavement in accordance on the drawing.	Quantity measurement shall be based on the following: a. excavation of bituminous pavement : (m²) b. excavation of granular base : (m³) c. construction of new granular base : (m³) d. construction of new bituminous pavement : (m²) e. spraying bituminous tack coat and prime coat : (m²)	Pavement widening work shall include: a. excavation of the existing pavement b. Hauling of disposal materials resulting from excavation to decided location c. compacting subgrade d. spreading and compacting new granular base e. spraying bituminous prime coat f. spreading and compacting new bituminous layer g. Spraying bituminous tack coat. h. quality testing of materials

A-04-02	SHOULDER	Shoulder is part of the road located along the outer edge of pavement with dimension, line and grade shown in the drawing. There are two types of shoulder, i.e.: a. Granular Shoulder, b. Bituminous paved shoulder	Quantity measurement of the shoulder shall be based on the following: a. granular shoulder: m^3 b. Bituminous paved shoulder: m^2	Include: a. Granular shoulder Provisioning, hauling, spreading, and compacting of the material b. Bituminous paved shoulder Provisioning, mixing, hauling, spreading, and compacting and also prime coat spraying. c. quality testing of material and field quality control.
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7.5. GRANULAR SUB-BASE AND BASE (A-05)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-05-01	SUB-BASE COURSE	Sub-base course is part of the pavement on prepared subgrade with thickness, dimension, line, and grade as shown on the drawings and using material that comply with specifications.	Quantity measurement of the sub-base shall be in m^3	Sub-base course work shall include: a. Provisioning, hauling, spreading and compacting b. quality testing of materials and field quality control
A-05-02	BASE COURSE	Base course is a part of the pavement on prepared subbase with thickness, dimension, line and grade as shown on the drawings and using material that comply with specifications	Work volume of base course is calculated in m^3	This work includes: a. Provisioning, hauling, spreading, and compacting. b. Quality testing material and field quality control.
A-05-03	GRANULAR PAVEMENT	Granular pavement is construction of aggregate pavement without bituminous cover according to specification and drawings.	The quantity measurement of the granular pavement shall be in m^3	Granular pavement work shall include: a. Provisioning, hauling, spreading, and compacting; b. Quality test of material and field quality control.

7.6 SOIL AND GRANULAR MATERIAL STABILIZATION (A-06)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-06-01	SOIL CEMENT BASE	Soil cement base is base course using soil or aggregate mixed with certain portion of Portland cement, with thickness, dimension, line and grade as shown in the drawing and the compaction shall have compressive strength in accordance with specifications.	Quantity measurement of soil cement base are as follow: a. soil or aggregate : m^3 b. Portland cement ; tons	Soil cement base shall include: a. Provisioning and hauling of materials, mixing, spreading and compacting. b. Quality testing of material and field quality control.
A-06-02	CEMENT TREATED BASE	Cement treated base is base course using Portland cement aggregate mixture with thickness, dimension, line and grade as shown on the drawing and the composition of material shall comply with specifications	The following rules shall apply for quantity measurement of cement treated base: a. aggregate material : m^3 b. Portland cement : tons	Soil treated base shall include : a. provisioning and hauling of materials, mixing, spreading, and compacting b. quality testing of material and field quality control
A-06-03	SOIL-LIME STABILIZATION	Soil-lime stabilization is base or subbase using lime-soil mixture with thickness, dimension, line and grade as shown on the drawing and the mixture composition shall comply with specifications	The following rules shall be applied for quantity measurement a. soil : m^3 b. lime : tons	Soil-lime base work shall include: a. provisioning, and hauling of materials, mixing, spreading, and compacting b. quality testing of materials and field quality control
A-06-04	BITUMINOUS STABILIZATION	Bituminous stabilization is base course using granular material mixed with bituminous material with material composition shall comply with specification while the thickness dimension, line and grade should be based on the drawing.	The following rule shall be applied for quantity measurement: a. granular material : m^3 b. Bituminous materials : tons	Include: a. provisioning and hauling of materials, mixing, spreading and compacting b. quality testing of materials and field quality control
A-06-05	CHEMICAL STABILIZATION	is soil mixed specified chemical substance by	Quantity measurement of chemical stabilization	Chemical stabilization shall include:

		certain composition to improve the performance and to strengthen so as to improve subgrade, sub-base and base course	is calculated in m^3	a. Provisioning, hauling, mixing, spreading and compacting. b. Quality testing of materials and field quality control
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7.7 BUTIMINOUS PAVEMENT: (A-07)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-07-01	PRIME COAT	Prime coat is bituminous binder that sprayed homogenously on dust free and dry surface of granular base course, before spreading asphaltic layer.	Unit of measurement is m^2	Prime coat work shall include: a. removing loose dirt and other objects from surface of granular base b. spraying prime coat materials evenly throughout the surface based on the specification c. quality testing of prime coat and field spraying test
A-07-02	TACK COAT	Tack coat is bituminous binder that sprayed homogenously and uniformly on dust free and fully dry surface of asphaltic layer, before spreading next asphaltic layer.	Measured in m^2	Tack coat work shall include: a. Cleaning the whole surface. b. Spraying tack coat evenly to the whole surface. c. quality testing of tack coat and field spraying test
A-07-03	SAND SHEET	Sand sheet is thin layer of wearing course with thickness, dimension, lines and grade as shown on the drawing, consist of sand and bituminous material that mixed, spreaded and compacted in hot condition at a certain temperature in accordance with specification.	Measured in m^2	Sand sheet work shall include: a. Provisioning, mixing, spreading, and compacting. b. Prior to spreading conducting the surface compaction. 1. Clearing, 2. Spreading tack coat. 3. Material quality testing and field quality control.
A-07-04	HOT ROLLED SHEET	Hot rolled sheet is wearing course or base course with thickness, dimension, lines and grade as shown on the drawing, consist of granular materials	Quantity of hot rolled sheet work shall be measured in m^2	Hot rolled sheet work shall include: a. Surface Provisioning: ☐ Cleaning ☐ Tack Coat b. Material Provisioning,

		mixed, spreaded and compacted in hot condition at a temperature and composition in accordance with specification. The thickness of Hot rolled sheet is 40mm.		Mixing, spreading, and compacting. c. Quality testing of materials and field control
A-07-05	HOTMIX ASPHALTIC CONCRETE	Hotmix asphaltic concrete is constructing or assembling rigid asphaltic layer on its rigid base. Its composition are: course aggregate, fine aggregate, filler, asphalt which then mixed, spreaded and compacted in hotmix based on the drawing.	The work volume of hotmix Asphaltic concrete is calculated in unit: □ AC-base (m ³) □ AC Binder (m ²) □ AC wearing (m ²)	AC-BASE work shall include: a. Provisioning materials, mixing, spreading, and compacting. b. Quality testing of material and field quality control
A-07-06	ASPHALT TREATED BASE = ATB, AND ASPHALT TREATED SUB BASE = ATSB)	ATB is hot mix of aggregate bituminous mixtures as base or subbase, with thickness, dimension, lines and grades as shown on the drawing, quality of material and material composition should be in accordance with specification	Asphalt treated base is measured in m ³	AC-BC work shall include: a. Provisioning, hauling, mixing, spreading and compacting b. Quality test of materials and field quality control.
A-07-07	SURFACE DRESSING	Surface dressing is the work of dressing asphalt on the surface of aggregate base A which already applied asphalt binder or on the existing asphalt, then spreaded with fine aggregate in which its quality and grade should be as required /specified.	The work volume is calculated as follow: a. Cover aggregate of single and double surface dressing is in m ² . b. asphaltic materials for spreading is in m ² and multiply to the weight per unit rigid volume.	Includes: a. Single surface dressing, is asphalt dressing which covered with chipping. b. Double surface dressing, is asphalt dressing with double surface (chipping), each layer is given asphalt binder.
A-07-08	BITUMINOUS COLDMIX	Bituminous coldmix is pavement with thickness, dimension, lines and grades as shown on drawing; consist of aggregate and bituminous material, mixed, stored, spreaded and compacted in cold condition	Quantity of bituminous cold mix shall be measured in m ³ as approved by Engineer.	Bituminous coldmix shall include: a. Provisioning, hauling, mixing, storage, spreading, and compacting b. Quality test of material and field quality control

A-07-09	PENETRATION MACADAM	Penetration Macadam is a regulating course of stabilized aggregate bitumen with thickness, dimension, line and grade as shown on the drawing; consist of course aggregate, key aggregate and cover aggregate in accordance with specification. Penetration on macadam can be functioned as base.	Quantity of penetration macadam is measured in m^3 as agreed by the project owner.	Penetration macadam pavement shall include: a. Provisioning and hauling of materials, spreading, compacting. b. Bituminous spraying on every surface that has been compacted. c. Quality test of materials and field quality control.
A-07-10	SANDING	Sanding is a maintenance work of existing pavement surface by spraying bitumen binder on the surface and dry cleaned sand	Quantity of sanding is measured in m^2	Sanding work shall include: a. Provisioning, bitumen heating, and spraying and spreading of sand. b. Quality test of materials and field quality control.

7.8. STRUCTURE: (A-08)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-08-01	CEMENT CONCRETE	Cement concrete is construction of all concrete structures, including reinforced, plain concrete, cast in place or precast and composite with thickness, dimension, lines, level and grade as shown on the drawing	Quantity of concrete structure is measured in m^3	Construction of cement concrete includes: a. Provisioning material, mixing, Pouring, compacting, and curing ☐ Lean Concrete ☐ Reinforced Concrete ☐ Pre Cast and cast in situ prestressed concrete b. Quality testing of materials and field quality control.
A-08-02	PRESTRESSED CONCRETE	Prestressed concrete is constructing of structures with shape, dimension, line, and grade as shown on the drawing. By using precast, prestressed, cast in place, either post tension or pre-tension and shall use materials in accordance with specification.	Quantity of prestressed concrete structure is measured in the following rules: a. Precast prestressed concrete girder : each b. diaphragm : m^3 c. stress wire : kg	Prestressed concrete structure shall include: a. fabrication, transportation/shipping, storage, joint and erection/launching. Quality test of materials and field quality control.

A-08-03	REINFORCED STEEL	Reinforcing steel is furnishing and placing reinforced steel with type, shape, diameter, length and quality based on the specification.	Quantity of reinforced steel is measured in kg	Reinforced steel shall include: a. Furnishing, transportation, and storage b. Fabrication (cutting and bending) c. installation d. Quality test of materials and field quality control.
A-08-04	STRUCTURAL STEEL	Structural steel is construction steel girder with type, shape, dimension, level, lines and grade as shown on the drawing and the steel quality should be in accordance with specifications.	Quantity of structural steel shall be measured in Kg	Structural steel work shall include: a. Provisioning, transporting, fabricating and storage b. Erection/launching
A-08-05	PILE FOUNDATION	Pile foundation is construction of foundation to support bridge structures, consist of timber, reinforced concrete, prestressed concrete and steel pile with shape, dimension, length and configuration as shown on the drawing and the quality shall be in accordance with specifications. There are two types of pile foundation: a. Driven Pile - Timber Pile - Steel pile - Reinforced concrete - Prestressed concrete b. Cast in place - Bore pile	Quantity of construction of pile foundation is measured as follow: a. furnishing timber pile : m³ b. furnishing of reinforced concrete pile : lin. m c. Furnishing of prestress concrete : lin. m d. furnishing steel pile: lin. m e. driving pile: lin. m f. construction of bore pile: lin.m g. construction of concrete sheet pile: m² h. construction of steel sheet pile : m²	Construction of pile foundation shall include: a. Furnishing, transporting, storing, precast concrete casting, boring and driving. b. Quality test of material and field quality control.
A-08-06	OPEN CAISSON FOUNDATION/ WELL FOUNDATION	Open caisson foundation is a construction of open caisson to support bridge structures, with shape, dimension, elevation and depth as shown on the drawing	Quantity of open caisson foundation is measured in linear meter	Construction of open caisson foundation shall include: a. Provisioning of caisson wall : ☐ Segmental precast ☐ Cast in situ b. installing caisson

		and the quality of material should be in accordance with specification		wall
A-08-07	MORTAR CEMENT	Cement mortar is producing and applying mortar cement to use in various work, consisting of Portland cement and sand mixed with water that has composition and quality as stated in specification.	Quantity of cement mortar work is measured in m^3	Cement mortar shall include: a. Provisioning and mixing of material and finishing. b. Quality test of materials
A-08-08	STONE MASONRY	Stone masonry is construction of structure with shape, dimension, line and grade as shown on the drawing, consisting of stone diameter 10-20 cm and mortar cement in accordance with specifications	Quantity of stone masonry work is measured in m^3	Construction of stone masonry structure shall include: a. supplying of materials; b. stone assembly with mortar cement c. Quality test of material and field quality control. Excluded excavation and lean concrete laying.
A-08-09	RIP RAP	Rip rap is constructing scour protection of surface composed of erodible material, consisting of stone formation 40-50 cm in diameter with shape, dimension, level, lines and grade as shown on the drawing.	Quantity of rip rap is measured in m^3	Construction of rip rap shall include: a. Provisioning materials b. Stone laying
A-08-10	GABION	Gabion is construction of scour protection or retaining wall with type, shape, dimension as shown on drawings, consisting of the wire mesh boxes filled with stone 10-20 cm in diameter.	Quantity of gabion is measured in m^3	Construction of gabion shall include: a. Material provision b. Structure installation
A-08-11	BLIND STONE	Blind stone is a construction of underlying foundation base consisting of stone grouted with mortar cement with thickness, dimension, lines and grades as shown on drawing.	Quantity of blinding stone is measured in m^3	Construction of blinding stone shall include: a. Preparation of soil bed surfaces. b. Supplying and installing

A-08-12	CEMENT CONCRETE PAVEMENT	Portland cement concrete pavement is a construction of concrete pavement with thickness, dimension, lines and grade as shown on the drawing and the quality of materials is in accordance with specification	Quantity of Portland cement concrete pavement is measured as follows: a. concrete : m³ b. steel tie bar and dowels: Kg c. Joint sealant : Meter	Construction of concrete pavement shall include: a. Provisioning materials, mixing, compacting and curing. b. Installing of dowels bar and tie bar c. Cutting and sealing of expansion / construction joint. d. Quality test of materials and performance
A-08-13	LEAN CONCRETE	Lean concrete is construction of levelling the layer with thickness, lines and granular as shown on the drawing. Composed of fine aggregate, coarse aggregate, Portland cement and water, then mixed homogeneously and laid on well prepared ground surface.	Quantity of lean concrete is measured in m³	Construction of lean concrete shall include: a. Provisioning materials, mixing, compacting and curing. b. Quality test of materials and performance

7.9. WALL: (A-09)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-09-01	CONCRETE BLOCK (BATAKO) AND BRICK WALL	Concrete /brick Wall is installed as a divider between internal rooms, or external wall	The net area (square meter) of wall should be based on length, width and height measured from edge of column/beam. Holes/opening for doors, windows should be deducted from the area of wall. Opening for piping, cabling shall not be deducted. If reinforcement is inserted in concrete (batako) wall, it should be calculated separately in kg. If inserted glass block wall, then should be calculated separately in unit (each).	Include all material, tools and labour used for mixing the mortar, transportation and installing wall at the right position. Include grooving which should be according to specification.

			For block/brick installed as a riser or tread on stairs, could be calculated separately in line meter (m').	
A-09-02	PLASTERING AND RENDERING	As a finishing work to cover the surface of block (batako) /brick wall. Render is the finished surface of plaster ready to receive painting works	The area of plaster should be calculated in square meter (m²), separately per-quality of mortar. The area of render should be calculated separately from the plaster work, in square meter (m²) If the wall covered with ceramic or the like, the area of ceramic should be calculated separately in square meter (m²).	Include all material, tools and labours needed to mix the mortar, transportation and install the plaster and render at the right position.
A-09-03	CURTAIN WALL	Curtain wall is a glass wall with alluminium frame, installed at outside wall of building, to protect the building from heat and noise	Alluminium frame should be measured in line meter (m') for each type of profile. Glass measured in square meter, calculated from the opening, and according to the type and thickness. Should be calculated separately for iron monger, decorative etc.	Include all tools, labours, supporting materials (sealant etc.) needed for fabrication, assembling and installing at correct position
A-09-04	PARTITION	Partition is a divider wall, that made of wooden, metal frame and covered by wooden, gypsum, glass or any other materials	In calculating the quantity of partition, should be separated between frame and covers. Wooden frame should be calculated in cubic meter (m³). Metal frame, should be calculated in line meter (m'). For wooden, glass or metal covers, should be calculated in square meter (m²). All quantity should be calculated net, according to the drawing and specification.	Include all tools, labour and supporting material needed for fabrication, assembling and installation on the right position

			For skirting should be calculated separately in line meter (m'). If in BOQ mentions in unit per-type complete, then it can be calculated in unit (each) per type.	
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7.10. DOORS AND WINDOWS: (A-10)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-10-01	DOOR AND WINDOW	Door and Window are part of room's cover, made of woods, glass, metal etc.	Wooden doors/windows frame should be calculated in cubic meter (m³), according to the type and dimension Metal frame should be calculated in line meter (m') according to the type and dimension. Wooden door/window leave shall be calculated in square meter (m²) according to the type and dimension. All quantities shall be calculated in net area, according to the drawing and specification. Glass is calculated in net area (m²) and does not allow to calculate through overlapping / list. For louvre glass shall be calculated in line meter (m'). Can also be calculated in unit (each) per-type for doors/windows if stated clearly so in the BOQ.	Include all tools and labours, supporting material needed for fabrication, assembling and installing on the right position. Iron monger should be calculated separately in unit (each), according to the type and dimension and specification.

7.11. ROOF (A-11)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-11-01	ROOF FINISHES	Roof finishes / roof covers is to protect the building from heat, rain, dust ect. Made of ceramic, zinc,	Roof cover is measured in square meter (m ²). Ridge capping, gutters	Include all tools and labour, and supporting materials (nail, screw, or the like).

		concrete, etc	measured in line meter (m')	
			Water proofing, insulation and others, should be calculated separately, in square meter (m ²).	
A-11-02	ROOF FRAME	Roof frame to support the roof cover, made of concrete, steel, wood or the like	Wooden roof frame measured in net dimension according to the drawing and calculated in cubic meter (m³), however, the waste material is not part of the calculation of the frame quantity. Steel frame also measured in net dimension and calculated in line meter (m') or kg according to the drawing and type /dimension of the profile. Concrete frame can be calculated same with the other reinforced concrete works.	Include all tools, labours, supporting materials as nails, anchors, rivets, etc. as needed.

7.12. CEILING (A-12)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-12-01	CEILING	Ceiling is part of work to cover the upper part of a room, made of wooden or metal frame, covered by glass, wooden, gypsum, acoustic board, plastic board etc.	In calculating the quantity of ceiling, should be separated between frame and covers. Wooden frame should be calculated in cubic meter (m³). Metal frame, should be calculated in line meter (m'). For wooden, glass, gypsum, acoustic or metal covers, should be calculated in square meter (m²). All quantity should be calculated in net, according to the drawing and	Include all tools, labour and supporting material needed (hangers) for fabrication, assembling and installation on the right position. Ceiling trim, sound barriers, heat barriers which should be calculated separately according to the specification

			specification. The space for lamp, diffuser, loud speakers, sprinkler and others, shall not be deducted from the area of ceiling. For heat/sound insulation work, should be calculated separately in square meter (m²). Cornices and list should be calculated separately in line meter (m')	
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7.13. FLOOR FINISHES (A-13)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-13-01	FLOOR	Floor is a work to cover the ground part of a room/field, made of ceramic, granite, vinyl, carpet or others.	Floors is measured in square meter (m ²) according to the floor schedule, type and dimensions, mentioned in the specification and drawing. Skirting, tread and riser of stairs, is measured in line meter (m')	Include all tools and labours and supporting materials, and polishing according to specification

7.14. FINISHING WORKS (A-14)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-14-01	PAINT FURNISH	The finishing works of the plaster, wooden and the like in order to cover the surface to make it looks fine	The quantity should be measured in square meter (m ²). For cornice, hand rail and part that less than 30 cm wide should be measured in line meter (m').	Include all tools, labours, supporting materials, the first and second layer of base, putty and the like.
A-14-02	METAL WORKS	Including all non structural metal work such as railing, balustrade, netting and any others artistic metal work.	The quantity should be calculated in square meter (m ²), except for cornice or the like in line meter (m')	Include all tools, labours and supporting materials for fabrication, assembling and installing on good condition, clean .

7.15 .MECHANICAL WORKS (A-15)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-15-01	DIESEL GENERATING SET	Generate power, with diesel machine as a prime mover to produce energy	Measured in complete unit according to the specification.	Include all related works, installation, supporting materials, tools, equipment such as doors, panel, Automatic Transfer

		needed to turn the generator rotor		Switch/Automatic Main Failure, testing and commissioning, operation manual.
A-15-02	TRANSFORMATOR	Transformer is a fixed or moveable electrical machine, to change the primary electric power/tension to the Secondary power /tension with constant frequency, through a pair of magnetic and electromagnetic conduction.	Measured in complete set of unit according to specification	Include all related works such as installation, lightning arrestor, cut-out, distribution panel, testing and commissioning, operation manual.
A-15-03	UNINTERRUPTIBLE POWER SUPPLY (UPS)	UPS is a reserved power supply tools in case of emergency	Measured in complete set of unit according to the specification	Include all related works such as installation, testing and commissioning, operation manual.
A-15-04	AIR CONDITIONING (AC)	Air conditioning is an equipment which is able to balance the temperature as needed. Compose of compressor, condenser, orifice tube, evaporator, and expansion valves.	Measured in complete Set of unit and sub unit, according to the drawing and specification.	Include all related works to AC units, installations, supporting materials so that the AC would install on its position and provides temperature as needed. Including commissioning test, operational and manual maintenance.
A-15-05	FIRE FIGHTING	Fire fighting is an associated fire fighting installation system such as : Fire hydrant with hose reel system, audio/visual advisory system, sprinkler system, gaseous extinguisher system, automatic fire alarm and detection system, portable hand operated system, complete with	Measured in unit and sub unit, according to the drawing and specification	Include all related works, installations, and supported materials, testing and commissioning, operation manual

		installation system and control system.		
A-15-06	FIRE EXTINGUISHER	Fire extinguisher is a portable fire fighting, for emergency and small fire.	Measured in unit (each)	Include installation, and supporting materials to fix at position stated in the drawing and specification
A-15-07	HORIZONTAL AND VERTICAL MOVEMENT SYSTEM (LIFT & ESCALATOR)	Horizontal and vertical movement system in a building is a system for movement of people, or goods/materials, in vertical or horizontal direction, such as lift, escalator, conveyor etc	Measured in complete unit (each), according to the specification and drawing.	Include all related works, supported materials to fix at the position stated in the drawing and specification, testing and commissioning, operation manual
A-15-08	BUILDING AUTOMATION	Building Automation is an automatic associated / integrated all system in a building, related to building management system.	Measured in unit and sub unit of IT, CCTV, Electrical, security, access control system, AC system, fire system and the like	Include all related works, supported materials to fix at the position stated in the drawing and specification, testing and commissioning, operation manual
A-15-09	FRESH WATER INSTALLATION	Fresh water installation is a system to accommodate the availability of fresh water in a building in healthy condition and certain capacity	Pipe should be measured in line meter (m'), include length of fittings per-diameter, for pipe with diameter less than 3 inches. For pipe with diameter more than 3 inches, fittings should be calculated separately in numbers per diameter. For main water source from shallow/deep well or city water, should be calculated separately in unit or Lump Sum For pump and accessories should be calculated separately in complete set of Unit	Include cutting, bending, joining of pipes and fittings, crossing with wall or floor. For fittings more than 3 inches diameter, the unit cost should be included in the fitting's cost. For main water source, the cost should include all tools, equipment, permission. Fittings means elbow, bends, tees, unions, sockets, nipples etc.

A-15-10	WASTE WATER INSTALLATION	Waste water installation is an installation system for draining waste water in/out of the building, using pipes and fittings. Fittings means all accessories needed to connect the pipes such as elbow, bends, tees, unions, sockets, nipples ect. All pipes should be classified in types, diameter, connection method and installations	Pipe should be measured in line meter (m'), include length of fitting per-diameter, for pipe with diameter less than 3 inches while for pipe with diameter more than 3 inches, fitting should be calculated separately in No. (Numbers) per diameter. For concrete/ceramic Pipe shall be measured along the center line of pipe in diameter, in line meter (m'). For sanitary fittings such as elbow, bends, sockets, nipples etc. should be calculated separately in unit (each) complete with accessories in accordance with drawing and specification.	Include cutting, bending, joint and fittings, crossing with walls or floors. For fittings more than 3 inches diameter, the unit cost should be included in the fitting's cost.
A-15-11	WWTP/STP	Waste water treatment plant / sewerage treatment plant is a complete treatment unit to process the waste water into a proper waste before dumped into public drain	Measured in complete set of unit and sub unit	Include all treatment installation, but excluded the civil works, testing, commissioning, and operation manual

7.16. ELECTRICAL WORKS (A-16)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-16-01	ELECTRICAL INSTALLATION	Electrical Installation is an installation inside the building starting from main panel distribution (MDP) or main circuit breaker (MCB) to lighting point or power / socket point	All cables should be calculated separately in diameter and type of cables is in line meter (m'), according to the wiring diagram. For lamps, sockets, power switch and other is calculated in Number (each). For cable trunking is in line meter (m')	Include all insulation and supporting material, based on build in drawing, merger, testing and commissioning.
A-16-02	LIGHTNING ARRESTOR	Lightning arrestor is an installation to capture the lightning by using Franklin system or any others system such as radioactive etc.	Measured the complete system, in unit	Including all tools, supporting materials, earthing, testing and commissioning

A-16-03	SOUND SYSTEM	An indoor / outdoor sound system installation	Measured the complete unit system in unit in accordance with design and specification	Include all accessories needed such as loud speakers, microphones, wiring, mixers and others
A-16-04	INFORMATION AND TECHNOLOGI (IT) SYSTEM	IT system is an Integrated installation system for communication and information line	Measured in a complete unit system in unit	Include all permits needed, software, hardware, and supported materials needed and install them according to specification

7.17. EXTERNAL WORKS (A-17)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-17-01	BOUNDARY FENCE	Boundary fence is a permanent fence surround the building site, for safety and aesthetic; consist of bricks, stone or steel	Fence measured in line meter, and the door is measured in unit	Including all supporting construction such as foundation, painting, fabrication and transportation, install on the site according to drawing and specification.
A-17-02	ROAD AND PARKING AREA	Road and parking area inside the boundary.	Road and parking area measured in square meter (m ²). Kerbs measured in line meter (m')	include traffic marking needed
A-17-03	LANDSCAPING	All the landscaping work inside the boundary	The grass should be measured in square meter, and the plantation in unit (each), according to the kind of plantation	Include fertilizers, and maintenance to guarantee the proper growth of grass and plantation
A-17-04	FITTINGS AND TOOLS	Fittings and tools mean all necessary play ground, outdoor bench needed in garden	Measured in unit according to the type/kind of fittings/tools	Include all necessary supporting construction / tools

7.18. SCANNER&X-RAYS

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-18-01	X-RAY	To scan any metals that are attached to a person / passanger's body who is about to enter check in room or passanger waiting room	Measured in Unit	Including provisioning and calibration fee.
A-18-02	SCANNERS	Scanner is an instrument to detect any prohibited/illicit/dangerous objects in the luggage	Measured in Unit	Including the following fees: 1. Provisioning, 2. Installation, 3. Quality Testing, 4. Calibration, and 5. maintenance.

7.19. INSTRUMENT LANDING SYSTEM –ILS (A-19)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-19-01	INSTRUMENT LANDING SYSTEM	Instrument landing system is the illuminating systems that are installed along both sides of runway and taxi way which functioned to guide plane landing and taking off safely	ILS is calculated per unit installed	Including provisioning fee, installation, and other necessary tools needed.

7.20. BAGGAGE TRANSFER EQUIPMENT

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-20-01	CONVEYOR	Conveyor is a tool/equipment that is needed to transport/transfer baggage/passenger from check in location to baggage counter	Measured in Meter	Including provisioning fee, installation fee and quality testing.
A-20-02	TROLLEY	Used to load or transfer baggage from trolley to plane and vice versa.	Measured in: - Push cart : Unit - Trolley: Unit	Including push cart and trolley

7.21. AIR TRAFFIC CONTROL

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-21-01	AIR TRAFFIC COMMUNICATION	Air traffic communication is a set of tools that are used to regulate and control air traffic	Measured in Unit	Including provisioning fee, installation fee and quality testing.
A-21-02	RADAR	Radar is a device to monitor air traffic movement	Measured in Unit	Including provisioning fee, installation fee and quality testing.

7.22. DAY WORK (A-22)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-22-01	DAY WORK	Day work is an approved and instructed operation work not originally envisaged during design process as well as not included in original BoQ but in which it becomes apparent during construction phase as being necessary for	Quantity of day work is measured as follow: a. Actual materials quantity delivered by suppliers and approved day work recorded as regulation in part 1 to 9 b. Actual construction equipment approved in day work record in : hour c. Actual number of day work labor approved in day works record : hour	Day work shall include: a. additional drainage work b. additional excavation, filling, and stabilization work c. restore the existing pavement line d. testing e. additional overlay f. additional structure works

		the satisfactory execution and completion of the project		
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7.23. FINAL SITE CLEARING (A-23)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-23-01	FINAL SITE CLEARING	Performing the cleaning work once construction is completed and to prepare the work outside the boundary	Measured in square meter (m ²). Prepared field for external building facilities such as parking, landscaping, park etc.	Include all cleaning from debris/rubbish and remove to outside location

7.24. FURNITURE AND TOOLS (A-24)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-24-01	FURNITURE	All kind of furniture needed for each room	Measured in unit/pair (each) according to the furniture schedule and drawing.	Include all supporting material and fixed them at position indicated.
A-24-02	TOOLS&EQUIPMENT	All special tools or equipment not mention in other item, such as kitchen utensils, gondola, medical equipment/tools, boilers etc.	Measured in complete unit (each)	Including all supporting materials, fixing at the position, testing and commissioning

7.25. GENERAL EXPENSES (A-25)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-25-01	GENERAL EXPENSES	General expenses are all non physical cost / expenses needed to support the progress of the project, such as project management cost, insurances etc	Should be breakdown per item, such as insurance, ceremonial cost, social cost, bank guarantee, etc, calculated in LumpSum	All general expenses should be described in cost structure/cost breakdown schedule and valid as a pay item

7.26. PROFIT (A-26)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-26-01	PROFIT	Profit is a sum calculated as the profit of contractors according to the	Profit should calculated as % from the Total Net Project Cost	Total Net Project Cost can be seen in item 7.0. (Method of Measurement)

		Government regulation.		
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7.27. PROVISIONAL SUM (A-27)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-27-01	PROVISIONAL SUM	A certain value that is reserved for a particular work but has not yet calculated its cost at the time of contract agreement.	It should be determined by owner in USD, and included in the contract amount	Can only be used upon the written order of the owner

7.28. CONTINGENCY SUM (A-28)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-28-01	CONTINGENCY SUM	A certain value that is reserved for a particular work that has not known yet for its usage.	It should be determined by owner in USD, and included in the contract amount	Can only be used upon the written order of the owner

7.29. CONSULTANT FEE (A-29)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-29-01	CONSULTANT FEE	Fee for design and supervision consultant,	It should be calculated based on Standard Fee for Consultant in Timor Leste	For design consultant include but limited to feasibility study, pre-design, detail design, specification, BOQ, Cost Estimate, and support the owner in the pre-bid meeting. For supervision consultant include but not limited to daily, weekly and monthly report, daily supervision of the contractor's works, approve all shop drawing and as built drawing, and final report

7.30. PMU COST (A-30)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-30-01	PMU COST	PMU cost is a specific funds allocated in the project for the purposes of the Project Management Unit, in performing	PMU cost should be calculated based on the certain percentage from Total Net Project Cost. List of PMU cost for various type of building could be seen in Standard Fee for Consultant in Timor Leste.	Total Net Project Cost can be seen in item 7.0. (Method of Measurement)

		Project management activities		
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7.31. TAX (A-31)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
A-31-01	TAX	The income tax according to the government of Timor Leste regulation	Calculated by a certain percentage from the Total Net Project Cost	Integrated in Total Gross Project Cost as Total Project Budget (Orsamento)



**STANDARD METHOD OF MEASUREMENT
FOR
ELECTRIC POWER TRANSMISSION
20 Kv**

1. TITLE OF THE DOCUMENT

The title of this document is TIMOR LESTE STANDARD METHOD OF MEASUREMENT – 6, For Electric Power Transmission - 20 KV and Home Installation, (January 2016) second volume, referred as TL-SMM – 6.

TL-SMM-6 is intended to be utilized in conjunction with the General Condition of Contract, General Specifications or any other relevant provisions provided in the Contract Document.

The works shall be itemized and described in Bill of Quantity in sufficient details to enable contractors to price it adequately and the method of measurement shall be stated in the Preamble of Bill of Quantity.

The preamble shall state the method of measurement other than TLSMM-6, if any, which are adopted while preparing the Bill of Quantity and to be used for measurement of completed parts of the works. Such method of measurement shall comprise those not covered by TL-SMM-6.

2. OBJECTIVE

The objective of TLSMM-6 is to set forth the procedure according to which the Bill of Quantity shall be prepared, priced and the quantities expressed and measured.

3. DEFINITION

- 3.1. In this document and in Bill of Quantity prepared according to the procedure set forth herein the following words and expressions have the meanings hereby assigned to them, except where the context otherwise required.
- 3.2. “Condition of Contract” means the “General Condition of Contract” as provided in the Bidding/Contract Documents prepared by Owner
- 3.3. Word and expression defined in the Condition of Contract have the same meaning herein.
- 3.4. All references to clauses are references to clauses numbered in the Condition of Contract and reference to paragraphs are references to paragraphs numbered herein
- 3.5. The word “Work” includes works carried out, goods, materials and services to be supplied, and the liabilities, obligations and risks to be undertaken by the Contractor under the Contract agreement.
- 3.6. The expression “expressly required” means as shown on the Drawings or as described in the Specifications or as instructed by the Engineer pursuant to the relevant provisions of Condition of Contract
- 3.7. “Day work” means the method of valuing work on the basis of time spent by the workman, the materials used and the plant employed on the site work.
- 3.8. “Original Ground Surface” means the surface of ground before any work to be carried out
- 3.9. “Final Excavated Surface” means the surface indicated on the Drawings to which excavation is to be carried out
- 3.10. “Commencing Ground Surface” for an item in a Bill of Quantities means, the surface of the ground from where that particular item of work has commenced
- 3.11. “Excavated Ground Surface for an item in the Bill of Quantity means, the surface to which excavation included in that particular item of work is to be carried out.

4.0. GENERAL PRINCIPLES

4.1. Unit of Measurement

The unit of measurement for each item shall be aligned for the item stated in the TLSMM-6. The unit of measurement stated against a descriptive feature in the TLSMM-6 shall apply to all items to which descriptive feature applies. Meter, Kilogram, Second (MKS) units system has been adopted in this TLSMM-6.

In describing the dimension of a certain works, its sequence should be as followed, length, width and height or thickness.

Each work should be calculated its net volume, excluding its disposal, overlapping, compactness, widening etc. All items either stated in this TLSMM-6 or otherwise such as transportation, warehouse, permit, loading and unloading, etc. will be calculated in unit price of its work.

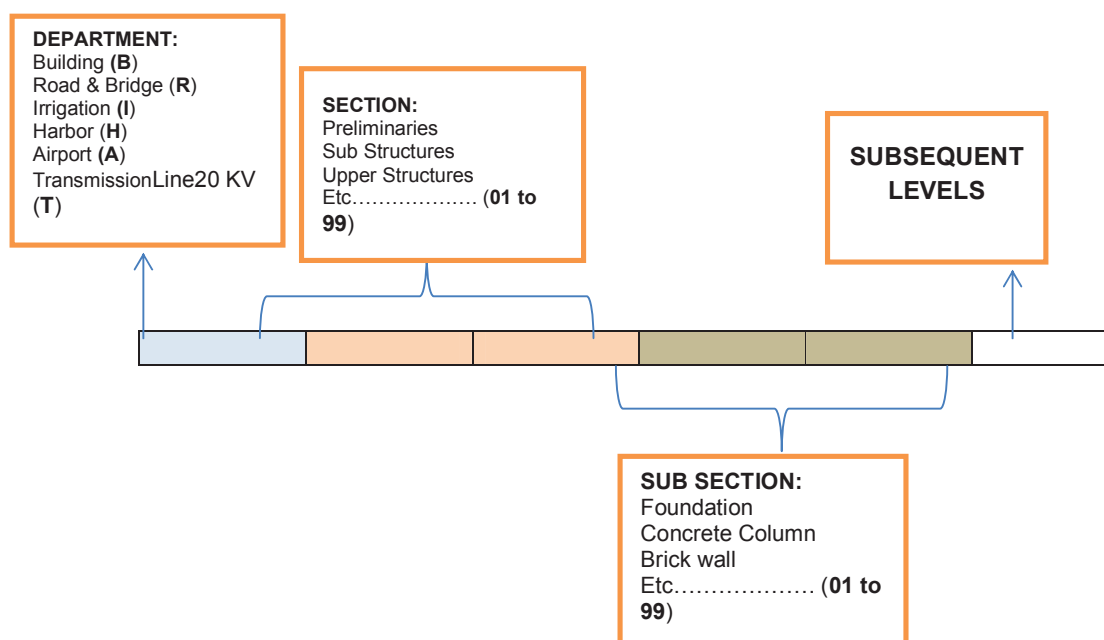
The unit of each work will follow the unit as stated in point 5.0.

The volume is rounded to two (2) decimal digits, ex. 1,234.78 not 1,234.7765

4.2. TL-SMM – 6 CODE

Works are classified into various “Sections” which further classified into “sub-sections” Unique code has been allocated to each item of work for its identification and presentation in the TLSMM –6, Bill of Quantity and elsewhere. Coding arrangement is as given hereunder:

- . First digit represents the “Department”
- . Next two digits represent the “Section”
- . Next two digits represent the “Sub Section”
- . Next digits represent the subsequent levels



4.3. Sub Section

Works included in the sub section is to execute and measure for payment (pay item).

4.4. Measurement Rules

Measurement rules set out the conditions under which work shall be measured and the method by which the quantities shall be computed. In addition the following general conditions shall also apply:

- a. Quantities of acceptable completed work relating to any part of specification shall be computed using net dimensions from the drawing with method given in this document except otherwise specified in special provisions or else in contract documents. No allowance shall be made for bulking, shrinkage or wastage.
- b. All works shall be measured according to drawing and specification, if required, shall be classified and measured separately as per Bill of Quantity.
- c. The contractor is not entitled to claim the difference in quantity calculated using TLSMM-6 and actual quantity as per site of a specific item except provision made herein, special provisions, or elsewhere in the contract documents.

4.5. Definition

Definition means the extent and limits of the item of work represented by a word or expression used in the work classification and in the Bill of Quantity prepared in accordance with TLSMM-6

4.6. Measurement Coverage

Measurement coverage provides that the work stated is deemed to be included in the appropriate items to the extent that such work is included in the Contract. In addition, following general conditions shall also apply:

- a. Loading, unloading and transportation of material related to any item of work
- b. All the items and activities in TLSMM – 6 shall deem to be included all operations required to perform the work as per Contract Documents.
- c. Additional measurement coverage which is necessary to grasp in details the method of measurement is given against relevant item or activity.

4.7. Additional Descriptions

Measurement coverage that are necessary to grasp in details the works stated in TLSMM-6, are provided against such particular item of work.

5. UNITS AND ABBREVIATION

The following units of measurement and abbreviations shall be used in power electric transmission:

Basic Unit	Symbol	Unit	Unit Symbol
Current	(i)	Ampere	(A)
Voltage	(V)	Volt	(V)
Resistance	(R)	Ohm	(Ω)
Apparent Power	(S)	Voltage ampere	(VA)
Power	(P)	Watt	(W)
Reactive Power	(Q)	Voltage ampere reactive	(VAR)
Inductance	(L)	Henry	(H)
Capacitance	(C)	Farad	(F)
Electric Charge	(Q)	Coulomb	(C)
Temperature	(T)	Kelvin	(K)
Luminous Intensity	(I)	Candela	(cd)
Atomic Mass	(M)	Mole	(n)
Length	(l)	Meter	(m)
Mass	(m)	Kilogram	(Kg)
Time	(t)	Second	(s)

6. Table for Electrical and Magnet Units

The main electrical and magnet measurement units and their definition including its conversion factor into international system (SI) are shown in CGS_m column and CGS_e as follows:

Quantity and Symbol	SI Units		Conversion Factor	
	Name & Symbol	Equation	CGS _m	CGS _e
Electric Current, I	Ampere, A	$F_z = 10^{-7} I^2 dN/dZ$	10	10/c
electric motive force, E	Volt, V	$P = IE$	10^{-8}	$10^{-8}c$
Potential, V	Volt, V	$P = IV$	10^{-8}	$10^{-8}c$
Resistance R	Ohm, Ω	$R = V/I$	10^{-9}	$10^{-9}c$
Electric Charge, Q	Coulomb, C	$Q = it$	10	10/c
Capacitance, C	Capacitance, F	$C = Q/V$	10^9	$10^9/c^2$
Electric field, E	$\rightarrow$, V/m	$E = V/l$	10^{-6}	$10^{-6}c$
Electric Flux, Φ	$\rightarrow$, C/m ²	$D = Q/l^2$	10^5	$10^5/c$
Permittivity, ϵ	$\rightarrow$, F/m	$\epsilon = D/E$	---	$10^{11}/4\pi c^2$
Magnetic Field, H	$\rightarrow$, A/m	$\oint H dl = ni$	$10^{3/4}$	---
Magnetic Flux, Φ	Weber, Wb	$E = d\Phi/dt$	10^{-8}	---
Magnetic Flux density, B	Tesla, T	$B = Q/l^2$	10^{-4}	---
Inductance, L, M	Henry, H	$M = Q/I$	10^{-9}	---
Permeability, μ	$\rightarrow$, H/m	$\mu = B/H$	$4\pi \times 10^{-7}$	---

7. Table for Basic Unit, Supplementary Unit and Derivatives Units

The following table 7.0 for basic unit, supplementary unit and derivative unit in SI

Quantity	Symbol and Dimension		Unit	Unit's Symbol
	Symbol	Dimension		
Basic Unit				
Length	l (el)	L	meter	m
Mass	m	M	kilogram	Kg
Time	t	T	Second	S
Electric Current	i	I	ampere	A
Thermodynamic Temperature	T	O	Degrees Kelvin	°K
Luminous Intensity			Candela	cd
Supplementary Unit				
Horizontal Angle	α, β, γ	[L] ⁰	radian	rad
Massive Angle	θ	[L] ²	stradian	sr
Derivative Unit				
Width	A	L ²	Square Meter	m ²
Volume	V	L ³	Cubic Meter	m ³
Frequency	f	T ⁻¹	Hertz	Hz (1/s)
Density	ρ	L ⁻³ M	Kilogram per cubic meter	Kg/m ³
Velocity	v	LT ⁻¹	Meter per second	m/s
Angular Speed	ω	[L] ⁰ T	radian per second	Rad/s
Acceleration	a	LT ⁻²	Meter per Square second	m/s ²
Angular acceleration	α	[L] ⁰ T ⁻²	Radian per Square second	Rad/s ²
Force	F	L M T ⁻²	Newton	N(kg m/s ²)
Stress, strain	p	L ⁻¹ M T ⁻²	Newton per Square meter	N/m ²
Work, Energy	W	L ² M T ⁻²	joule	J(Nm)

Power	P	$L^2 M T^{-3}$	watt	W(J/s)
Energy Quantity	Q	Tl	coulomb	C(A s)
Potential difference	V	$L^2 M T^{-3} I^{-1}$	volt	V(W/A)
Electric field Force	E, ε	$L M T^{-3} I^{-1}$	Volt per meter	V/m
Electric Resistance	R	$L^2 M T^{-3} I^2$	ohm	$\Omega(V/A)$
Electric Capacitance	C	$L^{-2} M^{-1} T^4 I^2$	Farad	F(As/V)
Magnetic Flux	Φ	$L^2 M T^{-2} I^{-1}$	weber	Wb(Vs)
Magnetic Field Force	H	$L^{-1} I$	Ampere per meter	A/m
Flux Magnetic density	B	$M T^{-2} I^{-1}$	tesla	T(Wb/m ²)
Inductance	L	$L^2 M T^{-2} I^2$	Henry	H(Vs/A)
Magnetic Force	U	I	Ampere	A
Luminous Flux			lumen	lm (cd sr)
Luminous			Candela per square meter	Cd/m ²
Illuminous			ln x	Lx(lm/m)

8. METHOD OF MEASUREMENT

A. Transmission Lines 20 KV

Section 01: Preparation

Section 02: Survey and identification of Pole Staking

Section 03: Foundation

Section 04: Electric Pole Staking

Section 05: Cross Arm and Isolator installation

Section 06: Laying of Guy-wire/Treckshoor or pole supporter

Section 07: switching

Section 08: stringing

Section 09: Connector fittings

Section 10: Installation of Network Protection Equipment

B. Electrical Installation for Building

Section 11: Finishing

Section 12: Design Work

Section 13: Stop Contact

Section 14: Light Switch

Section 15: Lighting Bulbs Installation

Section 16: Lighting Protection Installation

Section 17: Grounding Installation

TOTAL WORKS OF (SKUTM) (01 - 17).....(A)

TOTAL NET PROJECT COST.....B = A

Section 12: Equipment

Section 13: General Expenses

Section 14: Profit

Section 15: Provisional Sum

Section 16: Contingency

Section 17: Consultant Fee

Section 18: PMU Cost

Section 19: Tax

TOTAL GROSS OF PROJECT COST, C =B+ (12 - 19)

EXAMPLE OF GENERAL EXPENSES DETAILS (Section:13)

1. Material Samples including Quality Testing
2. Security
3. Occupational Health and Safety
4. Project Team/Staff Fees
5. Provisional Fee for Performance Bank Quarantees, Down payment, Retention Fee, ect.
6. Work Insurance Fee, Labor Insurance Fee
7. Communication Cost
8. Inauguration Fee
9. Rental fee for Lot/house/vehicles
10. Report Fee
11. Gathering/Meeting Fee
12. Social Fee
13. Other Non-Physical Fee for each project

8.1. PREPARATION: (T-01)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-01-01	DEMOLITION	The work of removing pole, Cables, and other old accessories that exist along the location in which a new transmission line will be constructed.	The types of demolition work is described in BOQ; its item shall be provided with unit price separately based on the BOQ. Measurement unit is Lumpsum	The Unit Price includes, equipment cost, labor, license fee, and cost of transporting the disposal material to determined location.
T-01-02	SITE CLEARING	Site Clearing is the work of clearing the site from dirt, garbage, and trees with diameter more than 15 - 100 cm	Measured in Sq.M	The Unit Price includes, equipment cost, labor, licensing fee, and cost of transporting the disposal material to determined location.
T-01-03	MOBILISATION	Mobilization is an initial activity to mobilize equipment, workforce, facility, and needed permit, before the project begins physically.	Each type of the equipment, workforce, facility and permit should be broken down its quantity as well as its specification in such a way to facilitate the calculation of mobilization price/cost. The unit is Lumpsum.	In calculating mobilization price/cost of each item, should have already included transportation fee, loading and unloading fee, permits, lease/purchase fee as well as other social fees
T-01-04	DEMOBILISATION	Demobilization is a final activity to demobilize equipment, workforce, and facility that is no longer used for project construction	Each type of the equipment, workforce, facility and permit should be broken down its quantity as well as its specification in such a way to facilitate the calculation of price/cost. The unit is Lumpsum.	In calculating demobilization cost of each item, should have included transportation cost, loading and unloading, permits, lease/purchase costs, as well as other social fees.
T-01-05	PHOTO DOCUMENTATION	Photo documentation is to show the physical condition of the site/construction of certain period	Measured in Lumpsum	The photo at least should be taken from four corners view, first photo should be taken during 0% of physical progress and the following photos

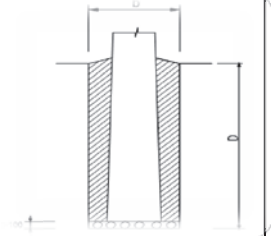
				should be taken accordingly.
T-01-06	SIGNBOARD	Signboard should contains information about the project	Measured in unit	Project signboard should be made with size and materials as described in design planning and technical specification. It should be installed at site construction before the project started and remains there until completion at the area where it is visible to people

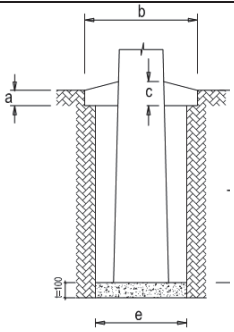
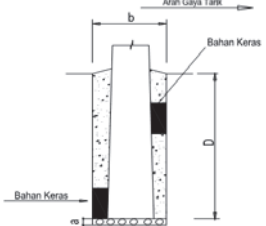
8.2. SURVEY AND IDENTIFICATION OF POLE STAKING: (T-02)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-02-01	SURVEY AND ROUTE DETERMINATION	1. survey is the activity of collecting data and mapping the area including topographical condition, network route, pole position, number of poles, and the possibility of road widening and the change of construction 2. Staking is the activity determining pole location, pole span, pole angle, guy wire, Overhead pole, anchor location, pole numbering, soil condition in which the pole, pole foundation and transformer location will be constructed.	1. Network construction line is as much as possible constructed in straight line 2. The surface ground from one point to another should be at the same height or at least has minimal difference. 3. The line/point location should be optimized by considering design planning, network/area development in the future. 4. Considered the required safest distance in case the network line is close enough to other objects (buildings/network, trees, etc), 5. Survey is conducted at least by two technicians for the purpose of cross	Determining line direction, measuring line distance, the network angle, and determining the end pole.

			checking, and it should be equipped with measurement tools such as compass, and roll meter. The unit is Lumpsum	
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8.3. FOUNDATION WORK: (T-03)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-03-01	FOUNDATION WORK	Foundation is a mixture of concrete or laying of river stone to reinforce the pole; the foundation volume should be prepared accordingly and should withstand towards any forces such stress and strain of the cable, wind force and the like.	1. For shallow Foundation, it can be calculated according to the design and specification, in cubic meter (m³) 2. Deep foundation can be calculated according to the drawing and specification, measured in Unit (each).	1.Type A Foundation Type A for angular and corner pole which attached with guy wire at normal soil condition  * t = solid ground layer * b = midline of hole diameter + at least twice the diameter of the pole. * $D = 1/6 \times \text{pole length}$ * foundation size b x b * Concrete Mixture * 1 cement : 3 sand : 5 gravel 2. Type B Foundation Type B pole for 350 daN Pole without guy wire B at normal soil condition

				 * $A = 150 \text{ mm}$ * $b = \text{pole diameter} + 600\text{mm}$ * $d = 1/6 \times \text{pole length}$ * $e = \text{pole diameter} + 400 \text{ m}$ * concrete mixture 1 cement : 3 sand : 5 gravel 3. Type C Foundation construction without additional of concrete foundation for small angular line up to 15° at normal clay /sandy condition, and it doesn't need to add solid material (stone, etc) for $0^\circ - 5^\circ$ angular  * hole $b = 2 \times \text{pole diameter}$ * Depth $D = 1/6 \times \text{pole length} + 100 \text{ mm}$ * Base (a) : 100mm
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8.4. ELECTRIC POLE STAKING: (T-04)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-04-01	ELECTRIC POLE STAKING	The construction of Medium voltage overhead transmission line electric pole is to support overhead transmission network; made of iron pole or rounded concrete pole, which has standard tube-shaped at its shielded upper part that cutting out the visible part of the pole	Things to consider for the electric pole size are: a. Pole height depends on the size of the voltage system. b. Depth of the pole foundation depends on the soil condition of the construction site. The pole span depends on the load used in the area, types of cable used, and the pole height. Measured in Unit (each)	a. Overall length: 9, 11, and 13 meter. b. The height is measured from the ground surface of 7,5 meter, 9,2 meter, and 11 meter c. Workload for 10 cm below the tip of the pole: : 200 daN, 350 daN , 500 daN, 800 daN and 1200 daN . Basically, the main characteristic of iron pole and concrete pole are same but the pole itself. d. Prior to staking pole, make sure the hole depth at least 1/6 the pole length and check other preparation needed as well.
T-04-02	TANGENT POLE	Tangent pole is used for straight line and for angle line no less than 5 degrees with its function to support the transmission wire and isolator that has lighter load.	Types of isolator used for tangent pole are pin type isolator and line post isolator Measured in Unit (each)	e. In constructing electric pole using concrete mixture, consider the safety support for labor and there are at least three persons required. And avoid constructing the pole using tripod
T-04-03	DEADEND POLE	Building pole at dead end of the electric power network is to stress out the wire transmission.	Use two or three guy wire If the stress force at the end of the pole is higher so as to proportionate the force of the stress out wire transmission. The Isolator used for the pole should be in accordance with stress force, which is suspension type insulator. Measured in Unit (each)	f. after standing the pole, laid the foundation in accordance with design construction and take note if that pole is an angular pole. g. cross arm/isolator installation should be

T-04-04	ANGULAR POLE	Angular pole is used for cable channel that has angle greater than 5 degrees.	Normally the angles created are always greater; as such pole is always attached with guy wire as a resistance from the tension wire transmission that created the angle. The allowable angles are: a. small angle between $5^{\circ} - 10^{\circ}$, and b. large angle between $10^{\circ} - 60^{\circ}$. Division of these angles determines the position of the isolator installed on pole. Because each isolator has its mechanical characteristic force. For small angle between $5^{\circ} - 10^{\circ}$ installed double pin types insulator since installing single insulator may not support the tension force up to 10° angles while for large angle between $10^{\circ} - 60^{\circ}$, the tension force of the transmission wire is greater as such the angular pole with this large angle should be installed with suspension type insulator.	in accordance with medium voltage overhead transmission line (SUKTM) design construction at the specific pole. Check the tension of cross arm bolt at pole.
T-04-05	TENSION POLE	Tension pole is used to fasten the wire stress at angular pole in which its guy wire facing towards the main road or river that prevents to place the guy wire in the	Since the function of the tension pole is to fasten the wire tension, the isolator is no longer needed. However, if the location of the tension pole is in heavy load area then the tension pole may be used as service pole by using	

		middle of the road or in the middle of the river.	isolated wire that over-hung the tension wire and pin type insulator.	
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8.5. CROSS ARM AND ISOLATOR INSTALLATION: (T-05)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-05-01	CROSS ARM INSTALLATION	Is part of the pole that is used for holding / placing insulation or holding ground wire	a. install supported cross-arm at pole as a step on place for technician and it should be 1.2m from planned cross-arm position. b. Install the cross-arm based on the (SKUTM) construction plan and tighten each bolt at least 20Nm using spanner size 19 or 22 Measured in Set	Based on the specified nominal voltage network of <i>SKUTM</i> 20kV, the cross arm has to be an international standard specification: UNP iron for Length 1800, 2000 mm, all Cross-arm components should be galvanized in hot dip with 70 micron thickness
T-05-02	ISOLATOR INSTALLATION	Isolator is used to support overhead wire and as an insulation between the conductor-voltage with towers	Insulator has properties or capabilities to be able to separate two or more electrical conduction that are adjacent so as to prevent electrical current flowing to the ground. Thus the construction should be cautious and the insulating material must have a good dielectric strength so that it can diminish its electrical conduction. Measured in set	a. the preferred type of insulator is Line Post Isolator and Suspension Isolator with properties of 22 kV - 23 kV nominal voltages, 3 set of chips, Maximum Diameter 240 mm ² , minimum height 245 mm, voltage impulse jump 160 kV. b. the main part of an insulator composes of dielectric, metal pin and metal bar. Generally dielectric is made of porcelain, glass, silicon and rubber, while pin is made of coated iron or steel. c. There are also indoor and outdoor isolators. d. Outdoor Isolator is finned made so as to extend the flow of leakage current and

				prevent the formation of water bridge when it moistened by rain water. There are also supported isolator and suspension isolator. supported isolator consists of three types, isolator pin, isolator post, and Isolator pin-post. Based on its shape suspension isolator consist of two types: plate isolator and cylinder isolator.
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8.6. LAYING OF GUY-WIRE/TRACKSHOOR OR POLE SUPPORTER: (T-06)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-06-01	LAYING GUY WIRE/ TRECKSSHOOR	Treckschoor is used to counter the course of conductor flow	Mounted at 45° – 60° stretch angles to counter the course of conductor flow. Measured in Set	Guy Wire should not be installed along the heavy traffic area or along the populated area. the slope angle of guy wire should be no more than 60°
T-06-02	LAYING POLE SUPPORTER	Pole supporter is used to minimize the usage of pole with large workload	Pole supporter and its components is to buffer/stress/strain the start – end post, angle/curve, branching and tensile post, Unit is Set	There are several types of Pole Support: span-wire, horizontal guy-wire (span guy wire). Use horizontal guy wire in case using guy wire or span guy wire between posts is not possible.

8.7. SWITCHING: (T-07)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-07-01	DISCONNNETIN G SWITCH = DS	Disconnecting switch is a device works as a disconnector that is designed not to be activated when the current load still passing.	a. Disconnecting switch is used to isolate high power supply equipment. b. DS is designed with visual warning for labor safety, in other words when the switch is in active mode or there is no current flow, the visual sign will turn on to give signal that it is	a. Normally disconnecting switch, air break switch, and oil switches are used and operating its lever together. b. Disconnecting switch is also used to isolate buses or other electrical devices, to separate feeder's components for the

			safe and vice versa. c. Disconnecting switch must be shielded to prevent sparks between knife connector and its clip, because otherwise it is dangerous for operator.	purpose of maintenance and testing.
T-07-02	LOAD BREAK SWITCH =LBS	Load Break Switch is a device that has capability to close and open loaded circuits and to break loaded circuit but has no capability to break interrupted circuit.	a. Load Break Switch can be operated from distance using modem or control panel. If the control panel is down it can be operated manually using telescopic stick. b. Load Break Switch placed at the end of the network used as a joint to another network when the network is experiencing maintenance interference. Since it can be operated from distance using modem. it may allow electrical current to continuously flow. Measured in set	a. Measuring the Load Break Switch is done during the switch is closed using switch Tester that will be connected between the incoming wire to switch break and its contact in order to measure its resistance. b. Measuring the resistance of the insulator is done using merger which will be connected between bushing and between body Load Break Switch c. Measuring the damper resistance of arc fire is to check the whether the vacuum is leaking or not

8.8. STRINGING: (T-08)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-08-01	STRINGING	The function of stringing is to conduct electric current through wire without insulation and ground wire or overhead insulated wire through cable	Check the followings prior to stringing: 1) Concrete post should be supported with temporary guy wire/ treckschoor at start and end pole. 2) install cross-arm at each post 3) The readiness of conduction material in drum at roll buffer. 4) At least install two Stringing Block at each post.	Once the stringing is done, Re-inspect the installation, the required pulled force, deflection, conduction bonding on isolator and the measurement of insulation resistance.

			5) Labor required to stringing the wire. 6) supervisor/safety officer. 7) drum wire holder speed control officer 8) tools needed 9) safety equipment needed Noted the followings during the stringing: 1) When deploying, it is required to start from the middle, drawn from the central part of asfpan post. 2) Strip according to the required length size and temporarily clamp them at traverse end post. 3) the withdrawn of the two edge string should be carried out together and always equip with balance running blocks or rollers until the strings reach required pull force and deflection. 4) recheck and immediately adjust the strings using repair sleeve in case there are loosen strings at some areas Unit is meter	
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8.9. CONNECTOR FITTINGS: (T-09)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-09-01	JOINT SLEEVE CONNECTOR	Joint sleeve is a type of connector to join string at straight line position.	The cable sleeve is made of aluminum alloy. - Sleeve resistance is in mill ohm smaller than string resistance. - Temperature at joint sleeve should be smaller than string.	size 150, 70, 50, 35, 16, 10mm

			Measured in unit (each)	
T-09-02	PARALEL GROOVE CONNECTOR	Type of connector used as a joint string at branch point.	Alluminium Parallel Groove Connector is made of Alluminium Alloy in complete set which includes bolts and nuts. Finishing with hot dip galvanized	Size 150,70,50,35,16,10 mm
T-09-02	LIVE LINE CONNECTOR	Type of connector used for works during live-line	Live line connector (LLC) is made of Alluminium alloy finishing with hot dip galvanized Measured in Unit	Size 150,70,50,35,16,10 mm

8.10. INSTALLATION OF NETWORK PROTECTION EQUIPMENT: (T-10)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-10-01	INSTALLING FUSE CUT OUT	Fuse cutout is an electrical protection device utilized to protect network from power surge causes by short circuit or overload current	fuse cutout is atin or silver alloy wires that has cross-section adapted to the magnitude of the maximum allowable current flows in the wire The selection of wire used in fuse cutout is based on the low melting factor and must have high conductivity The melting factor is determined by the temperature of the material. The Unit is Set	a. materials used for fuse cutout are: silver wire, copper wire, zinc wire, lead wire or alloy wire. Many distribution networks use silver wire considering silver wire has conductivity 60.6 ohm/cm higher than copper wire and has temperature 960⁰, installed within porcelain tube filled with white sand as a function to extinguish arc fire and to connect the wire to the phase wire so that current may flow on it. b. Use separate switch for this type of fuse cutout for this network distribution. Connected with removable knife model switches at its tip. while at its bottom connected with a hinge
T-10-02	AUTOMATIC RECLOSER	Automatic circuit recloser = Recloser is a	Properties of automatic recloser: • Fast tripping in	Size and shape of recloser are as followed:

		circuit breaker that works automatically to prevent system from power surge due to short circuit interruption.	anticipating temporary interruption. • Delayed tripping in coordinating downstream protective. • Recloser will reset to its initial status once the interruption is over. And the recloser will count again from initial if the interruption occurs again after resetting. Repetitive: automatic reset after successful recloser. Non repetitive: in case there is interruption it needs to manually reset. Unit is Set	- based on its usage time a. high speed recloser is an automatic recloser required delayed time less than 1 second. This is for 1 phase, 3 phases and for 1+3 phases b. Delayed Recloser is Low speed automatic recloser with delayed time greater than 1 second. This is for 3 phases recloser. - based on its phases a. Single Phase Single phase recloser is mounted in a tank connected with mechanical interconnection used to lock only. each phase works freely to lock or to reclose. When one of the phases is locked it will delayed in providing the energy. b. Triple Phase The switches will open altogether for any interruption. These three phases are connected mechanically to each other to turn it off and on and its operation takes long.
T-10-03	AUTOMATIC SECTIONALIZER	Auto sectionalizer is a switch designed with electronic/mechanical control to interrupt section of medium voltage	It works in conjunction with protective source such as relay recloser/recloser to automatically isolate interrupted medium voltage overhead transmission line section. sectionalizer in this line	Classification and the sizes: based on voltage Automatic Vacuum Switch or Sectionalizer. Breaker material: Lubricant, vacuum, gas, SF6. control Materials: Hydraulic or electronic

		network, and as a load/circuit breaker to separate the main channel and some sections, so that in case of permanent disturbances, the area should be free from network even if it is just the smallest disturbance.	opens when circuit has no voltage but should be able to close during short circuit. it can also be used to open and close overload circuit. This switch works on the basis of voltage sensing. Equipped with a regulator and voltage transformer as a source of propulsion and sensing. The Unit is Set	phase: single phase or triple phase.
T-10-04	SHIELDED WIRE	Shielded wire is used to reduce electrical noise due to lightning strike. Shielded wire may be installed for overhead transmission in lightning prone open area.	a. Shielded wire is installed in cross-arm position, below 80 cm. b. Shielded wire is installed directly in each pole. c. Installing shielded wire in lightning prone area may reduce electrical interruption due to lightning to 37%.	

8.11. FINISHING: (T-11)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-11-01	FINISHING	There should be engineering and commissioning test once the installation of medium voltage overhead transmission line is complete in accordance with the rules and regulation set, then the competent Institution (EDTL) may release Ready For Operation	a. Commissioning test for overhead transmission should be done carefully since it is located in long distance route. Make sure all network routes are safe before operating or energizing. b. Involve the following entities in conducting commissioning test and operating overhead transmission line: 1. The Owner of the project 2. EDTL	Metering system should consists of: a. single-line diagram that shows connection point and its metering tools; b. Initial test certificate and current transformer and voltage transformer calibration and meter. c. Calculation of drop voltage at circuit voltage; d. Load calculation at

		Certificate	3. Contractor 4. Local Government	meter circuit.
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8.12. ELETRICAL INSTALLATION WORK FOR BUILDING (T-12)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-12-01	DESIGN	Electricity installation Planning or Design is an integrated of art and science. art in this aspect related to the beauty of its drawing while science is due to its technical measurement, strength, durability, efficiency and how to do it, etc.	a. The outcome produced in designing or planning is the drawing and the analysis. Drawing may be in the form of sketching, perspective drawing, projected drafting, design plan and situational drawing, b. floor plan drawing of a building that will be installed electricity is drawn using standardize symbols Unit is Lumpsum	Includes: Power supply, Low Voltage Distribution System Estimation: Maximum Actual Load, Drop Voltage Calculation, Conductor Cable Size Calculation, Indoor and outdoor lighting calculation.
T-12-02	STOP CONTACT INSTALLATION	Installation of stop contact is to serve as source of voltage which is required by household or office building (computer, radio, TV, electric fan, etc) and the voltage is obtained from zero and conductor phase which is connected to the stop contact	a. The height of the installation is ± 30 cm – 150 cm above floor, and should equip with its cover or safety if installed less than 150 cm. b. Reachable c. Should be installed in such a way that the neutral conductor cable is on the right hand side or below. Measured in Unit.	a. stop contact should be installed in such a way that when connected it is not possible to accidentally touch with the active cable. b. Make sure that stop contact is made of fire resistance, moist-resistance and durable material
T-12-03	ELECTRIC SWITCH INSTALLATION	Electric Switch is used to disconnecting and connecting electric current from source to load.	a. Inside the switch is equipped with a spring that can disconnect network in split of second, with this fast termination, the probability emergence of bow fire among contact (lever) switch becomes smaller b. Within the switch contains current and voltage amount which should be adjusted to the served load or should be greater than	a. Switch should be installed in such a way that when connected it is not possible to accidentally touch with the active cable.. b. Make sure that switch is made of fire resistance, moist-resistance and durable material

			served load, but no less than 5 ampere.	
			Measured in Unit	
T-12-04	LIGHTING BULBS INSTALLATION	The installation of lighting bulbs is to emit light for the needs of irradiating human's activity that inhabiting building either indoor or outdoor.	Light emission in a room or a building should accommodate each activity and it should be adjusted to its room's function. Measured in Unit	a. Ligthing Bulbs should be installed in such a way that when it is on or off, is not possible to accidentally touch with the active cable. b. Make sure that lighting bulb is made of fire resistance and moist-resistance
T-12-05	LIGHTNING PROTECTION INSTALLATION	The installation of lightning protection is to serve minimizing direct thunderbolt effect so that it can protect the building structure	a. Installation should be done properly, minute calculation, and meet work health safety and occupational standard. b. Should calculate radius protection of external rod. c. Should calculate as well the height of the building, workload intensity, thunderbolt closeness, ground level height, etc.	a. Broad range of protection radius b.Environmental friendly with good conductor materials
T-12-06	GROUNDING INSTALLATION	The function of grounding is to ground more current when there are series of short circuit	a.Cable rod should be planted to the earth and touch the earth. b. Made from a pipe iron, steel, profile or other metal bars furnished with BC wire and planted it into the ground. Unit is set	a. Insuno Electrode diameter 12 mm, coated with copper, height 1,5 meter b.Electrode Pipe diameter 1,5 “, height 2,75 meter and should be bolted

8.12. TOOLS: (T-12)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-12-01	TOOLS	All special tools orequipment notmention in otheritem, such as kitchen utensils, gondola, medical equipment/tools, boilers etc.	Measured in complete unit (each)	Include all supporting materials, fixing at the position, testing and commissioning

8.13. GENERAL EXPENSES: (T-13)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-13-01	GENERAL EXPENSES	General expenses are all non-physical cost/expenses needed to support the progress of the project during construction phase	Should be described per item, such as insurance fee, ceremonial cost, social cost, bank guarantee, etc. Measured in LumpSum	All general expenses should be described in cost structure/cost breakdown schedule and valid as a pay item

8.14. PROFIT (T-14)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
B-17-01	PROFIT	Profit is a calculated sum as the profit of contractors according to the Government regulation.	Profit is calculated as % based on the government criteria	Total Net Project Cost can be seen in item 8.0. (Method of Measurement)

8.15. PROVISIONAL SUM (8-15)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-15-01	PROVISIONAL SUM	A certain value that is reserved for a particular work but has not yet calculated its cost at the time of contract agreement.	It should be determined by owner in USD, and includes in the contract amount	Can only be used upon the written order from the owner

8.16. CONTINGENCY (T-16)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-16-01	CONTINGENCY	A certain value that is reserved for a particular work that has not known yet for its usage.	it should be determined by owner in USD, and include in the contract amount	Can only be used upon the written order from the owner

8.17. CONSULTANT FEE: (T-17)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-17-01	CONSULTANT FEE	Fee for design and supervision	it should be calculated based on Standard Fee	For design consultant include

		consultant, in which its value stated in the contract	for Consultant in Timor Leste	but limited to feasibility study, pre-design, detail design, specification, BOQ, Cost Estimate, and support the owner in the pre-bid meeting. For supervision consultant include but not limited to daily, weekly and monthly report, day by day supervise the contractor's works, approve all shop drawing and as built drawing, and final report
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8.18. PMU COST: (T-18)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-18-01	PMU COST	PMU cost is a specific funds allocated in the project for the Project Management Unit, in performing Project management activities.	PMU cost should be calculated based on the certain percentage from Total Net Project Cost. List of PMU cost for various type of building could be seen in Standard Fee for Consiltant.in Timor Leste.	Total Net Project Cost can be seen in item 8.0. (Method of Measurement)

8.19. TAX: (T-18)

CODE NO.	WORK ITEM	DEFINITION	MEASUREMENT RULES	MEASUREMENT COVERAGE
T-19-01	TAX	Referred to the income tax according to the government of Timor Leste regulation	Calculated by a certain percentage from the Total Net Project Cost	Integrated in Total Gross Project Cost as Total Project Budget (Orsamento)

AGENCIA DESENVOLVIMENTO NACIONAL



**STANDARD COEFFICIENT OF UNIT PRICE
ANALYSIS
FOR
CIVIL WORKS
(MANUAL WORKS)**

STANDARD COEFFICIENT OF UNIT PRICE ANALYSIS

I. PREPARATION WORK

	REQUIREMENT		UNIT	COEFFICIENT	
1	1 M Temporary Fence of Corrugated Iron, 2m high				
	MATERIAL	Dolken wood Ø 8-10 / 4m	Piece	1.2514	
		Portland Cement	Kg	2.5000	
		0.2 corrugated iron	Sheet	1.2158	
		Concrete sand	M³	0.0050	
		Gravel	M³	0.0090	
		Wooden rafters 5/7	M³	0.0410	
		Common Nail 2 "-5"	Kg	0.0829	
		Zincromate	Kg	0.4616	
	LABOR	Unskilled labor	Day	0.2495	
		Carpenter	Day	0.2858	
		Skilled head	Day	0.0200	
		Foreman	Day	0.0200	
2	1 M Measuring and installing batter board				
	MATERIAL	Wooden rafters 5/7	M³	0.0177	
		Common Nail 2 " -5 "	Kg	0.0200	
		Wood boards 3/20	M³	0.0070	
	LABOR	Unskilled labor	Day	0.1000	
		Carpenter	Day	0.1000	
		Skilled head	Day	0.0100	
		Foreman	Day	0.0050	
	3	1 M² Building Cement and Tools warehouse			
		MATERIAL	Dolken wood Ø 8-10 / 4m	Piece	1.7000
Wood			M³	0.2074	
Common Nail 2 " -5 "			Kg	0.3000	
Portland Cement			Kg	10.5000	
Concrete sand			M³	0.0300	
Gravel			M³	0.0500	
Corrugated BJLS 28			Sheet	1.5306	
LABOR		Unskilled labor	Day	1.0000	
		Carpenter	Day	2.0000	
		Skilled head	Day	0.2000	
		Foreman	Day	0.0500	
4		1M² Guard house construction (wood construction)			
	MATERIAL	Dolken wood Ø 8-10 / 4m	Piece	3.0500	
		Wood	M³	0.2807	
		Common Nail 2 " -5 "	Kg	0.7117	
		Corrugated BJLS 28	Sheet	1.7090	
	LABOR	Unskilled labor	Day	1.0167	
		Carpenter	Day	1.5250	
		Skilled head	Day	0.1527	
		Foreman	Day	0.0510	
5	1 M² Site clearing and site levelling				
	LABOR	Unskilled labor	Day	0.1000	
		Foreman	Day	0.0500	
6	1 Piece Installation of project signage				
	MATERIAL	Project name plate	Piece	1.0000	
		5/7 wooden rafter class II	M³	0.0235	
		Common Nail 2 " - 5 "	Kg	0.1665	
	LABOR	Unskilled labor	Day	0.2503	
		Foreman	Day	0.0443	

7	1 M ² Making barrack labor			
	MATERIAL	Dolken wood Ø 8-10 / 4m	Piece	1.2500
		Wood	M³	0.1860
		Nail 2 " -5 "	Kg	0.3000
		Portland Cement	Kg	18.0000
		concrete sand	M³	0.0300
		Gravel	M³	0.0500
		Corrugated BJLS 28	Sheet	1.5401
		Plywood 4 mm	Sheet	0.5883
	LABOR	Unskilled labor	Day	1.0000
		Carpenter	Day	2.0000
		Skilled head	Day	0.2000
		Foreman	Day	0.0500
8	1 M ² Make mortar tub (40x50x20) cm .			
	MATERIAL	Wood outstretched	M³	0.0370
		Nail 2 " -5 "	Kg	0.0820
		Rafter 5/7 - 4m	Piece	1.0250
	LABOR	Carpenter	Day	0.3075
		Foreman	Day	0.0020
9	1M ² Temporary road construction			
	MATERIAL	Cleaved Stone 15/20	M³	0.1500
		Crushed stone 5/7	M³	0.0900
		Sand	M³	0.0100
	LABOR	Unskilled labor	Day	1.0000
		Foreman	Day	0.0500
10	1 M³ Demolition of reinforced concrete			
	LABOR	Unskilled labor	Day	6.6670
		Foreman	Day	0.3330
11	1 M³ Demolition of red brick wall			
	LABOR	Unskilled labor	Day	5.6670
		Foreman	Day	0.0330
II. EARTH WORKS				
	REQUIREMENT		UNIT	COEFFICIENT
1	1 M³ Ordinary soil excavation of 1 meter depth			
	LABOR	Unskilled labor	Day	0.6700
		Foreman	Day	0.0320
2	1 M³ Ordinary soil excavation of 2 meters depth			
	LABOR	Unskilled labor	Day	0.7500
		Foreman	Day	0.0470
3	1 M³ Ordinary soil excavation of 3 meters depth			
	LABOR	Unskilled labor	Day	0.8900
		Foreman	Day	0.0685
4	1 M³ Hard soil excavation of 1 meter depth			
	LABOR	Unskilled labor	Day	0.9500
		Foreman	Day	0.0530
5	1 M³ Ground rock excavation of 1 meter depth			
	LABOR	Unskilled labor	Day	1.5000
		rock soil	Day	0.0600
6	1 M³ Mud soil excavation of 1 meter depth			
	LABOR	Unskilled labor	Day	0.9163
		Foreman	Day	0.0700
7	1 M ² Cliff stripping work (1 meter high)			
	LABOR	Unskilled labor	Day	0.4230
		Foreman	Day	0.0260
8	1 M³ Disposing of land 30 meters distance			

	LABOR	Unskilled labor	Day	0.3300
		Foreman	Day	0.0126
9	1 M3 Backfilling of excavated area			
	LABOR	Unskilled labor	Day	0.2142
		Foreman	Day	0.0143
10	1 M³ Soil compaction (per 20 cm)			
	LABOR	Unskilled labor	Day	0.5000
		Foreman	Day	0.0500
11	1 M3 Sand filling			
	MATERIAL	Filled sand	M³	1.2000
	LABOR	Unskilled labor	Day	0.3023
		Foreman	Day	0.0127
12	1 M³ Installation of 10 cm thick layer of ijuk (palm tree fibers)			
	MATERIAL	Ijuk (palm tree fiber/filter material)	M³	2.7577
	LABOR	Unskilled labor	Day	0.1500
		Foreman	Day	0.0150
13	1 M³ Compacted sand-gravel mixed to raise building floor			
	MATERIAL	Sand - gravel mixed (Sirtu)	M³	1.2000
	LABOR	Unskilled labor	Day	0.3046
		Foreman	Day	0.0379

III. FOUNDATION WORKS

	REQUIREMENT		UNIT	COEFFICIENT
1	1 M³ Construction of stone masonry foundation (1 Pc : 3 Sand)			
	MATERIAL	Stone masonry 15/20 cm	M³	1.2000
		Portland Cement	Kg	202.0000
		Sand	M³	0.4850
	LABOR	Unskilled labor	Day	1.5000
		Stonemason	Day	0.6000
		Skilled head	Day	0.0905
		Foreman	Day	0.0452
2	1 M³ Construction of stone masonry foundation (1 Pc : 4 Sand)			
	MATERIAL	Stone masonry 15/20 cm	M³	1.2000
		Portland Cement	Kg	163.0000
		Sand	M³	0.5348
	LABOR	Unskilled labor	Day	1.8313
		Stonemason	Day	0.8404
		Skilled head	Day	0.0991
		Foreman	Day	0.0452
3	1 M³ Construction of stone masonry foundation (1 Pc : 5 Sand)			
	MATERIAL	Stone masonry 15/20 cm	M³	1.2000
		Portland Cement	Kg	136.0000
		Sand	M³	0.5440
	LABOR	Unskilled labor	Day	1.7141
		Stonemason	Day	0.7130
		Skilled head	Day	0.1095
		Foreman	Day	0.0546
4	1 M³ Construction of rip rap foundation			
	MATERIAL	Stone masonry 15/20 cm	M³	1.2000
		Filled sand	M³	0.3033
	LABOR	Unskilled labor	Day	0.7800
		Stonemason	Day	0.3900
		Skilled head	Day	0.0579
		Foreman	Day	0.0285
5	1 M³ Cyclope Foundation (60% Concrete K175 + 40% Stone)			
	Material	Stone masonry 15/20	M³	0.4800
		Portland cement	Kg.	197.5000

	Labour	Concrete sand	M³	0.3160
		Gravel	M³	0.4790
		Unskilled labour	Oh	2.2710
		Stone mason	Oh	0.8500
		Skilled head	Oh	0.0850
		Foreman	Oh	0.0430
IV. CONCRETE WORKS				
	REQUIREMENT		UNIT	COEFFICIENT
1	10 Kgs of steel reinforcement			
	MATERIAL	Steel Reinforced	Kg	10.5000
		Concrete wire	Kg	0.1500
	LABOR	Unskilled labor	Day	0.0949
		Blacksmith	Day	0.0757
		Skilled head	Day	0.0109
		Foreman	Day	0.0050
2	1 M Formwork for foundation			
	MATERIAL	Wood class III	M³	0.0329
		Nail 5 ' - 10 '	Kg	0.1586
		formwork oil	Ltr	0.0168
		Unskilled labor	Day	0.5200
	LABOR	Carpenter	Day	0.2600
		Skilled head	Day	0.0260
Foreman		Day	0.0130	
3	1 M Formwork for tie beam			
	MATERIAL	Multiplex 9mm	Sheet	0.3500
		Wood class III	M³	0.0450
		Nail 5 ' - 10 '	Kg	0.3000
		formwork oil	Ltr	0.0256
	LABOR	Unskilled labor	Day	0.5200
		Carpenter	Day	0.2600
		Skilled head	Day	0.0260
Foreman		Day	0.0130	
4	1 M² Formwork for columns			
	MATERIAL	Wood class III	M³	0.0400
		Nail 5 ' - 12 '	Kg	0.4000
		formwork oil	Liter	0.0555
		Wooden beams Class II	M³	0.0150
		9 mm thick plywood	Sheet	0.3500
		Dolken wood 8 " -10 " / 4 m	Piece	2.0000
	LABOR	Unskilled labor	Day	0.6600
		Carpenter	Day	0.3300
		Skilled head	Day	0.0330
		Foreman	Day	0.0160
5		1 M² Formwork for beams		
	MATERIAL	Wood class III	M³	0.0400
		Nail 5 ' - 12 '	Kg	0.4000
		formwork oil	Ltr	0.0536
		Wooden beams Class II	M³	0.0360
		9 mm thick plywood	Sheet	0.3500
		Dolken wood 8 " -10 " / 4 m	Piece	2.0000
	LABOR	Unskilled labor	Day	0.6600
		Carpenter	Day	0.3300
Skilled head		Day	0.0330	
6	1 M² Formwork for floor			
	MATERIAL	Wood class III	M³	0.0400

		Nail 5 ' - 12 '	Kg	0.4000
		formwork oil	Liter	0.0536
		Wooden beams Class II	M³	0.0360
		9 mm thick plywood	Sheet	0.3500
		Dolken wood 8 " -10 " / 4 m	Piece	2.0000
	LABOR	Unskilled labor	Day	0.6600
		Carpenter	Day	0.3300
		Skilled head	Day	0.0330
		Foreman	Day	0.0160
7	1 M² Formwork for stairs			
	MATERIAL	Wood class III	M³	0.0300
		Nail 5 ' - 12 '	Kg	0.4000
		formwork oil	Liter	0.1500
		Wooden beams Class II	M³	0.0183
		9 mm thick plywood	Sheet	0.3455
		Dolken wood 8 " -10 " / 4 m	Piece	2.0000
	LABOR	Unskilled labor	Day	0.6600
		Carpenter	Day	0.3300
		Skilled head	Day	0.0330
		Foreman	Day	0.0161
8	1 M² Concrete trolley platform			
	MATERIAL	Wood class III (board)	M³	0.0260
		Nail 5 ' - 12 '	Kg	0.6000
		Dolken wood 8 " -10 " / 4 m	Piece	0.5000
	LABOR	Unskilled labor	Day	0.1500
		Carpenter	Day	0.0500
		Skilled head	Day	0.0051
		Foreman	Day	0.0026
9	1 M³ Reinforced concrete foundation of K 175 , F'c = 14.5 MPa (150 kg steel + Formwork)			
	MATERIAL	Wood class III	M³	0.2000
		Nail 5 ' - 12 '	Kg	1.5000
		formwork oil	Liter	0.0667
		Steel Reinforced	Kg	150.0000
		Concrete wire	Kg	2.2500
		Portland Cement	Kg	323.0000
		Concrete sand	M³	0.5440
		Gravel	M³	0.8159
	LABOR	Unskilled labor	Day	4.2108
		Stonemason	Day	0.3093
		Carpenter	Day	1.0842
		Blacksmith	Day	1.0500
		Skilled head	Day	0.2450
		Foreman	Day	0.1922
10	1 M³ Reinforced concrete sloop K 175 , F'c = 14.5 MPa (200 kg steel + Formwork)			
	MATERIAL	Wood class III	M³	0.2700
		Nail 5 ' - 12 '	Kg	2.0000
		formwork oil	Liter	0.1000
		Steel Reinforced	Kg	200.0000
		Concrete wire	Kg	3.0000
		Portland Cement	Kg	323.0000
		Concrete sand	M³	0.5440
		Gravel	M³	0.8159
	LABOR	Unskilled labor	Day	4.9152
		Mason	Day	0.3093
		Carpenter	Day	1.5600
		Blacksmith	Day	1.4000
		Skilled head	Day	0.3270
		Foreman	Day	0.2013

11	1 M³ Reinforced concrete column K 175 , F'c = 14.5 MPa (300 kg steel + Formwork)			
	MATERIAL	Wood class III	M³	0.4000
		Nail 5 ' - 12 '	Kg	4.0000
		formwork oil	Liter	2.0000
		Steel Reinforced	Kg	300.0000
		Concrete wire	Kg	4.5000
		Portland Cement	Kg	323.0000
		Concrete sand	M³	0.5440
		Gravel	M³	0.8159
		Class II wood beams	M³	0.1500
		9 mm thick plywood	Sheet	3.5000
		Dolken wood 8 " / 4 m	Piece	16.0000
	LABOR	Unskilled labor	Day	7.1750
		Mason	Day	0.3093
		Carpenter	Day	2.7920
		Blacksmith	Day	2.1000
		Skilled head	Day	0.4883
		Foreman	Day	0.2747
12	1 M³ Reinforced concrete beams K 175 , F'c = 14.5 MPa (200 kg steel + Formwork)			
	MATERIAL	Wood class III	M³	0.3200
		Nail 5 ' - 12 '	Kg.	3.2000
		formwork oil	Liter	2.0000
		Steel Reinforced	Kg	200.0000
		concrete wire	Kg	3.0000
		portland Cement	Kg	323.0000
		concrete sand	M³	0.5440
		gravel	M³	0.8159
		Class II wood beams	M³	0.1500
		9 mm thick plywood	Sheet	3.5000
		Dolken wood 8 " / 4 m	Piece	16.0000
	LABOR	Unskilled labor	Day	7.1750
		Mason	Day	0.3093
		Carpenter	Day	1.6500
		Blacksmith	Day	1.4000
		Skilled head	Day	0.4883
		Foreman	Day	0.2747
13	1 M³ Reinforced concrete plate K175 , f * c 14.5 MPa (150 kg steel + Formwork)			
	MATERIAL	Wood class III	M³	0.1350
		Nail 5 ' - 12 '	Kg	1.3497
		formwork oil	Liter	0.6750
		Steel Reinforced	Kg	150.000
		Concrete wire	Kg	2.2500
		Portland Cement	Kg	323.0000
		Concrete sand	M³	0.5440
		Gravel	M³	0.8159
		Class II wood beams	M³	0.0505
		9 mm thick plywood	Sheet	2.1810
		Dolken wood 8 " / 4 m	Piece	16.0000
	LABOR	Unskilled labor	Day	6.7690
		Mason	Day	0.3093
		Carpenter	Day	1.3000
		Blacksmith	Day	1.0500
		Skilled head	Day	0.2650
	14	1 M Practical reinforced concrete columns (11 x 11) cm		
MATERIAL		Wood class III	M³	0.0025
		Nail 5 ' - 12 '	Kg	0.0452
		Steel Reinforced	Kg	3.0000

		Concrete wire	Kg	0.4500
		Portland Cement	Kg	4.1750
		Concrete sand	M³	0.0063
		Gravel	M³	0.0093
	LABOR	Unskilled labor	Day	0.1588
		Stonemason	Day	0.0473
		Carpenter	Day	0.0113
		Blacksmith	Day	0.0118
		Skilled head	Day	0.0108
		Foreman	Day	0.0050
15	1 M³ Concrete f *c = 7.4 MPa (K 100)			
	MATERIAL	Portland Cement	Kg	254.0000
		Gravel	m3	0.8197
		Concrete sand	m3	0.6200
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140
16	1 M³ Concrete f *c = 9.8 MPa (K 125)			
	MATERIAL	Portland Cement	Kg	284.5500
		Gravel	m3	0.8273
		Concrete sand	m3	0.6175
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140
17	1 M³ Concrete f *c = 12.2 MPa (K 150)			
	MATERIAL	Portland Cement	Kg	315.7000
		Gravel	m3	0.8180
		Concrete sand	m3	0.5845
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140
18	1 M³ Concrete f *c = 14.5 MPa (K 175)			
	MATERIAL	Portland Cement	Kg	323.0000
		Gravel	m3	0.7800
		Concrete sand	m3	0.5200
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140
19	1 M³ Concrete f *c = 16.9 MPa (K 200)			
	MATERIAL	Portland Cement	Kg	349.0000
		Gravel	m3	0.8100
		Concrete sand	m3	0.5400
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140
20	1 M³ Concrete f *c = 19.3 MPa (K 225)			
	MATERIAL	Portland Cement	Kg	377.0200
		Gravel	m3	0.8200
		Concrete sand	m3	0.5000
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140

21	1 M³ Concrete f * c = 21.7 MPa (K 250)			
	MATERIAL	Portland Cement	Kg	384.0000
		Gravel	m3	0.8200
		Concrete sand	m3	0.4900
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140
22	1 M³ Concrete f * c = 24 MPa (K 275)			
	MATERIAL	Portland Cement	Kg	412.0000
		Gravel	m3	0.7800
		Concrete sand	m3	0.5560
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140
23	1 M³ Concrete f * c = 26.4 MPa (K 300)			
	MATERIAL	Portland Cement	Kg	425.0000
		Gravel	m3	0.8900
		Concrete sand	m3	0.4900
	LABOR	Unskilled labor	Day	1.6842
		Stonemason	Day	0.2807
		Skilled head	Day	0.0281
		Foreman	Day	0.0140
24	1 M³ Concrete f * c = 31.2 MPa (K 350)			
	MATERIAL	Portland Cement	Kg	464.3500
		Gravel	m3	0.7800
		Concrete sand	m3	0.4867
	LABOR	Unskilled labor	Day	2.1000
		Stonemason	Day	0.3500
		Skilled head	Day	0.0717
		Foreman	Day	0.0360
25	1 M³ Reinforced concrete tie beam K 350 , F * c = 31.2 MPa (150 kg steel + Formwork)			
	MATERIAL	Wood class III	M³	0.2770
		Nail 5 ' - 12 '	Kg	2.0500
		Oil formwork	Liter	0.6150
		Steel Reinforced	Kg	150.0000
		Concrete wire	Kg	2.2500
		Portland Cement	Kg	464.3500
		Concrete sand	M³	0.4867
		Plywood 9mm thick	piece	2.9160
		Gravel	M³	0.7800
	LABOR	Unskilled labor	Day	4.3460
		Stonemason	Day	0.2820
		Carpenter	Day	1.3325
		Blacksmith	Day	1.0765
		Skilled head	Day	0.2700
		Foreman	Day	0.0135
26	1 M³ Reinforced concrete beam quality of K 350 , f * c = 31.2 MPa (175kg steel + Formwork)			
	MATERIAL	Wood class III	M³	0.3280
		Nail 5 ' - 12 '	Kg	3.2800
		formwork oil	Liter	1.6400
		Steel Reinforced	Kg	175.0000
		Concrete wire	Kg	2.6250
		Portland Cement	Kg	464.3500
		Concrete sand	M³	0.4867

		Gravel	M³	0.7800
		Class II wood beams	M³	0.1500
		9 mm thick plywood	Sheet	4.0000
		Dolken wood 8 " / 4 m	Piece	16.0000
	LABOR	Unskilled labor	Day	5.4325
		Stonemason	Day	0.3415
		Carpenter	Day	1.6500
		Blacksmith	Piece	1.4000
		Skilled head	Day	0.3330
		Foreman	Day	0.1650
27	1M³ Reinforced concrete beam quality of K 275 ,f * c 24 MPa (175kg steel + Formwork)			
	MATERIAL	Wood class III	M³	0.3280
		Nail 5 ' - 12 '	Kg.	3.2800
		formwork oil	Liter	1.6400
		Steel Reinforced	Kg	175.0000
		Concrete wire	Kg	2.6250
		Portland Cement	Kg	412.0000
		Concrete sand	M³	0.5560
		Gravel	M³	0.7800
		Class II wood beams	M³	0.1400
		9 mm thick plywood	Sheet	4.0000
		Dolken wood 8 " / 4 m	Piece	16.0000
	LABOR	Unskilled labor	Day	5.4325
		Stonemason	Day	0.3415
		Carpenter	Day	1.6500
		Blacksmith	Day	1.4000
		Skilled head	Day	0.3330
		Foreman	Day	0.1650

V. ROOF WORKS

	REQUIREMENT		UNIT	COEFFICIENT	
1	1 kg WF steel truss				
	MATERIAL	WF Steel profile	kg	1.2000	
		Welding rod	kg	0.0008	
		bolt and nut	kg	0.028	
	FABRICATION	Unskilled labor	day	0.0035	
		Skilled labor	day	0.007	
		Foreman	day	0.0035	
	ERRECTION	Tools = 7.5% of total material			
		Unskilled labor	day	0.0035	
		Skilled labor	day	0.012	
		Foreman	day	0.000875	
		Crane	hour	0.012	
2	1 kg steel purlin C chanel				
	MATERIAL	C Chanel profile	kg	1.025	
		Welding rod	kg	0.00008	
		bolt and nut	kg	0.0028	
	ERRECTION	Unskilled labor	day	0.0028	
		Skilled labor	day	0.0056	
		Foreman	day	0.0028	
3	1 kg RHS/SHS steel profile				
	MATERIAL	RHS/SHS profile	kg	1.025	
		Welding rod	kg	0.00008	
		bolt and nut	kg	0.0028	
	ERRECTION	Unskilled labor	day	0.0028	
		Skilled labor	day	0.0056	

4	Foreman		day	0.0028	
	1kg light steel truss				
	MATERIAL	Light steel profile	kg	1.025	
		Self drilling screw	piece	6	
	FABRICATION	Unskilled labor	day	0.00175	
		Skilled labor	day	0.0035	
		Foreman	day	0.00175	
		Tools, = 7.5% of Total material			
	ERRECTION	Unskilled labor	day	0.0035	
		Skilled labor	day	0.007	
		Foreman	day	0.0035	
5	1 kg steel tie rod/zagrod				
	MATERIAL	Steel rod	kg	1.025	
		bolt and nut	piece	3.00013	
	ERRECTION	Unskilled labor	day	0.0028	
		Skilled labor	day	0.0056	
		Foreman	day	0.0028	
6	1 kg steel profile/C chanel for truss, with welding connection				
	MATERIAL	Steel profile	kg	1.1000	
		welding rod	kg	0.0008	
	FABRICATION	Unskilled labor	day	0.0035	
		Skilled labor	day	0.0070	
		Foreman	day	0.0035	
		Tools, - 7.5% of total material			
	ERRECTION	Unskilled labor	day	0.0035	
		Skilled labor	day	0.012	
		Foreman	day	0.000875	
		Crane	hour	0.0120	
7	1 kg steel profile/C chanel for truss, with bolt connection				
	MATERIAL	Steel profile	kg	1.100	
		bolt and nut	kg	0.0028	
	FABRICATION	Unskilled labor	day	0.0035	
		Skilled labor	day	0.007	
		Foreman	day	0.0035	
		Tools, - 7.5% of total material			
	ERRECTION	Unskilled labor	day	0.0035	
		Skilled labor	day	0.012	
		Foreman	day	0.000875	
		Crane	hour	0.012	
8	1 M² Install corrugated zinc				
	MATERIAL	Corrugated Zinc	Sheet	0.7000	
		nail	Kg	0.0200	
	LABOR	Unskilled labor	Day	0.1409	
		Carpenter	Day	0.1256	
		Skilled head	Day	0.0510	
		Foreman	Day	0.0067	
9	1 M Install shingle ridge capping				
	MATERIAL	Zinc plate 3 " x 6 " BJLS 28	Sheet	0.4000	
		Nail ½ " - 1 "	Kg	0.0600	
		Nail 2 " - 5 "	Kg	0.0500	
		Wood boards 3 cm	M ³	0.0060	
	LABOR	Unskilled labor	Day	0.1250	
		Carpenter	Day	0.2500	
		Skilled head	Day	0.0420	
		Foreman	Day	0.0063	
10	1 M² Install roof tile (small "Plentong")				
	MATERIAL	Tile "Plentong"	Piece	23.0770	
	LABOR	Unskilled labor	Day	0.1500	

		Carpenter	Day	0.0656
		Skilled head	Day	0.0070
		Foreman	Day	0.0035
11	1 M² Install ridge tiles "Plentong"			
	MATERIAL	Ridge "Plentong"	Piece	4.4351
		Portland Cement	Kg	8.0000
		Sand	M ³	0.0320
	LABOR	Unskilled labor	Day	0.4000
		Carpenter	Day	0.2000
		Skilled head	Day	0.0200
		Foreman	Day	0.0100
12	1 M² Install corrugated asbestos roof 1.80 x 0.92m x 5mm			
	MATERIAL	Asbestos wave	Sheet	0.7577
		Nail	Kg	0.1200
	LABOR	Unskilled labor	Day	0.1400
		Carpenter	Day	0.0670
		Skilled head	Day	0.0070
		Foreman	Day	0.0035
13	1 M² Install shingle roof			
	MATERIAL	Shingle tile	Piece	61.0000
		Nail ½ " - 1 "	Kg	0.2033
	LABOR	Unskilled labor	Day	0.1687
		Carpenter	Day	0.2543
		Skilled head	Day	0.0253
		Foreman	Day	0.0080
14	1 M² Setting reed roof			
	MATERIAL	Reed	Sheet	6.6625
		Strap	Kg	0.5125
	LABOR	skilled labor	Day	0.2050
		Foreman	Day	0.01025

VI. WALL WORKS

	REQUIREMENT		UNIT	COEFFICIENT
1	1 M² Install brick (concrete block) 40x20x10 cm, speci 1Pc : 4Sand			
	MATERIAL	Brick / Concrete block	Piece	12.5000
		Portland Cement	Kg	12.0000
		Sand	M ³	0.0380
	LABOR	Unskilled labor	Day	0.3518
		Stonemason	Day	0.1131
		Skilled head	Day	0.0193
		Foreman	Day	0.0091
2	1 M² Install paving blocks 20x25x6 cm			
	MATERIAL	Paving blocks	Piece	20.6000
		Portland Cement	Kg	8.3200
		Sand	M ³	0.0620
	LABOR	Unskilled labor	Day	0.3210
		Stonemason	Day	0.4370
		Skilled head	Day	0.0220
		Foreman	Day	0.0175
3	1 M² Install paving blocks 20x10x6 cm			
	MATERIAL	Paving blocks	Piece	51.5000
		Portland Cement	Kg	8.3200
		Sand	M ³	0.0620
	LABOR	Unskilled labor	Day	0.3210
		Stonemason	Day	0.4370
		Skilled head	Day	0.0220
		Foreman	Day	0.0175

4	1 M³ Install Gabion River stone (2 x 1 x 1 m)			
	MATERIAL	River Stone	M ³	1.1000
		Gabion	Unit	0.5000
	LABOR	Unskilled labor	Day	0.6667
		Foreman	Day	0.0240

VII. PLASTER WORKS

	REQUIREMENT		UNIT	COEFFICIENT
1	1 M² Plastering 1 Pc : 3 Sand , 15 mm thick			
	MATERIAL	Portland Cement	Kg.	7.0521
		Sand	M ³	0.0200
	LABOR	Unskilled labor	Day	0.2559
		Stonemason	Day	0.1500
		Skilled head	Day	0.0167
		Foreman	Day	0.0083
2	1 M² Plastering 1 Pc : 4 Sand , 15 mm thick			
	MATERIAL	Portland Cement	Kg	6.2400
		Sand	M ³	0.0214
	LABOR	Unskilled labor	Day	0.2559
		Stonemason	Day	0.1500
		Skilled head	Day	0.0167
		Foreman	Day	0.0083
3	1 M² Plastering 1 Pc : 2 Sand, 20 mm thick			
	MATERIAL	Portland Cement	Kg	12.7500
		Sand	M ³	0.0270
	LABOR	Unskilled labor	Day	0.3500
		Stonemason	Day	0.1500
		Skilled head	Day	0.0202
		Foreman	Day	0.0101
4	1 M² Plastering 1 Pc : 3 Sand, 20 mm thick			
	MATERIAL	Portland Cement	Kg	10.3500
		Sand	M ³	0.0310
	LABOR	Unskilled labor	Day	0.3500
		Stonemason	Day	0.1500
		Skilled head	Day	0.0202
		Foreman	Day	0.0101
5	1 M² Plastering 1 Pc : 4 Sand, 20 mm thick			
	MATERIAL	Portland Cement	Kg	8.3200
		Sand	M ³	0.0320
	LABOR	Unskilled labor	Day	0.3500
		Stonemason	Day	0.1500
		Skilled head	Day	0.0202
		Foreman	Day	0.0101
6	1 M² Plastering Cement splashes, 1 Pc : 2 Sand			
	MATERIAL	Portland Cement	Kg	5.6080
		Sand	M ³	0.0110
	LABOR	Unskilled labor	Day	0.2559
		Stonemason	Day	0.1270
		Skilled head	Day	0.0130
		Foreman	Day	0.0060
7	1 M² Plastering 1 Pc : 5 Sand, 15 mm thick			
	MATERIAL	Portland Cement	Kg	4.7751
		Sand	M ³	0.0220
	LABOR	Unskilled labor	Day	0.2559
		Stonemason	Day	0.1500
		Skilled head	Day	0.0167
		Foreman	Day	0.0083

8	1 M² Plastering 1 Pc : 5 Sand, 20 mm thick			
	MATERIAL	Portland Cement	Kg	6.4490
		Sand	M ³	0.0230
	LABOR	Unskilled labor	Day	0.3500
		Stonemason	Day	0.1500
		Skilled head	Day	0.0202
		Foreman	Day	0.0101

VIII. FINISHING WORKS

	REQUIREMENT		UNIT	COEFFICIENT
1	1 m² Finishing Cement groove of red brick wall			
	MATERIAL	Portland Cement	Kg	3.8220
		Sand	M ³	0.0230
	LABOR	Unskilled labor	Day	0.1500
		Stonemason	Day	0.0731
		Skilled head	Day	0.0074
		Foreman	Day	0.0037
2	1 M² Finishing Cement groove of conblock wall			
	MATERIAL	Portland Cement	Kg	1.6400
		Sand	M ³	0.0120
	LABOR	Unskilled labor	Day	0.0720
		Stonemason	Day	0.0360
		Skilled head	Day	0.0040
		Foreman	Day	0.0020
3	1 M² Finishing Cement groove of stone masonry, 1 PC : 2 Sand			
	MATERIAL	Portland Cement	Kg	6.3400
		Sand	M ³	0.0120
	LABOR	Unskilled labor	Day	0.3000
		Stonemason	Day	0.1500
		Skilled head	Day	0.0150
		Foreman	Day	0.0075
4	1 M² Render			
	MATERIAL	Portland Cement	Kg	3.4988
		Sand	M ³	0.0120
	LABOR	Unskilled labor	Day	0.1753
		Stonemason	Day	0.1057
		Skilled head	Day	0.0146
		Foreman	Day	0.0073

IX. WOOD WORKS

	REQUIREMENT		UNIT	COEFFICIENT
1	Make and Install 1 M³ Door and window, wooden frame class I			
	MATERIAL	Wood beams	M ³	1.1080
		Nail 10 cm	Kg	1.0031
		Wood glue	Kg	1.0000
	LABOR	Unskilled labor	Day	6.9380
		Carpenter	Day	20.8140
		Skilled head	Day	2.1521
		Foreman	Day	0.4283
2	Make and Install 1 M³ Door and window, wooden frame class II/III			
	MATERIAL	Wood beams	M ³	1.1080
		Nail 10 cm	Kg	1.0031
		Wood glue	Kg	1.0000
	LABOR	Unskilled labor	Day	6.0000
		Carpenter	Day	18.0000
		Skilled head	Day	2.0000
		Foreman	Day	0.3890
3	Make and Install 1 M² Standard Clamp Doors, Wood Class II			
	MATERIAL	Wooden board	M ³	0.0400

	LABOR	Nail 5-7 cm	Kg	0.4750
		Unskilled labor	Day	0.5725
		Carpenter	Day	1.5508
		Skilled head	Day	0.1551
		Foreman	Day	0.0956
4	Make and Install 1 M² Simple Clamp Doors , Wood Class III			
	MATERIAL	Wooden board	M ³	0.0400
		Nail 5-7 cm	Kg	0.4750
	LABOR	Unskilled labor	Day	0.5725
		Carpenter	Day	1.5508
		Skilled head	Day	0.1551
		Foreman	Day	0.0956
5	Make and Install 1 M² Door leave, Wood Class I/II			
	MATERIAL	Wooden board	M ³	0.0400
		Wood glue / nail	Kg	0.5000
	LABOR	Unskilled labor	Day	1.0000
		Carpenter	Day	2.5543
		Skilled head	Day	0.2556
		Foreman	Day	0.0500
6	Make and Install 1 M² Door and window glass, wooden frame class I/II			
	MATERIAL	Wooden board	M ³	0.0240
		Wood glue / nail	Kg	0.1593
	LABOR	Unskilled labor	Day	0.8000
		Carpenter	Day	2.1006
		Skilled head	Day	0.2043
		Foreman	Day	0.0400
7	Make and Install 1 M² Door and window louvre, Wood Class I/II			
	MATERIAL	Wooden board	M ³	0.0385
		Wood glue	Kg	0.5000
	LABOR	Unskilled labor	Day	1.0000
		Carpenter	Day	3.0000
		Skilled head	Day	0.3000
		Foreman	Day	0.0500
8	Make and Install 1 M² Double plywood door, with wood frame class II (width up to 90 cms)			
	MATERIAL	Wooden board	M ³	0.0250
		Nail 1 to 2.5 cm	Kg	0.0300
		Wood glue	Kg	0.5000
		Plywood 4 mm size 90x220cm	Sheet	1.0000
	LABOR	Unskilled labor	Day	0.6359
		Carpenter	Day	2.0127
		Skilled head	Day	0.2000
		Foreman	Day	0.0546
9	Make 1 M² Double plywood door, exposed frame, wood class I/II			
	MATERIAL	Wooden board	M ³	0.0260
		Nail 1 to 2.5 cm	Kg	0.0300
		Wood glue	Kg	0.5000
		Plywood 4 mm size 90x220cm	Sheet	1.0000
	LABOR	Unskilled labor	Day	0.6651
		Carpenter	Day	2.1006
		Skilled head	Day	0.2043
		Foreman	Day	0.0560
10	Make and install 1 M² Louvre frame, wood class I/II			
	MATERIAL	Wooden board	M ³	0.0600
		Nail 1 to 2.5 cm	Kg	0.1500
	LABOR	Unskilled labor	Day	0.5743
		Carpenter	Day	2.0000
		Skilled head	Day	0.2000
11		Foreman	Day	0.0764

	Make and install 1 M² Double teakwood, expose frame, wood class I			
	MATERIAL	Wooden board	M ³	0.0217
		Nail 1 to 2.5 cm	Kg	0.0300
		Wood glue	Kg	0.3000
		Taekwood 4 mm size 90x220cm	Sheet	1.0000
	LABOR	Unskilled labor	Day	0.6366
		Carpenter	Day	2.0434
		Skilled head	Day	0.2043
		Foreman	Day	0.0560
12	Install 1 M³ Conventional wooden truss, class I, II and III , spans 6 m			
	MATERIAL	wood beams	M ³	1.1000
		5mm thick iron strips	Kg	15.0000
		Nail 12 cm	Kg	3.4460
	LABOR	Unskilled labor	Day	4.4054
		Carpenter	Day	10.1540
		Skilled head	Day	1.0154
		Foreman	Day	0.2000
13	Install 1 M³ Exposed truss, wood Class I			
	MATERIAL	wood beams	M ³	1.1150
		5mm thick iron strips	Kg	15.0000
		Nail 12 cm	Kg	2.4260
	LABOR	Unskilled labor	Day	4.7508
		Carpenter	Day	20.1000
		Skilled head	Day	2.0100
		Foreman	Day	0.2375
14	Install 1 M³ Purlin, wood Class II			
	MATERIAL	wood beams	M ³	1.1000
		5mm thick iron strips	Kg	15.0000
		Nail 12 cm	Kg	3.0000
	LABOR	Unskilled labor	Day	2.4000
		Carpenter	Day	7.2000
		Skilled head	Day	0.7200
		Foreman	Day	0.1200
15	Install 1 M² roof frame of ceramic tile , wood Class II			
	MATERIAL	Wooden rafters (5x7) cm	M ³	0.0140
		Batten (2x3) cm	m ³	0.0038
		Nail 5 and 10 cm	Kg	0.2500
	LABOR	Unskilled labor	Day	0.1000
		Carpenter	Day	0.1000
		Skilled head	Day	0.0100
		Foreman	Day	0.0050
16	Install 1M² concrete tile of roof frame, wood Class II			
	MATERIAL	Wooden rafters (5x7) cm	M ³	0.0140
		Batten (3x4) cm	M ³	0.0070
		Nail 5 and 10 cm	Kg	0.2500
	LABOR	Unskilled labor	Day	0.1000
		Carpenter	Day	0.1000
		Skilled head	Day	0.0100
		Foreman	Day	0.0050
17	Install 1M² shingle roof frame, wood Class II			
	MATERIAL	Wood Class II	M ³	0.1690
		Nail 5 to 10 cm	Kg	0.2050
	LABOR	Unskilled labor	Day	0.1230
		Carpenter	Day	0.1230
		Skilled head	Day	0.0123
		Foreman	Day	0.0060
18	Install 1M² ceiling frame, (50x100) cm wood class II / III			
	MATERIAL	Wooden rafters (5x7) cm	M ³	0.0150
		Nail 7 to 10 cm	Kg	0.2000

	LABOR	Unskilled labor	Day	0.1500
		Carpenter	Day	0.3000
		Skilled head	Day	0.0300
		Foreman	Day	0.0150
19	Install 1M² ceiling frame, (60x60) cm wood class II / III			
	MATERIAL	Wooden rafters (5x7) cm	M ³	0.0163
		Nail 7 and 10 cm	Kg	0.2543
	LABOR	Unskilled labor	Day	0.2033
		Carpenter	Day	0.3050
		Skilled head	Day	0.0305
		Foreman	Day	0.0152
20	Install 1M roof edge board size 3x20 cm, wood class I / II			
	MATERIAL	Wooden board	M ³	0.0100
		Nail 5 to 7 cm	Kg	0.0759
	LABOR	Unskilled labor	Day	0.1194
		Carpenter	Day	0.2390
		Skilled head	Day	0.0239
		Foreman	Day	0.0050
21	Install 1M roof edge board size 3x30 cm, wood class I / II			
	MATERIAL	Wooden board	M ³	0.0110
		Nail 5 to 7 cm	Kg	0.0759
	LABOR	Unskilled labor	Day	0.1194
		Carpenter	Day	0.2390
		Skilled head	Day	0.0239
		Foreman	Day	0.0050
22	Install 1M² wall partition frame, 60x120 cm , wood Class II / III			
	MATERIAL	Wooden beams	M ³	0.0283
		Nail 5 to 7 cm	Kg	0.1527
	LABOR	Unskilled labor	Day	0.1527
		Carpenter	Day	0.4577
		Skilled head	Day	0.0473
		Foreman	Day	0.0080
23	Install 1 M² double teakwood partition wall , wood Class II			
	MATERIAL	Wooden beam 6/12 cm	M ³	0.0275
		Nail 5 and 10 cm	Kg	0.1500
		4 mm Taekwood size 120x240 cm	Sheet	0.8451
		Wood glue	Kg	0.4500
	LABOR	Unskilled labor	Day	0.1436
		Carpenter	Day	0.4307
		Skilled head	Day	0.0431
		Foreman	Day	0.0077
24	Install 1 M² double plywood partition wall , wood Class II			
	MATERIAL	Wooden beam 6/12 cm	M ³	0.0280
		Nail 5 and 10 cm	Kg	0.1440
		4 mm plywood size 120x240cm	Sheet	0.8451
		Wood glue	Kg	0.4500
	LABOR	Unskilled labor	Day	0.1914
		Carpenter	Day	0.5742
		Skilled head	Day	0.0574
		Foreman	Day	0.0096
25	Install 1 M² wooden board walls, wood class I			
	MATERIAL	Wooden board	M ³	0.0070
		Nail 5 and 10 cm	Kg	0.1025
		Nail couplers 10 cm	Kg	0.1538
	LABOR	Unskilled labor	Day	0.6150
		Carpenter	Day	1.8450
		Skilled head	Day	0.1845
		Foreman	Day	0.0308
26	Install 1 M² plywood (Lambrizing) wall, size 120 x 240 cm			

	MATERIAL	4 mm (Lambrazing) plywood size 120x240 cm	Sheet	0.4100
		Nail 1 and 2.5 cm	Kg	0.0515
	LABOR	Unskilled labor	Day	0.0255
		Carpenter	Day	0.0770
		Skilled head	Day	0.0077
		Foreman	Day	0.0010

X. FLOOR & WALL COVER

	REQUIREMENT		UNIT	COEFFICIENT
1	1 M² Install Marble Floor Size (30 x 30) cm			
	Material	Marble Floor 30 x 30 cm	Piece	11.8700
		Portland cement	Kg.	8.0000
		Sand	M ³	0.0450
		Colored cement	Kg.	0.9400
	Labour	Unskilled labour	Day	0.4986
		Stone mason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175
2	1 M² Install Granite Floor Size (40 x 40) cm			
	Material	Granite 40 x 40 cm	Piece	6.6250
		Portland cement	Kg.	8.0000
		Sand	M ³	0.0450
		Colored cement	Kg.	0.9400
	Labour	Unskilled labour	Day	0.4986
		Stone mason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175
3	1 M² Install Marble Floor Size (60 x 60) cm			
	Material	Marble Floor 60 x 60 cm	Piece	3.0000
		Portland cement	Kg.	8.0000
		Sand	M ³	0.0450
		Colored cement	Kg.	0.9321
	Labour	Unskilled labour	Day	0.4986
		Stone mason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175
4	1 M² Install Marble Floor Size (100 x 100) cm			
	Material	Marble Floor 100 x 100 cm	Piece	1.0600
		Portland cement	Kg.	8.0000
		Sand	M ³	0.0450
		Colored cement	Kg.	0.6500
	Labour	Unskilled labour	Day	0.7000
		Stone mason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175
5	1 M' Install Ceramic Plinth Size (10 x 40) cm			
	Material	Ceramic plinth 10 x 40 cm	Piece	2.5750
		Portland cement	Kg.	1.2724
		Sand	M ³	0.0033
		Colored cement	Kg.	0.1000
	Labour	Unskilled labour	Day	0.0900
		Stone mason	Day	0.0900
		Skilled head	Day	0.0090
		Foreman	Day	0.0050

6	1 M' Install Ceramic Plinth Size (10 x 30) cm			
	Material	Ceramic plinth 10 x 30 cm	Piece	3.5000
		Portland cement	Kg.	1.2724
		Sand	M ³	0.0033
		Colored cement	Kg.	0.1000
	Labour	Unskilled labour	Day	0.0900
		Stone mason	Day	0.0900
		Skilled head	Day	0.0090
		Foreman	Day	0.0050
7	1 M Install Ceramic Plinth Size (10 x 20) cm			
	Material	Ceramic plinth 10 x 20 cm	Piece	5.2100
		Portland cement	Kg.	1.2724
		Sand	M ³	0.0033
		Colored cement	Kg.	0.1000
	Labour	Unskilled labour	Day	0.0900
		Stone mason	Day	0.0900
		Skilled head	Day	0.0090
		Foreman	Day	0.0050
8	1 M' Install Ceramic Plinth Size (5 x 20) cm			
	Material	Ceramic plinth 5 x 20 cm	Piece	5.3000
		Portland cement	Kg.	0.5700
		Sand	M ³	0.0015
		Colored cement	Kg.	0.0130
	Labour	Unskilled labour	Day	0.0900
		Stone mason	Day	0.0900
		Skilled head	Day	0.0090
		Foreman	Day	0.0050
9	1 M' Install Marble Plinth Size (10 x 60) cm			
	Material	Marble plinth 10 x 60 cm	Piece	1.7000
		Portland cement	Kg.	1.2724
		Sand	M ³	0.0033
		Colored cement	Kg.	0.1000
	Labour	Unskilled labour	Day	0.0900
		Stone mason	Day	0.0900
		Skilled head	Day	0.0090
		Foreman	Day	0.0050
10	1 M² Install Mozaik Floor Size (30 x 30) cm, mix 1pc : 3sand			
	Material	Mozaic	Piece	11.8700
		Portland cement	Kg.	8.0000
		Sand	M ³	0.0450
		Colored cement	Kg.	0.9400
	Labour	Unskilled labour	Day	0.4986
		Stone mason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175
11	1 M' Instal Internal/Cove Arsitik Plinth Size (5 x 5 x 20) cm			
	Material	Internal/cove	Piece	5.3000
		Portland cement	Kg.	1.2724
		Sand	M ³	0.0033
		Colored cement	Kg.	0.1000
	Labour	Unskilled labour	Day	0.8250
		Stone mason	Day	0.8250
		Skilled head	Day	0.0825
		Foreman	Day	0.0412
12	1 M² Install Wall Porcelain Size (11 x 11) cm			
	Material	Porcelain	Piece	86.0000
		Portland cement	Kg.	9.3000
		Sand	M ³	0.0180

13	Labour	Colored cement	Kg.	0.9400	
		Unskilled labour	Day	1.0000	
		Stone mason	Day	0.5000	
		Skilled head	Day	0.0500	
		Foreman	Day	0.0250	
	1 M² Install Wall Porcelain Size (10 x 20) cm				
	Material	Porcelain	Piece	51.5000	
		Portland cement	Kg.	9.3000	
		Sand	M ³	0.0180	
14	Labour	Colored cement	Kg.	1.0000	
		Unskilled labour	Day	0.9450	
		Stone mason	Day	0.5000	
		Skilled head	Day	0.0500	
		Foreman	Day	0.0250	
	1 M² Install Wall Porcelain Size (20 x 20) cm				
	Material	Porcelain	Piece	25.3588	
		Portland cement	Kg.	9.3000	
		Sand	M ³	0.0180	
15	Labour	Colored cement	Kg.	0.9400	
		Unskilled labour	Day	0.9450	
		Stone mason	Day	0.5000	
		Skilled head	Day	0.0500	
		Foreman	Day	0.0250	
	1 M² Install Wall Artistic Ceramics Size (5 x 20) cm				
	Material	Artistic Ceramics	Piece	106.0000	
		Portland cement	Kg.	9.3000	
		Sand	M ³	0.0180	
16	Labour	Colored cement	Kg.	2.9000	
		Unskilled labour	Day	0.9450	
		Stone mason	Day	0.5000	
		Skilled head	Day	0.0500	
		Foreman	Day	0.0250	
	1 M² Install Brick Lining Wall Size (3 x 7 x 24) cm				
	Material	Brick Lining (3 x 7 x 24) cm	Piece	63.0000	
		Portland cement	Kg.	12.4400	
		Sand	M ³	0.0250	
17	Labour	Colored cement	Kg.	1.0000	
		Unskilled labour	Day	1.0000	
		Stone mason	Day	0.5000	
		Skilled head	Day	0.0500	
		Foreman	Day	0.0250	
	Install 1 m² Paras stone wall				
	Material	Paras stone	M ²	1.0400	
		Portland cement	Kg.	11.7500	
		Sand	M ³	0.0360	
18	Labour	Unskilled labour	Day	0.7000	
		Stone mason	Day	0.3500	
		Skilled head	Day	0.0350	
		Foreman	Day	0.0175	
	Install 1 m² Andasite stone wall				
	Material	Andasite Stone	M ²	1.2000	
		Portland cement	Kg.	11.7500	
		Sand	M ³	0.0350	
	Labour	Unskilled labour	Day	0.7000	

19			Stone mason	Day	0.3500
			Skilled head	Day	0.0350
			Foreman	Day	0.0175
	1 M ² Install Vinyl Floor Size (30 x 30) cm				
		Material	Vinyl	Piece	11.8700
			Wood glue	Kg.	0.3500
		Labour	Unskilled labour	Day	0.1650
	Skilled		Day	0.1650	
	Skilled head		Day	0.0165	
	Foreman		Day	0.0080	
20	1 M' Install Rubber Vinyl floor Size (15 x 30) cm				
		Material	Rubber Vinyl	Piece	1.7600
			Wood glue	Kg.	0.0800
		Labour	Unskilled labour	Day	0.0880
			Skilled	Day	0.0880
			Skilled head	Day	0.0088
			Foreman	Day	0.0044
21	1 M ² Install Wall Paper, width 50 cm				
		Material	Wall Paper	M	2.2000
			Glue	Kg.	0.2000
		Labour	Unskilled labour	Day	0.3850
			Skilled	Day	0.1925
			Skilled head	Day	0.0160
			Foreman	Day	0.0020
22	Install 1 m ² Floor Hardener				
		Material	Floor Hardener	Kg.	5.0000
		Labour	Unskilled labour	Day	0.1320
			Skilled	Day	0.1320
			Skilled head	Day	0.0441
			Foreman	Day	0.0220
	23	1 m ² Demolition Work Removal of Old Wall plaster Including Clearing			
		Material	-	-	
		Labour	Unskilled labour	Day	0.0714
			Foreman	Day	0.0109
		Equipme nt	5% of Labour cost	%	5
24	1 m ² Removal of Roof Tiles or Shingles				
		Material	-	-	
		Labour	Unskilled labour	Day	0.0200
			Foreman	Day	0.0040
		Equipme nt	5% of Total Labour	%	5
25	1 m ² Demolition mortar Concrete Floor				
		Material	-	-	
		Labour	Unskilled labour	Day	0.4057
			Foreman	Day	0.0321
		Equipme nt	5% of Total Labour	%	5
26	1 m ² Removal of Corrugated Zinc Roofing				
		Material	-	-	
		Labour	Unskilled labour	Day	0.0500
			Foreman	Day	0.0050
		Equipme nt	Minor Tool 5% of Total Labour	%	5
27	1 m ² Removal of Timber Roof Framing				
		Material	-	-	
		Labour	Unskilled labour	Day	0.2500
			Foreman	Day	0.0250
		Equipme nt	Minor Tool 5% of Total Labour	%	5

28	nt			
	1 m² Removal of Ceiling Framing and Plywood Linning			
	Material	-	-	
	Labour	Unskilled labour	Day	0.2000
		Foreman	Day	0.0200
29	Equipme nt	5% of Total 5Labour	%	5
	1 M² Install grey floor tile pc 20 x20 cm			
	MATERIAL	Gray tiles 20 x 20 cm	Piece	25.3588
		Portland Cement	Kg	10.4000
		Sand	M ³	0.0450
		Colour Cement	Kg	0.3467
	LABOR	Unskilled labor	Day	0.3228
		Stonemason	Day	0.1966
		Skilled head	Day	0.0197
		Foreman	Day	0.0095
30	1 M Install grey tile skirting 15 x20 cm			
	MATERIAL	Plinth tiles	Piece	6.1554
		Portland Cement	Kg	1.2724
		Sand	M ³	0.0033
	LABOR	Unskilled labor	Day	0.0900
		Stonemason	Day	0.0900
		Skilled head	Day	0.0090
		Foreman	Day	0.0045
31	1 M² Install wood floor			
	MATERIAL	Wooden floor (gym floor)	M ²	1.1177
		Wood glue	Kg	0.6100
	LABOR	Unskilled labor	Day	0.7000
		Carpenter	Day	0.3560
		Skilled head	Day	0.0407
		Foreman	Day	0.0203
32	1 M² Install carpet floor			
	MATERIAL	Carpet	M ²	1.0500
		Glue	Kg	0.3500
	LABOR	Unskilled labor	Day	0.1710
		Carpenter	Day	0.1270
		Skilled head	Day	0.0127
		Foreman	Day	0.0091
33	1 M² Install brushed coral, mix 1 : 2			
	MATERIAL	Brushed Coral	Kg	10.0000
		Portland Cement	Kg	3.8950
		Sand	M ³	0.0665
	LABOR	Unskilled labor	Day	0.5125
		Stonemason	Day	0.2050
		Skilled head	Day	0.0205
		Foreman	Day	0.0102
34	Install 1 M wood skirting class II size (2 x 10) cm			
	MATERIAL	Wooden board class II	M ³	0.0023
		Nail screw 5 cm	Kg	0.0500
	LABOR	Unskilled labor	Day	0.1200
		Stonemason	Day	0.1200
		Skilled head	Day	0.0120
		Foreman	Day	0.0060
35	Install 1 m² of ceramic floor tile size (30 x 30) cm			
	MATERIAL	Ceramics	Piece	11.8700
		Portland Cement	Kg.	8.0000
		Sand	M ³	0.0450
		Color Cement	Kg	0.9400
	LABOR	Unskilled labor	Day	0.7000

		Stonemason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175
36	Install 1 m² of ceramic floor tile size (40 x 40) cm			
	MATERIAL	Ceramics	Piece	6.6250
		Portland Cement	Kg	8.0000
		Sand	M ³	0.0450
		Cement color	Kg	0.9400
	LABOR	Unskilled labor	Day	0.7000
		Stonemason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175
37	Install 1 m² of ceramic floor tile size (60 x 60) cm			
	MATERIAL	Ceramics	Piece	3.0000
		Portland Cement	Kg	8.0000
		Sand	M ³	0.0450
		Cement color	Kg	0.9321
	LABOR	Unskilled labor	Day	0.7000
		Stonemason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175
38	Install 1 m² of natural stone			
	MATERIAL	Natural stone	M ²	1.1000
		Portland Cement	Kg	11.5453
		Sand	M ³	0.0193
	LABOR	Unskilled labor	Day	0.7000
		Stonemason	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0175

XI. CEILING WORKS

		REQUIREMENT	UNIT	COEFFICIENT
1	1 M² Install Acoustic Ceiling Size (60 x 120) cm			
	Material	Acoustic	Sheet	1.5000
		Nail 1 to 2,5 cm	Kg.	0.0500
	Labour	Unskilled labour	Day	0.1100
		Carpenter	Day	0.1100
		Skilled head	Day	0.0110
		Foreman	Day	0.0055
2	1 M² Install Acoustic Ceiling Size (30 x 60) cm			
	Material	Acoustic	Sheet	5.8000
		Nail 1 to 2,5 cm	Kg.	0.0500
	Labour	Unskilled labour	Day	0.1100
		Carpenter	Day	0.1100
		Skilled head	Day	0.0110
		Foreman	Day	0.0055
3	1 M² Install Acoustic Ceiling Size (30 x 30) cm			
	Material	Acoustic	sheet	12.0000
		Nail 1 to 2,5 cm	Kg.	0.0500
	Labour	Unskilled labour	Oh	0.1318
		Carpenter	Oh	0.1318
		Skilled head	Oh	0.0132
		Foreman	Oh	0.0065
4	1 M² Install Acoustic Ceiling Size (60 x 120) cm + Aluminum Frame			
	Material	Alumunium Profile "T"	M	3.6000

5			Wire Ø 4 mm	Kg.	0.1500
			Ramset	Piece	1.0500
			Acoustic 60 x120	sheet	1.5000
		Labour	Unskilled labour	Day	0.5000
			Carpenter	Day	0.5000
			Skilled head	Day	0.0500
			Foreman	Day	0.0250
		Install 1 m' of Gypsum Profile ceiling list			
	Material	List Plafond Gypsum Profil	M	1.0500	
		Tepung Gypsum	Kg.	0.1325	
6	Labour	Unskilled labour	Day	0.0600	
		Carpenter	Day	0.0600	
		Skilled head	Day	0.0060	
		Foreman	Day	0.0030	
		Install 1 M² asbestos Cement ceiling 4 / 5 / 6mm			
	MATERIAL	Plate asbestos	M²	1.1000	
		Nail ½ " - 1 "	Kg	0.0100	
	LABOR	Unskilled labor	Day	0.0300	
		Carpenter	Day	0.0700	
		Skilled head	Day	0.0070	
		Foreman	Day	0.0400	
7	Install 1 M² plywood ceiling				
	MATERIAL	Plywood	Sheet	0.3750	
		Nail ½ " - 1 "	Kg	0.0300	
	LABOR	Unskilled labor	Day	0.1000	
		Carpenter	Day	0.1000	
		Skilled head	Day	0.0100	
		Foreman	Day	0.0050	
	8	Install 1 M² wood ceiling 9cm			
MATERIAL		Wooden board	M³	0.0155	
		Nail ½ " - 1 "	Kg	0.0105	
LABOR		Unskilled labor	Day	0.8200	
		Carpenter	Day	0.8200	
		Skilled head	Day	0.0820	
		Foreman	Day	0.0410	
9		Install 1 M wooden trim profile for ceiling			
	MATERIAL	Wood trim profile	M'	1.0500	
		Nail trim	Kg	0.0329	
	LABOR	Unskilled labor	Day	0.0500	
		Carpenter	Day	0.1235	
		Skilled head	Day	0.0050	
		Foreman	Day	0.0030	
	10	Install 1 M² gypsum board ceiling size (1200x2400x9) mm			
MATERIAL		Gypsum board	Sheet	0.3646	
		Screw	Kg	0.1100	
LABOR		Unskilled labor	Day	0.2280	
		Carpenter	Day	0.4158	
		Skilled head	Day	0.0416	
		Foreman	Day	0.0140	

XII. STEEL AND ALUMINIUM WORKS

	REQUIREMENT		UNIT	COEFFICIENT
1	Fabrication of steel door panel, 2mm steel plate and angle bar			
	Material	Iron elbow L 30 x 30 x 3	Kg	15.0000
		Steel plate	Kg	32.8000
		Welding rod	Kg	0.0300
	Labour	Unskilled labour	Day	1.0775

2		Welder	Day	1.0775	
		Skilled head	Day	0.1600	
		Foreman	Day	0.0600	
	Welding Work Using Electrodes	Material	Welding rod	Kg.	0.4000
			Diesel fuel	Ltr	0.3000
			Lubricant	Ltr	0.0400
			Labour	Unskilled labour	Day
		Welder		Day	0.0200
		Skilled head		Day	0.0020
		Foreman		Day	0.0020
Equipme nt		Equipment rental	Hour	0.1700	
3		Install 1 m² Scquare tube window frame (25 x 5) cm			
	Material	Scuare tube iron	M	4.7600	
		Wainscoting Iron Glass 1x1 cm	M	4.5200	
		Welding Machine	Cm	20.000	
	Labour	Unskilled labour	Day	0.6825	
		Welder	Day	0.6825	
		Skilled head	Day	0.0683	
		Foreman	Day	0.0339	
	4	Install 1 M² Rolling Door Iron			
		Material	Rolling door Iron	M2	1.0000
Labour		Unskilled labour	Day	1.2600	
		Blacksmith	Day	1.2600	
		Skilled head	Day	0.1260	
		Foreman	Day	0.0063	
5	1 M² Install Folding Door				
	Material	PVC Plastic Door	M2	1.0000	
	Labour	Unskilled labour	Day	0.4620	
		Skilled	Day	0.4620	
		Skilled head	Day	0.0462	
		Foreman	Day	0.0231	
6	1 M² Install Sunscreen Aluminium				
	Material	Sunscreen Aluminium	M2	1.0000	
	Labour	Unskilled labour	Day	0.0840	
		Skilled	Day	0.8400	
		Skilled head	Day	0.0840	
		Foreman	Day	0.0420	
7	1 M² Install Aluminium Rolling Door				
	Material	Aluminium Rolling Door	M2	1.0000	
	Labour	Unskilled labour	Day	1.0000	
		Skilled	Day	1.0000	
		Skilled head	Day	0.1000	
		Foreman	Day	0.0500	
8	1 M² Install Aluminium Strip, width 8 Cm				
	Material	Aluminium profiles	M	4.4000	
		Aluminium Strip	M	14.6000	
	Labour	Unskilled labour	Day	0.0850	
		Skilled	Day	0.0850	
		Skilled head	Day	0.0085	
		Foreman	Day	0.0042	
9	1 M Install Alumunium Door Frames				
	Material	Aluminium profiles	M	1.1000	
		Screw Fixer	Piece	2.0000	
		Sealant	Tube	0.0600	
	Labour	Unskilled labour	Day	0.0430	
		Skilled	Day	0.0430	

10		Skilled head	Day	0.0043
		Foreman	Day	0.0022
	1 M² Install Glass Doors, Aluminium Frame			
	Material	Aluminium Door	M	4.4000
		Glass profile	M	4.5000
		Sealant	Tube	0.2700
	Labour	Unskilled labour	Day	0.0850
		Skilled	Day	0.0850
		Skilled head	Day	0.0090
		Foreman	Day	0.0050
11	1 M² Install Venetions Blind and Vertical Blinds			
	Material	Venetions Blind dan Vertical Blinds	M ²	1.0000
	Labour	Unskilled labour	Day	0.3500
		Skilled	Day	0.3500
		Skilled head	Day	0.0350
		Foreman	Day	0.0180
12	1 M2 Install Iron Bars Strip Size 2x3 mm			
	Material	Iron strip	Kg.	6.1770
		Welding	Cm	27.0800
	Labour	Unskilled labour	Day	1.6700
		Welder	Day	1.6700
		Skilled head	Day	0.1670
		Foreman	Day	0.0830
13	1 M² Install Mosquito Net			
	Material	Mosquito Net	M2	1.1000
		Welding	Cm	11.1100
		Steel strip size (0.2 x 2) Cm	Kg.	1.7160
	Labour	Unskilled labour	Day	0.1000
		Skilled	Day	0.1000
		Skilled head	Day	0.0100
		Foreman	Day	0.0050
14	Install 1 kg of iron profile			
	MATERIAL	Steel profile	Kg	1.1000
		Zincromate	kg	0.0710
	LABOR	Unskilled labor	Day	0.0600
		Blacksmith	Day	0.0242
		Skilled head	Day	0.0060
		Foreman	Day	0.0023
15	Install 1 m² louvre window include Steel guard			
	MATERIAL	Frame + 5 mm glass	M2	1.1000
		Screw 1 cm - 2.5 cm	Piece	10.0000
		Iron strip	M'	7.0000
	LABOR	Unskilled labor	Day	0.2000
		Blacksmith	Day	0.2000
		Skilled head	Day	0.0200
		Foreman	Day	0.0010
16	Install 1 m roof gutter zinc BJLS 28 width 90 cm			
	MATERIAL	Zinc plate	M'	1.0500
		Nail 1 cm - 2.5 cm	Piece	0.0150
		Wooden planks Class II or III	M3	0.0190
	LABOR	Unskilled labor	Day	0.2310
		Blacksmith	Day	0.4000
		Skilled head	Day	0.0400
		Foreman	Day	0.0100
17	Install 1 m gutter ½ circle D - 15 cm , BJLS 30 zinc plate			
	MATERIAL	Zinc plate	M'	1.0500
		Nail 1 cm - 2.5 cm	kg	0.010
		Wooden planks Class II or III	M3	0.0125

	LABOR	Unskilled labor	Day	0.1500
		Blacksmith	Day	0.3000
		Skilled head	Day	0.0300
		Foreman	Day	0.0080

XIII. KEY AND GLASS WORKS

	REQUIREMENT		UNIT	COEFFICIENT
1	1 Unit ordinary lock			
	MATERIAL	Ordinary Lock	Piece	1.0000
	LABOR	Unskilled labor	Day	0.0100
		Blacksmith	Day	0.5000
		Skilled head	Day	0.0100
		Foreman	Day	0.0050
2	1 Unit door hinge			
	MATERIAL	Door hinges	Piece	1.0000
	LABOR	Unskilled labor	Day	0.0150
		Blacksmith	Day	0.1500
		Skilled head	Day	0.0150
		Foreman	Day	0.0010
3	1 Unit butterfly hinge for window			
	MATERIAL	Hinge window	Piece	1.0000
	LABOR	Unskilled labor	Day	0.0100
		Blacksmith	Day	0.1000
		Skilled head	Day	0.0100
		Foreman	Day	0.0010
4	1 Unit wind hook			
	MATERIAL	Hooks wind	Piece	1.0000
	LABOR	Unskilled labor	Day	0.0150
		Blacksmith	Day	0.1500
		Skilled head	Day	0.0150
		Foreman	Day	0.0010
5	1 Unit latch lock			
	MATERIAL	Latch lock	Piece	1.0000
	LABOR	Unskilled labor	Day	0.0098
		Blacksmith	Day	0.0683
		Skilled head	Day	0.0068
		Foreman	Day	0.0010
6	1 M² Install glass , thickness 3-5 mm			
	MATERIAL	Glass	M ²	1.1000
		Sealant	Kg	0.0500
	LABOR	Unskilled labor	Day	0.0150
		Blacksmith	Day	0.1500
		Skilled head	Day	0.0150
		Foreman	Day	0.0010

XIV SANITATION WORK

	REQUIREMENT		UNIT	COEFFICIENT
1	Install 1 piece mono block closet			
	MATERIAL	Sitting closet (complete)	Piece	1.0000
	LABOR	Unskilled labor	Day	1.4501
		Stonemason	Day	1.2366
		Skilled head	Day	0.1236
		Foreman	Day	0.0618
2	Install 1 piece porcelain squat closet			
	MATERIAL	Porcelain squat closet	Piece	1.0000

	LABOR	Portland Cement	Kg	6.1000
		Sand	M ³	0.0103
		Unskilled labor	Day	1.0000
		Stonemason	Day	1.5250
		Skilled head	Day	1.5000
		Foreman	Day	0.1627
3	Install 1 piece urinal			
	MATERIAL	Urinal (complete)	Piece	1.0000
	LABOR	Unskilled labor	Day	1.0000
		Stonemason	Day	1.0000
		Skilled head	Day	0.1000
		Foreman	Day	0.0500
4	Install 1 piece sink			
	MATERIAL	Sink (complete)	Piece	1.0000
	LABOR	Unskilled labor	Day	1.2000
		Stonemason	Day	1.2366
		Skilled head	Day	0.1236
		Foreman	Day	0.0618
5	Install 1 piece fiberglass tub, the volume of 220 L			
	MATERIAL	Fiberglass tub 220 liter	Piece	1.0364
	LABOR	Unskilled labor	Day	1.9474
		Stonemason	Day	2.7000
		Skilled head	Day	0.5400
		Foreman	Day	0.1189
6	Install 1 piece masonry control pit 30 x 30 / T35 cm			
	MATERIAL	Brick / concrete block	Piece	53.0000
		Portland Cement	Kg	44.0000
		Sand	M ³	0.0700
		Gravel concrete	M ³	0.0700
		Steel Reinforced	Kg.	1.4150
		Concrete sand	M ³	0.0600
	LABOR	Unskilled labor	Day	3.2000
		Stonemason	Day	1.0150
		Skilled head	Day	0.1015
		Foreman	Day	0.0160
7	Install 1 M galvanized pipe Ø ½ " - 1 "			
	MATERIAL	Galvanized pipe	M'	1.2000
		Accessories (% of the pipe price)	%	35.0000
	LABOR	Unskilled labor	Day	0.0540
		Stonemason	Day	0.0900
		Skilled head	Day	0.0090
		Foreman	Day	0.0045
8	Install 1 M galvanized pipe Ø 1½ " - 3 "			
	MATERIAL	Galvanized pipe	M'	1.2000
		Accessories (% of the pipe price)	%	35.0000
	LABOR	Unskilled labor	Day	0.1080
		Stonemason	Day	0.1800
		Skilled head	Day	0.0180
		Foreman	Day	0.0054
9	Install 1 M PVC pipe Ø ½ " - 1 ½ ", type AW			
	MATERIAL	PVC pipe	M'	1.2000
		Accessories	%	35.0000
	LABOR	Unskilled labor	Day	0.0360
		Stonemason	Day	0.0706
		Skilled head	Day	0.0075
		Foreman	Day	0.0043
10	Install 1 M PVC pipe Ø 2", type AW			
	MATERIAL	PVC pipe	M'	1.2000
		Accessories	%	35.0000

	LABOR	Unskilled labor	Day	0.0450
		Stonemason	Day	0.0750
		Skilled head	Day	0.0090
		Foreman	Day	0.0025
11	Install 1 M PVC pipe Ø 3" - 4", type AW			
	MATERIAL	PVC pipe	M'	1.2000
	LABOR	Unskilled labor	Day	0.0810
		Stonemason	Day	0.1879
		Skilled head	Day	0.0189
		Foreman	Day	0.0070
12	Install 1 piece faucet Ø ¾ " or ½ "			
	MATERIAL	Faucet	Piece	1.0000
		Seal tape	Piece	0.0245
	LABOR	Unskilled labor	Day	0.0100
		Stonemason	Day	0.1000
		Skilled head	Day	0.0100
		Foreman	Day	0.0050

XV. PAINTING WORKS

	REQUIREMENT		UNIT	COEFFICIENT
1	1 M² painting new wooden board (1 layer of foundation, 1 layer of primer , two coats cover)			
	MATERIAL	Zincromate	Kg	0.1850
		Putty	Kg	0.1380
		Priming	Kg	0.1700
		Cover paint 2 x	Kg	0.2730
		Paint brush	piece	0.0294
	LABOR	Unskilled labor	Day	0.0847
		Painter	Day	0.8900
		Skilled head	Day	0.0139
		Foreman	Day	0.0051
2	1 M² painting wood with varnish			
	MATERIAL	Varnish	Kg	0.2930
		Putty	Kg	0.0934
		Sandpaper	Sheet	0.8924
		Paint brush	Piece	0.0294
	LABOR	Unskilled labor	Day	0.0539
		Painter	Day	0.0806
		Skilled head	Day	0.0129
		Foreman	Day	0.0046
3	1 M² new wall painting (1 layer, 1 layer of primer, two coats cover)			
	MATERIAL	Foundation (Plamir)	Kg	0.1154
		Priming	Kg	0.0920
		Cover Paint (2 times)	Kg	0.2600
		Brush	Piece	0.0294
	LABOR	Unskilled labor	Day	0.1667
		Painter	Day	0.0833
		Skilled head	Day	0.0167
		Foreman	Day	0.0083
4	1 M² old wall painting (1 layer of primer, two coats cover)			
	MATERIAL	Priming	Kg	0.1200
		Cover Paint (2 times)	Kg	0.1839
		Brush	piece	0.0294
	LABOR	Unskilled labor	Day	0.0361
		Painter	Day	0.0420
		Skilled head	Day	0.0051
		Foreman	Day	0.0037

5	1 M² painting steel surface with Zincromate (priming)			
	MATERIAL	Zincromate	Kg	0.1230
		Paint oil	ltr	0.0136
		Brush	Bh.	0.0227
	LABOR	Unskilled labor	Day	0.0636
		Painter	Day	0.2000
		Skilled head	Day	0.0204
		Foreman	Day	0.0114
6	1 M² painting steel surfaces, one layer with Zincromate and scaffolding			
	MATERIAL	Zincromate	Kg	0.1000
		Paint brush	Piece	0.0100
		Wooden scaffolding	M ³	0.0020
	LABOR	Unskilled labor	Day	0.2500
		Painter	Day	0.2250
		Skilled head	Day	0.0230
		Foreman	Day	0.0080

XVI. ELECTRICAL INSTALATION WORK

I	PREPARATION WORK			
	REQUIREMENT		UNIT	COEFFICIENT
1.	Install Flourescent Lamp 2x36W RMI type, c/w housing and all accessories			
	material	Flourescent Lamp 2x36W, c/w housing and all accessories	ea	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.200
		Electrician	md	0.020
		Foreman	md	0.004
2.	Lighting installation ; NYM cable 3x2.5mm2 + 20mm PVC conduit high impact			
	material	NYM Cable 3 x 2.5mm2	m	11.500
		20mm uPVC conduit	m	11.500
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.170
		Electrician	md	0.170
		Foreman	md	0.020
3	Install PLC Downlight 18W. c/w housing and reflector			
	material	PLC Downlight 18W. c/w housing and reflector	ea	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.200
		Electrician	md	0.020
		Foreman	md	0.004
4	Install PLC Downlight 13W. c/w housing and reflector			
	Material	PLC Downlight 13W. c/w housing and reflector	ea	1.000

		Accessories	%	5.000
	Labor	Skilled Labour	md	0.200
		Electrician	md	0.020
		Foreman	md	0.004
5	Install Barret Lamp 18W, c/w housing			
	Material	Barret Lamp 18W, c/w housing	ea	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.200
		Electrician	md	0.020
		Foreman	md	0.004
6	Install Exit Lamp			
	Material	Barret Lamp 18W, c/w housing	ea	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	pd	0.200
		Electrician	pd	0.020
		Foreman	pd	0.004
	REQUIREMENT		UNIT	COEFFICIENT
7	Single Switch			
	Material	Single Switch	ea	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.170
		Electrician	md	0.017
		Foreman	md	0.008
8	Double Switch			
	Material	Double Switch	ea	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.170
		Electrician	md	0.017
		Foreman	md	0.008
9	Grid switch 4 gang			
	Material	Grid switch 4 gang	ea	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.170
		Electrician	md	0.017
		Foreman	md	0.008
10	Receptacle 1P 10A			
	Material	Receptacle 1P 10A	ea	1.000

	I	Accessories	%	5.000
	Labor	Skilled Labour	md	0.170
		Electrician	md	0.017
		Foreman	md	0.008
11	Receptacle 1P 10A - Floor type			
	Materia I	Receptacle 1P 10A - Floor type	ea	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.170
		Electrician	md	0.017
		Foreman	md	0.008
	REQUIREMENT		UNIT	COEFFICIENT
12	Receptacle installation ; NYM cable 3x2.5mm2 + 20mm uPVC conduit			
	Materia I	NYM Cable 3 x 2.5mm2	m	13.000
		20mm uPVC conduit	m	13.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.175
		Electrician	md	0.175
		Foreman	md	0.020
13	Outdoor installation ; NYFGBY cable 3x2.5mm2			
	Materia I	NYFGBY Cable 3x2.5mm2	m	1.000
		1/2" Galvanized pipe sch.40	m	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.175
		Electrician	pd	0.175
		Foreman	md	0.020
14	NYY Cable 4x70mm2 + NYA cable 25mm ²			
	Materia I	NYY Cable 4x70mm2	m	1.000
		NYA Cable 25mm2	m	1.000
		Accessories	%	5.000
15	Labor	Skilled Labour	md	0.166
		Electrician	md	0.166
		Chief Electrician	md	0.033
		Foreman	md	0.017
	NYY Cable 4x25mm2 + NYA cable 10mm ²			
	Materia I	NYY Cable 4x25mm2	m	1.000
		NYA cable 10mm2	m	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166

		Electrician	md	0.166
		Chief Electrician	md	0.033
		Foreman	md	0.017
16	NYY Cable 4x10 mm² + NYA cable 6mm²			
	Material	NYY Cable 4x10 mm ²	m	1.000
		NYA cable 6mm ²	m	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.166
		Electrician	md	0.166
		Chief Electrician	md	0.033
		Foreman	md	0.017
	REQUIREMENT		UNIT	COEFFICIENT
17	NYY Cable 1x4x300mm²			
	Material	NYY Cable 1x4x300mm ²	m	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.166
		Electrician	md	0.166
		Chief Electrician	md	0.033
		Foreman	md	0.017
18	NYFGBY cable 1x4x300mm²			
	Material	NYFGBY cable 1x4x300mm ²	m	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	md	0.166
		Electrician	md	0.166
		Chief Electrician	md	0.033
		Foreman	md	0.017
19	Tray cable (W=300 mm, H=100)			
	Material	Tray cable (W=300 mm, H=100)	m	1.000
		Fitting and all accessories	%	12.000
20	Labor	Skilled Labour	md	0.166
		Electrician	md	0.166
		Foreman	md	0.033
	Tray cable (W=200 mm, H=100)			
	Material	Tray cable; W=200 mm, H=50	m	1.000
		Fitting and all accessories	%	12.000
	Labor	Skilled Labour	md	0.166
		Electrician	md	0.166

		Foreman	md	0.033
21	Ladder Cable W=300 mm			
	Material	Ladder Cable W=300 mm	m	1.000
		Fitting and all accessories	%	12.000
	Labor	Skilled Labour	md	0.166
		Electrician	md	0.166
		Foreman	md	0.033
22	Ladder Cable W=200 mm			
	Material	Ladder Cable W=200 mm	m	1.000
		Fitting and all accessories	%	12.000
	Labor	Skilled Labour	md	0.166
		Electrician	md	0.166
		Foreman	md	0.033
23	PVC Pipe dia. 100mm - Class 150			
	Material	PVC Pipe dia. 100mm - Class 150	m	1.200
		Fitting and all accessories	%	35.000
	Labor	Skilled Labour	md	0.135
		Plumber	md	0.225
		Chief Plumber	md	0.023
		Foreman	md	0.007
24	PVC Pipe dia. 80mm - Class 150			
	Material	PVC Pipe dia. 80mm - Class 150	m	1.200
		Fitting and all accessories	%	35.000
	Labor	Skilled Labour	mdh	0.135
		Plumber	md	0.225
		Chief Plumber	md	0.023
		Foreman	md	0.007
	REQUIREMENT		UNIT	COEFFICIENT
25	PVC Pipe dia. 50mm - Class 150			
	Material	PVC Pipe dia. 50mm - Class 150	m	1.200
		Fitting and all accessories	%	35.000
	Labor	Skilled Labour	md	0.054
		Plumber	md	0.090
26		Chief Plumber	md	0.009
		Foreman	md	0.004
	PVC Pipe dia. 40mm - Class 150			
	Material	PVC Pipe dia. 40mm - Class 150	m	1.200
		Fitting and all accessories	%	35.000
	Labor	Skilled Labour	md	0.054
		Plumber	md	0.090

		Chief Plumber	md	0.009
		Foreman	md	0.004
27	PVC Pipe dia. 25mm - Class 150			
	Material	PVC Pipe dia. 25mm - Class 150	m	1.200
		Fitting and all accessories	%	35.000
	Labor	Skilled Labour	md	0.054
		Plumber	md	0.090
		Chief Plumber	md	0.009
		Foreman	md	0.004
28	PVC Pipe dia. 15mm - Class 150			
	Material	PVC Pipe dia. 15mm - Class 150	m	1.200
		Fitting and all accessories	%	35.000
	Labor	Skilled Labour	md	0.054
		Plumber	md	0.090
		Chief Plumber	md	0.009
		Foreman	md	0.004
29	PVC Pipe dia. 80mm - Class D			
	Material	PVC Pipe dia. 80mm - Class D	m	1.200
		Fitting and all accessories	%	35.000
	Labor	Skilled Labour	md	0.054
		Plumber	md	0.090
		Chief Plumber	md	0.009
		Foreman	md	0.004
	REQUIREMENT		UNIT	COEFFICIENT
30	PVC Pipe dia. 50mm - Class D			
	Material	PVC Pipe dia. 50mm - Class D	m	1.200
		Fitting and all accessories	%	35.000
	Labor	Skilled Labour	md	0.054
		Plumber	md	0.090
		Chief Plumber	md	0.009
		Foreman	md	0.004
31	Ball Valve Dia. 50, PVC class 150			
	Material	Ball Valve Dia. 50, PVC class 150	m	1.200
		Seal Tape		0.025
	Labor	Skilled Labour	Oh	0.010
		Plumber	Oh	0.100
		Chief Plumber	Oh	0.010

		Foreman	Oh	0.005
32	Detector / Push Button installation			
	Material	NYA Cable 1x1.5mm2	m	10.000
		20mm uPVC conduit	m	10.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017
33	Alarm Bell Installation			
	Material	NYA Cable 1x1.5mm2	m	13.000
		20mm uPVC conduit	m	13.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017
34	Box Terminal Installation			
	Material	NYA Cable 1x1.5mm2	m	12.000
		20mm uPVC conduit	m	12.000
		Perlengkapan instalasi	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017
35	ROR Heat Detector			
	Material	ROR Heat Detector	bh	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017
	REQUIREMENT		UNIT	COEFFICIENT
36	Smoke Detector			
	Material	Smoke Detector	bh	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017

37	Manual Push Button			
	Material	Manual Push Button	bh	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017
	Alarm Bell			
	Material	Alarm Bell	bh	1.000
38		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017
	Terminal Box (TB-FA)			
	Material	Terminal Box (TB-FA)	bh	1.000
39		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.190
		Electrician	Oh	0.190
		Chief Electrician	Oh	0.036
		Foreman	Oh	0.019
	NYFGBY cable 6 x1.5mm2			
	Material	NYFGBY cable 6 x1.5mm2	bh	72.000
40		20mm uPVC conduit		12.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017
	NYA cable 6 x 1 x 1.5mm			
	Material	NYA cable 6 x 1 x 1.5mm	bh	72.000
41		20mm uPVC conduit		12.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.166
		Electrician	Oh	0.166
		Chief Electrician	Oh	0.033
		Foreman	Oh	0.017
	REQUIREMENT		UNIT	COEFFICIENT

	Master Control Fire Alarm (MCFA) ; 9 Zone			
42	Material	MCFA - 9 Zone	bh	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.650
		Electrician	Oh	0.500
		Chief Electrician	Oh	0.050
		Foreman	Oh	0.020
	Serial Annunciator Panel			
43	Material	Serial Annunciator Panel	bh	1.000
		Accessories	%	5.000
	Labor	Skilled Labour	Oh	0.550
		Electrician	Oh	0.250
		Chief Electrician	Oh	0.030
		Foreman	Oh	0.010
	SCH.40 BS Pipe - Ø 150 mm			
44	Material	SCH.40 BS Pipe - Ø 150 mm	m	1.000
		Fitting and accessories	%	5.000
	Labor	Skilled Labour	Oh	0.135
		Welder	Oh	0.225
		Chief Welder	Oh	0.023
		Foreman	Oh	0.007
	SCH.40 BS Pipe - Ø 100 mm			
45	Material	SCH.40 BS Pipe - Ø 100 mm	m	1.000
		Fitting and accessories	%	5.000
	Labor	Skilled Labour	Oh	0.135
		Welder	Oh	0.225
		Chief Welder	Oh	0.023
		Foreman	Oh	0.007
	SCH.40 BS Pipe - Ø 65 mm			
46	Material	SCH.40 BS Pipe - Ø 100 mm	m	1.000
		Fitting and accessories	%	5.000
	Labor	Skilled Labour	Oh	0.135
		Welder	Oh	0.225
		Chief Welder	Oh	0.023
		Foreman	Oh	0.007
	SCH.40 BS Pipe - Ø 65 mm			
47	Material	SCH.40 BS Pipe - Ø 65 mm	m	1.000
		Fitting and accessories	%	5.000

	Labor	Skilled Labour	Oh	0.135
		Welder	Oh	0.225
		Chief Welder	Oh	0.023
		Foreman	Oh	0.007
	REQUIREMENT		UNIT	COEFFICIENT
	SCH.40 BS Pipe - Ø 50 mm			
	Material	SCH.40 BS Pipe - Ø 50 mm	m	1.000
48		Fitting and accessories	%	5.000
	Labor	Skilled Labour	Oh	0.135
		Welder	Oh	0.225
		Chief Welder	Oh	0.023
		Foreman	Oh	0.007
	Gate valve Ø 150, Class 150			
	Material	Gate valve Ø 150, Class 150	ea	1.000
49		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.400
		Foreman	Oh	0.200
	Gate valve Ø 100, Class 150			
	Material	Gate valve Ø 100, Class 150	ea	1.000
50		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Gate valve Ø 80, Class 150			
	Material	Gate valve Ø 80, Class 150	ea	1.000
51		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.150
		Welder	Oh	0.150
		Chief Welder	Oh	0.015
		Foreman	Oh	0.010
	Gate valve Ø 65, Class 150			
	Material	Gate valve Ø 65, Class 150	ea	1.000
52		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.150
		Welder	Oh	0.150

		Chief Welder	Oh	0.015
		Foreman	Oh	0.010
	REQUIREMENT		UNIT	COEFFICIENT
	Gate valve Ø 50, Class 150			
	Material	Gate valve Ø 50, Class 150	ea	1.000
53		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.150
		Welder	Oh	0.150
		Chief Welder	Oh	0.015
		Foreman	Oh	0.010
	Check valve Ø 150, Class 150			
	Material	Check valve Ø 150, Class 150	ea	1.000
54		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.400
		Foreman	Oh	0.200
	Check valve Ø 100, Class 150			
55	Material	Check valve Ø 100, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.400
		Foreman	Oh	0.200
	Check valve Ø 80, Class 150			
56	Material	Check valve Ø 80, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Check valve Ø 65, Class 150			
57	Material	Check valve Ø 65, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.150
		Welder	Oh	0.150
		Chief Welder	Oh	0.015

		Foreman	Oh	0.010
	Check valve Ø 50, Class 150			
58	Material	Check valve Ø 50, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.150
		Welder	Oh	0.150
		Chief Welder	Oh	0.015
		Foreman	Oh	0.010
	REQUIREMENT		UNIT	COEFFICIENT
	Butterfly Valve Ø 150, Class 150			
59	Material	Butterfly Valve Ø 150, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Strainer Ø 150, Class 150			
60	Material	Strainer Ø 150, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Strainer Ø 100, Class 150			
61	Material	Strainer Ø 100, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Strainer Ø 80, Class 150			
62	Material	Strainer Ø 80, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Strainer Ø 50, Class 150			

	Material	Strainer Ø 50, Class 150	ea	1.000
63		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.150
		Welder	Oh	0.150
		Chief Welder	Oh	0.015
		Foreman	Oh	0.007
		Flexible Joint Ø 150 mm, Class 150		
	Material	Flexible Joint Ø 150 mm, Class 150	ea	1.000
64		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
		Flexible Joint Ø 100 mm, Class 150		
	Material	Flexible Joint Ø 100 mm, Class 150	ea	1.000
65		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	REQUIREMENT		UNIT	COEFFICIENT
	Flexible Joint Ø 80 mm, Class 150			
	Material	Flexible Joint Ø 80 mm, Class 150	ea	1.000
66		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Foot Valve Ø 150 mm, Class 150			
	Material	Foot Valve Ø 150 mm, Class 150	ea	1.000
67		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Foot Valve Ø 100 mm, Class 150			
	Material	Foot Valve Ø 100 mm, Class 150	ea	1.000
68		Fitting and accessories	%	10.000

	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Foot Valve Ø 80 mm, Class 150			
69	Material	Foot Valve Ø 80 mm, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.400
		Welder	Oh	0.400
		Chief Welder	Oh	0.040
		Foreman	Oh	0.020
	Foot Valve Ø 50 mm, Class 150			
70	Material	Foot Valve Ø 50 mm, Class 150	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.120
		Welder	Oh	0.120
		Chief Welder	Oh	0.012
		Foreman	Oh	0.006
	Indoor Hydrant Box (IHB) Type A2, c/w Hose 40 mm diameter, Nozle and all accessories			
71	Material	Indoor Hydrant Box (IHB) Type A2, c/w Hose 40 mm diameter, Nozle and all accessories	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.500
		Welder	Oh	0.500
		Chief Welder	Oh	0.050
		Foreman	Oh	0.025
	REQUIREMENT		UNIT	COEFFICIENT
	Outdoor Hydrant Box (OHB) Type AC, c/w Hose 65 mm diameter, Nozle and all accessories			
72	Material	Outdoor Hydrant Box (OHB) Type AC, c/w Hose 65 mm diameter, Nozle and all accessories	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.500
		Welder	Oh	0.500
		Chief Welder	Oh	0.050
		Foreman	Oh	0.025
	Hydrant Pillar, two way system			
73	Material	Hydrant Pillar, two way system	ea	1.000
		Fitting and accessories	%	10.000

	Labor	Skilled Labour	Oh	0.500
		Welder	Oh	0.500
		Chief Welder	Oh	0.050
		Foreman	Oh	0.025
	Siamese Connection			
74	Material	Siamese Connection	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.500
		Welder	Oh	0.500
		Chief Welder	Oh	0.050
		Foreman	Oh	0.025
	Safety Relief Valve			
75	Material	Safety Relief Valve	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.200
		Welder	Oh	0.200
		Chief Welder	Oh	0.020
		Foreman	Oh	0.010
	Pressure Gauge			
76	Material	Pressure Gauge	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.200
		Welder	Oh	0.200
		Chief Welder	Oh	0.020
		Foreman	Oh	0.010
	100 mm Roof Drain			
77	Material	100 mm Roof Drain	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.200
		Welder	Oh	0.200
		Chief Welder	Oh	0.020
		Foreman	Oh	0.010
	80 mm Roof Drain			
78	Material	80 mm Roof Drain	ea	1.000
		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.200
		Welder	Oh	0.200
		Chief Welder	Oh	0.020

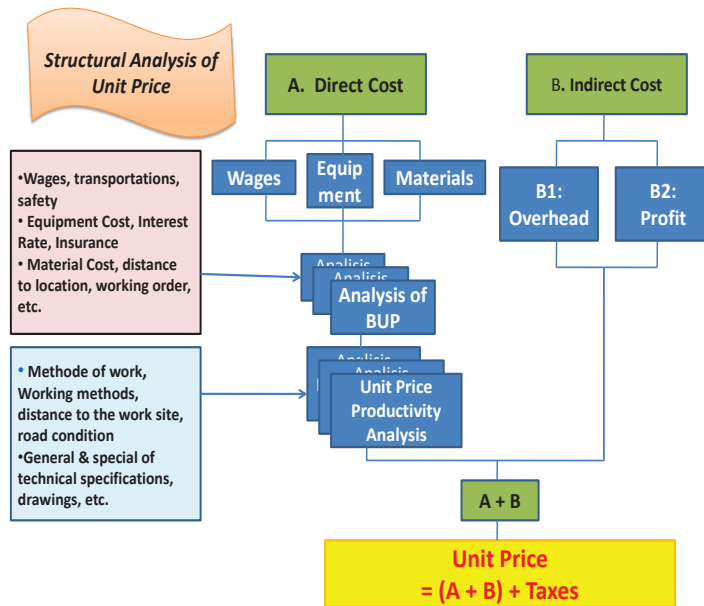
		Foreman	Oh	0.010
	150 mm Roof Drain			
	Material	150 mm Roof Drain	ea	1.000
79		Fitting and accessories	%	10.000
	Labor	Skilled Labour	Oh	0.200
		Welder	Oh	0.200
		Chief Welder	Oh	0.020
		Foreman	Oh	0.010

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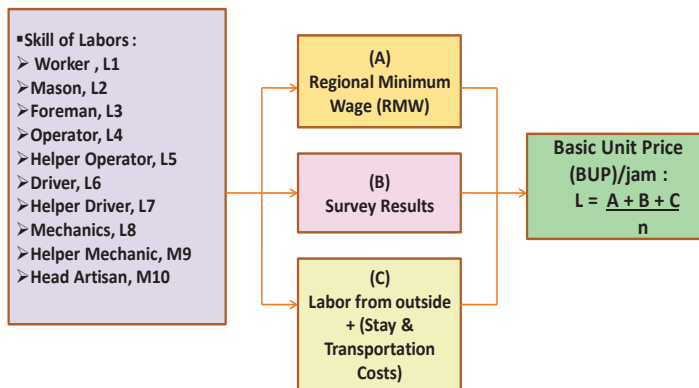


**STANDARD METHOD FOR
CALCULATION UNIT PRICE ANALYSIS
OF
HEAVY EQUIPMENT**

STRUCTURE OF UNIT PRICE ANALYSIS USING HEAVY EQUIPMENT



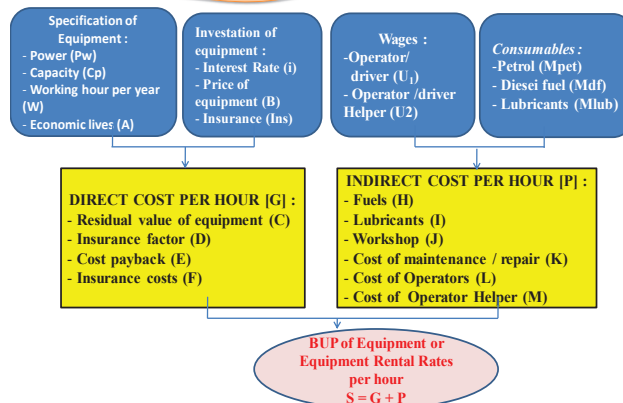
The Structure of the Basic Unit Price (BUP) Analysis of Wages



Note :

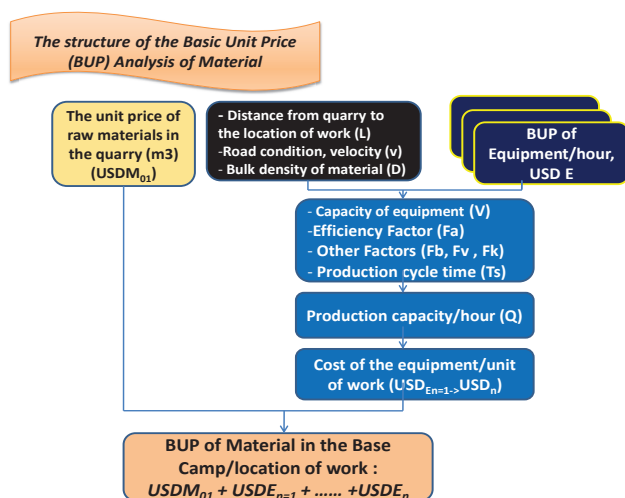
Basic Unit Price (BUP) of Labors is the cost of labor component (in time unit) to produce a specific job

The structure of the Basic Unit Price (BUP) Analysis of Equipment



Note :

Basic Unit Price (BUP) of Equipment is the cost of component (in time unit) to produce a specific job.



Note :

Basic Unit Price (BUP) of Materials is the cost of component (in time unit) to produce a specific job.

STANDARD NOTATION FOR HEAVY EQUIPMENT

GENERAL

NO.	DESCRIPTION	UNIT	NOTATION
A	EQUIPMENT		
1	Labor	hp	Pw
2	capacity	m3	Cp
3	Economic Value	year	A
4	working hours in 1 year	hour	W
5	Tool Price	USD	B
6	interest rate	%	i
7	insurance	%	Ins
B	DIRECT COST/FIX COST PER HOUR		
1	Residual value = 10% x B	USD	C
2	Capital Installment Factor	-	D
3	Return On Investment	USD	E
4	Insurance	USD	F
5	Fix cost per hour	USD	G
C	INDIRECT COST/OPERATIONAL COST PER HOUR		
1	Fuel	USD	H
2	Lubricant	USD	I
3	repair cost	USD	J
4	Maintenance and repair	USD	K
5	Operator	USD	L
6	Assistant operator	USD	M
7	Operational work per hour	USD	P
D	TECHNICAL SPECIFICATION		
1	Paint Density	kg/liter	D paint
2	Paint weight per m2	kg	Wpaint
3	Volume weight / density	m3/ton	Vd
4	Equipment efficiency factor	-	Ef

NO.	DESCRIPTION	UNIT	NOTATION
5	Bucket factor	-	Bf
6	Excavation depth conversion factor	-	Cf
7	Materials swell factor	-	Lf
8	Blade factor	-	Kf
9	Grade factor	-	Sf
10	Material loss factor	-	Wf
11	Material density factor	-	Sf
12	Effective working hours per day	hour	Ew
13	Average transportation distance	km	L
14	Number of loading	times	n1
15	Number of water filling	Kali	n2
16	Buckte capacity	m3	Vb
17	Tank capacity	m3	Vt
18	Blade Capacity	m3	Cb
19	Tools Production capacity	m12, m13,	V
20	Tools Production capacity/hour	k12, T13,	Q
21	Equipment coefficient	ka, T10	1/Q
22	Speed (peeling)	km/hr	Sp
23	Deceleratoion	km/hr	Sr
24	Equipment average speed	km/hr	Sa
25	Average speed of loading	km/hr	s1
26	Average speed when empty loaded	km/hr	s2
27	Water needed per m3 of solid material	m3	Wr
28	Effective blade width	m	Bw
29	Effective width of solid material	m	cw
30	Overlay width	m	Lo
31	Overlay length	m	Ly
32	Thickness of the solid material	m	t
33	Blader height	m	Bh
34	Water tank volume	m3	Vw
35	Cycle time	Minute	Ct
36	- Digging, loading	Minute	T1
37	- Lead time when filled	Minute	T2
38	- Lead Time when empty	Minute	T3
39	- Others (delayed time,etc)	Minute	T4
40	Backfill	%/m3	Fb
41	Volume of the tree	m3	Vtr
42	Density of the paint	kg	Vdp
43	Paint weight per m2	kg	Wp
44	Maximum Nominal agregate size	mm	An
45	Asphalt content in total mixture weight	%	As
46	Solid nominal thickness	m	t

EQUIPMENT

NO.	DESCRIPTION	NOTATION
1	Asphalt Mixing Plant	E1
2	Asphalt Finisher 4 m width	E2
3	Asphalt Sprayer	E3
4	Asphalt Liquid Mixer	E4
5	Asphalt Distributor	E5
6	Asphalt Distributor 3,000 gal.	E6
7	Asphalt Distributor 1,330	E7
8	Asphalt Tanker	E8
9	Aggregate (chip) Spreader	E9
10	Bulldozer 100 – 150 hp	E10
11	Bulldozer 285 hp	E11
12	Bulldozer 215 hp	E12
13	Bulldozer 140 hp	E13
14	Bore Pile Machine	E14
15	Concrete Mixer 0.3 – 0.6 m3	E15
16	Concrete Mixer (350)	E16
17	Concrete Mixer 2 bagger	E17

NO.	DESCRIPTION	NOTATION
18	Concrete Mixer 1 bagger	E18
19	Transit Mixer 6.5-7.5 cu.m.	E19
20	Transit Mixer 5-6 cu.m.	E20
21	Transit Mixer 3.5-4.5 cu.m.	E21
22	Truck Mixer (Agitator)	E22
23	Fulvi Mixer	E23
24	Concrete Vibrator	E24
25	Concrete Pump	E25
26	Concrete Pan Mixer	E26
27	Concrete Breaker	E27
28	Concrete Batching Plant	E28
29	Cement Tanker	E29
30	Compressor 4000-6500 l/m	E30
31	Cold Milling	E31
32	Cold Recycler	E32
33	Concrete Paver/Finisher 120 hp	E33
34	Crane 10 – 15 Ton	E34
35	Crawel crane 21-25 T	E35
36	Crawel crane 51-60 T	E36
37	Crane On Track 35 Ton	E37
38	Truck Mounted Crane 11-15 Ton	E38
39	Chain Saw	E39
40	Cargo Truck 2.5 Ton	E40
41	Cargo Truck 9-10 Ton	E41
42	Dump Truck 5.5 Ton	E42
43	Dump Truck 5.2 Ton	E43
44	Dump Truck 10 Ton	E44
45	Dump Truck 6-8 Ton	E45
46	Dump Truck 12-15 Ton	E46
47	Dump Truck 20-25 Ton	E42
48	Flat Bed Truck 3-4 m3	E48
49	Low Bed Trailer 20-25 Ton	E49
50	Trailer 20 Ton	E50
51	Container Truck	E51
52	Excavator 80 – 140 hp	E52
53	Hydraulic Excavator 1.00-2.30 cu.m.	E53
54	Hydraulic Excavator 0.90 cu.m.	E54
55	Hydraulic Excavator, with breaker	E55
56	Generator Set	E56
57	Hot Recycler	E57
58	Jack Hammer	E58
59	Pneumatic Breaker / Jack Hammer (hand held)	E59
60	Motor Grader >100 hp	E60
61	Motor Grader >125 hp	E61
62	Mobile Air Compressor 456-500 cfm	E62
63	Pile Driver + Hammer	E63
64	Paint Stripping Machine	E64
65	Rock Drill Breaker	E65
66	Stone Crusher Plant	E66
67	Slip Form Paver	E67
68	Three Wheel Roller	E68
69	Tandem Roller 6-8 Ton	E69
70	Tire Roller 8-10 Ton	E70
71	Pneumatic Tire Roller 10 Ton	E71
72	Vibratory Roller 5-8 Ton	E72
73	Vibratory Drum Roller 3-5 Ton	E73
74	Pedestrian Roller	E74
75	Tamper	E75
76	Tamping Rammer 7 hp	E76
77	Vibrating Rammer	E77
78	Vibratory Plate Compactor 7 hp	E78
79	Crawler Loader 1.80 m3	E79
80	Track Loader 75-100 hp	E80
81	Wheel Loader 1.0 – 1.6 m3	E81
82	Wheel Loader 1.8 m3	E82
83	Water Pump 70-100 mm	E83
84	Water Pump Submersible Ø4"	E84
85	Water Tanker 3000-4500 Liter	E85
86	Water Tank Truck with Pump 5000 liter	E86
87	Water Tank Truck with Pump 10000 ltr.	E87

MATERIAL

NO.	DESCRIPTION	UNIT	NOTATION
1	Sand (medium)	m3	M1
2	Concrete sand (Course)	m3	M2
3	Fine Sand (HRS)	m3	M3
4	Filled Sand (there is an element of clay)	m3	M4
5	Sand-gravel mixture	m3	M5
6	Fine aggregate	m3	M6
7	Course aggregate	m3	M7
8	Base Aggregate Class A	m3	M8
9	Base Aggregate Class B	m3	M9
10	Base Aggregate Class C	m3	M10
11	Base Aggregate Class C2	m3	M11
12	Filler	kg	M12
13	Gravel	m3	M13
14	River Stone	m3	M14
15	Cleaved Stone	m3	M15
16	Backfill materials	m3	M16
17	Selected Backfill material	m3	M17
18	Asphalt	kg	M18
19	Emulsion Asphalt	kg	M19
20	Kerosene	Liter	M20
21	Gasoline	Liter	M21
22	Diesel	Liter	M22
23	Lubricant	Liter	M23
24	Thinner	Liter	M24
25	Plastik Filler	m2	M25
26	Cement/ PC (40 kg)	Sack	M26
27	Cement/ PC (40 kg)	kg	M27
28	Concrete iron	kg	M28
29	Concrete wire	kg	M29
30	Gabion	kg	M30
31	Paint (Non Thermoplas)	kg	M31
32	Paint (Thermoplastic)	kg	M32
33	Scaffolding	m3	M33
34	Nail	kg	M34
35	Galvanize pipe ϕ 1.6"	piece	M35
36	Porous pipe	m	M36
37	Geotextile	m2	M37
38	Sodding	m2	M38
39	Paint Marker	kg	M39
40	Glass bead	kg	M40
41	Maximum Nominal agregate size	MM	Na
42	Asphalt content in total mixture weight	%	As
43	Solid nominal thickness	M	t

LABOR

NO.	DESCRIPTION	UNIT	NOTATION
1	Worker	Day	L1
2	Skilled Labor	Day	L2
3	Head of Skilled Labor	Day	L3
4	Supervisor	Day	L4
5	Operator	Day	L5
6	Assistant Operator	Day	L6
7	Driver	Day	L7
8	Driver Assistant	Day	L8
9	Operator's fee	USD	W1
10	Assistant operator's fee	USD	W2
11	Driver's fee	USD	W3
12	Assistant driver's fee	USD	W4
13	Number of workers needed	person	UL
14	Number of supervisors needed	person	FO

TABLES FOR HEAVY EQUIPMENT EFFICIENCY FACTOR

Table 1 : Heavy Equipment Efficiency Factor					
Operational Condition	Machine Maintenance				
	Very good	Good	Moderate	Bad	Very bad
very good	0.83	0.81	0.76	0.7	0.63
good	0.78	0.75	0.71	0.65	0.6
moderate	0.72	0.69	0.65	0.6	0.54
bad	0.63	0.61	0.57	0.52	0.45
very bad	0.53	0.5	0.47	0.42	0.32

Source : Rochmanhadi, Ir. 1992. *Kapasitas & Produksi alat-alat berat*.

Table 2 : BULDOZER Efficiency factor (F_{aBul})	
Work conditon	Work Efficiency
good	0.83
moderate	0.75
not so good	0.67
bad	0.58

Table 3 : Buldozer Blade Factor		
Work condition	Surface condition	Blade factor
Easy	not solid/hard, normal soil condition, less water content, backfill material	1.10 – 0.90
Moderate	not so solid/hard, sand contained, gravel, fine aggregate	0.90 – 0.70
Somewhat difficult	has somewhat high water content, clay content, sandy, dry/hard	0.70 – 0.60
Difficult	explosion rock, large cleave stone	0.60 – 0.40

Table 4 : DUMP TRUCK EFFICIENCY FACTOR	
Work conditon	Work Efficiency
Good	0.83
Moderate	0.8
Not so good	0.75
bad	0.7

Source : Lamp PAHS No. 008/BM/2010

Table 5 : Dump truck speed and field condition		
Field Condition	Load Condition	Speed, V (km/h)
Flat	Filled	40
	empty	60
Steep	Filled	20
	empty	40
Down slope	Filled	20
	empty	40

Source : Lamp PAHS No. 008/BM/2010

Table 6 : bucket fill factor / (F_b)		
Operation Condition	Field Condition	Bucket Factor (F_b)
Easy	Sandy normal soil, dry	1.0 – 1.1
Rather difficult	rocky normal soil	1.0 – 0.9
Difficult	Explosion rock	0.9 – 0.8

Source : *Specification and application hand book. Contoh-contoh perhitungan kapasitas produksi*
2005. Komatsu Edition 26

Table 7 : Excavation conversion Factor (F_v) for excavator				
excavation Condition (Excavation Depth / Maximum Excavation Depth)	Disposal Condition			
	Easy	Normal	Somewh at difficult	Difficult
< 40%	0.7	0.9	1.1	1.4
(40 -75)%	0.8	1	1.3	1.6
>75%	0.9	1.1	1.5	1.8

Source : Specification and application hand book. Contoh-contoh perhitungan kapasitas produksi 2005. Komatsu Edition 26

Table 8 : Tools performance efficiency factor (F_a) Excavator	
Operation Condition	Efficiency Factor
Good	0.83
Moderate	0.75
Somewhat less	0.67
less	0.58

Source : Specification and application hand book. Contoh-contoh perhitungan kapasitas produksi 2005. Komatsu Edition 26

Table 9 : Tools Performance efficiency factor (F_a) Motor Grader	
Operation Condition	Efficiency Factor
Road repairing, Levelling	0.8
Transferring	0.7
Spreading, Grading	0.6
Trenching	0.5

Source : Specification and application hand book. Contoh-contoh perhitungan kapasitas produksi 2005. Komatsu Edition 26

Table 10 : Faktor bucket (bucket fill factor) / (F_b)		
Disposal Factor	Wheel loader	Track loader
Easy	1.0 – 1.1	1.0 – 1.1
Moderate	0.85 – 0.95	0.95 – 1.1
Somewhat Difficult	0.80 – 0.85	1.0 – 0.9
Difficult	0.75 - 0.80	0.9 – 0.8

Source : Specification and application hand book. Contoh-contoh perhitungan kapasitas produksi 2005. Komatsu Edition 26

Table 11 : The speed, width compactness and number of tamping tool rotation			
Types	Average	Effective Compactness Width ($b - b_0$), m	Rotational Number (n)
Road roller	± 2	total tire width– 0.2	4 – 8
Tire roller	± 2.5	total tire width– 0.3	3 – 5
Vibrating roller besar	± 1.5	total tire width– 0.2	4 – 12
Vibrating roller kecil		total tire width– 0.1	
Soil compactor	4 – 10	Drive Tire width – 0.2	4 – 12
Tamper	± 1		
Macadam roller		total tire width– 0.2	
Tandem roller		(Shoe Width x 2) – 0.2 m	
Bulldozer			

Source : Specification and application hand book. Contoh-contoh perhitungan kapasitas produksi 2005. Komatsu Edition 26

Table 12: Tools Capacity on several types of materials				
Types of Compaction	Rock fill	Sand and Gravel	Silt	Clay
T (m) / Q (m ³ /jam)				
Vibrating plate compactor, kg				
50 – 100		0.15 / 15		
100 – 200		0.20 / 20		
400 – 500		0.35 / 35	0.25 / 25	
600 - 800	0.50 / 60	0.50 / 60	0.35 / 40	0.25 – 20
Vibrating tamper (rammer)				
75		0.35 - 10	0.25 - 8	0.20 – 6
Double drum roller				
600 - 800				
Vibrating plate compactor				
1200 - 1500		0.20 / 80	0.15 / 50	0.10 / 30

Source : Specification and application hand book. Contoh-contoh perhitungan kapasitas produksi 2005.

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Example of Job Activity Information Sheet

NO.	DESCRIPTION	INFORMATION
1	Contract Package No.	:
2	Package Name	:
3	Municipal	:
4	Work Location	See Attached
5	Existing Road Condition	
6	Effective Length (see Sketch Below)	15 kilometer (Leff = a + b)
7	Existing Road Width (Shoulder+ Pavement + Shoulder)	(0.50 + 4.50 + 0.50) meter
8	Planning Road Width (shoulder+ Pavement + Shoulder)	(1.00 + 6.00 + 1.00) meter
9	Road Cross Section, Types and Volume of the Main	See Attached
10	Work execution period	360 days calender
11	Average distance from base camp to work location, L	$L = \{(c+a/2) \times a + (c+b/2) \times b\} / (a+b)$ L = 8.75 Kilometer
Sketch for basic calculation		
12	Effective working hours in 1 day	: 7 Hour
13	Insurance, Tax, and other	: 0.002 x equipment principal cost
14	Interest rate for equipment investment	: 8.00%
15	SUMMARY of IMPLEMENTATION METHOD	:

Example Analysis Unit Price mobilization-demobilization

PAYMENT ITEM NO. :
 TYPES OF WORK : Mobilization - demobilization

Sheet-1

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	Land rent	m2			
B.	EQUIPMENT Check sheet-2				
C.	FIELD FACILITY				
1	base Camp	m2			
2	office	m2			
3	barrack	m2			
4	workshop	m2			
5	Warehouses, etc.	m2			
6					
D.	LABORATORY FACILITIES				
1	Laboratory space (according Images)	m2			
2	Laboratory Equipment	Set			
3	Furnishing & Services	Set			
4					
E.	MOBILIZE OTHERS				
1	EMERGENCY WORK				
a	Retrofitting the Old Bridge	LS			
b	Road Maintenance Work / Side	LS			
c					
2	OTHERS				
a	Complete Field Communication	Set			
b					
F.	DEMOBILIZATION	LS			

Total Mobilization Costs

Note: The number listed on each mobilization item already included over-head and profits as well as all taxes and duties (as applicable), and other expenses.

PAYMENT ITEM NO. :
 TYPES OF WORK : Mobilization - demobilization

Sheet-2

NO.	DESCRIPTION	CODE	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
B.	EQUIPMENTS					
1	Asphalt Mixing Plant	E1	Unit			
2	Asphalt Finisher 4 m width	E2	Unit			
3	Asphalt Sprayer	E3	Unit			
4	Asphalt Liquid Mixer	E4	Unit			
5	Asphalt Distributor	E5	Unit			
6	Asphalt Distributor 3,000 gal.	E6	Unit			
7	Asphalt Distributor 1,330	E7	Unit			

8	Asphalt Tanker	E8	Unit			
9	Aggregate (chip) Spreader	E9	Unit			
10	Buldozer 100 – 150 hp	E10	Unit			
11	Buldozer 285 hp	E11	Unit			
12	Buldozer 215 hp	E12	Unit			
13	Buldozer 140 hp	E13	Unit			
14	Bore Pile Machine	E14	Unit			
15	Concrete Mixer 0.3 – 0.6 m3	E15	Unit			
16	Concrete Mixer (350)	E16	Unit			
17	Concrete Mixer 2 bagger	E17	Unit			
18	Concrete Mixer 1 bagger	E18	Unit			
19	Transit Mixer 6.5-7.5 cu.m.	E19	Unit			
20	Transit Mixer 5-6 cu.m.	E20	Unit			
21	Transit Mixer 3.5-4.5 cu.m.	E21	Unit			
22	Truck Mixer (Agitator)	E22	Unit			
23	Fulvi Mixer	E23	Unit			
24	Concrete Vibrator	E24	Unit			
25	Concrete Pump	E25	Unit			
26	Concrete Pan Mixer	E26	Unit			
27	Concrete Breaker	E27	Unit			
28	Concrete Batching Plant	E28	Unit			
29	Cement Tanker	E29	Unit			
30	Compressor 4000-6500 l/m	E30	Unit			
31	Cold Milling	E31	Unit			
32	Cold Recycler	E32	Unit			
33	Concrete Paver/Finisher 120 hp	E33	Unit			
34	Crane 10 – 15 Ton	E34	Unit			
35	Crawel crane 21-25 T	E35	Unit			
36	Crawel crane 51-60 T	E36	Unit			
37	Crane On Track 35 Ton	E37	Unit			
38	Truck Mounted Crane 11-15 Ton	E38	Unit			
39	Chain Saw	E39	Unit			
40	Cargo Truck 2.5 Ton	E40	Unit			
41	Cargo Truck 9-10 Ton	E41	Unit			
42	Dump Truck 5.5 Ton	E42	Unit			
43	Dump Truck 5.2 Ton	E43	Unit			
44	Dump Truck 10 Ton	E44	Unit			
45	Dump Truck 6-8 Ton	E45	Unit			
46	Dump Truck 12-15 Ton	E46	Unit			
47	Dump Truck 20-25 Ton	E42	Unit			
48	Flat Bed Truck 3-4 m3	E48	Unit			
49	Low Bed Trailer 20-25 Ton	E49	Unit			
50	Trailer 20 Ton	E50	Unit			
51	Container Truck	E51	Unit			
52	Excavator 80 – 140 hp	E52	Unit			
53	Hydraulic Excavator 1.00-2.30 m3	E53	Unit			
54	Hydraulic Excavator 0.90 m3	E54	Unit			
55	Hydraulic Excavator, with breaker	E55	Unit			
56	Generator Set	E56	Unit			
57	Hot Recycler	E57	Unit			
58	Jack Hammer	E58	Unit			
59	Pneumatic Breaker / Jack Hammer (hand	E59	Unit			
60	Motor Grader >100 hp	E60	Unit			
61	Motor Grader >125 hp	E61	Unit			
62	Mobile Air Compressor 456-500 cfm	E62	Unit			
63	Pile Driver + Hammer	E63	Unit			
64	Paint Stripping Machine	E64	Unit			
65	Rock Drill Breaker	E65	Unit			
66	Stone Crusher Plant	E66	Unit			
67	Slip Form Paver	E67	Unit			
68	Three Wheel Roller	E68	Unit			

NO.	DESCRIPTION	CODE	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
69	Tandem Roller 6-8 Ton	E69	Unit			
70	Tire Roller 8-10 Ton	E70	Unit			
71	Pneumatic Tire Roller 10 Ton	E71	Unit			
72	Vibratory Roller 5-8 Ton	E72	Unit			
73	Vibratory Drum Roller 3-5 Ton	E73	Unit			
74	Pedestrian Roller	E74	Unit			
75	Tamper	E75	Unit			
76	Tamping Rammer 7 hp	E76	Unit			
77	Vibrating Rammer	E77	Unit			
78	Vibratory Plate Compactor 7 hp	E78	Unit			
79	Crawler Loader 1.80 m3	E79	Unit			
80	Track Loader 75-100 hp	E80	Unit			
81	Wheel Loader 1.0 – 1.6 m3	E81	Unit			
82	Wheel Loader 1.8 m3	E82	Unit			
83	Water Pump 70-100 mm	E83	Unit			
84	Water Pump Submersible Ø4"	E84	Unit			
85	Water Tanker 3000-4500 Liter	E85	Unit			
86	Water Tank Truck with Pump 5000 liter	E86	Unit			
87	Water Tank Truck with Pump 10000 ltr.	E87	Unit			
88	Scale Bridge, 35 Ton	E...	Set			
89	Pick Up Truck, 1 Ton	E...	Unit			
90	Survey Equipment	E...	Set			

Total for Item B on Sheet-1

Example Analysis Unit Price Traffic Protection and Maintenance					
PAYMENT ITEM NO. : TYPES OF WORK : Traffic Protection and Maintenance					
NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
I.	Data & Assumptions				
1	Number of job sites	Location	1		
2	Total Project Implementation Period	Day	360		
3	Maintenance period & Protection of traffic	Day	270		
4	Has included the preparation / installation				
5	Demolition including Demobilization				
II.	Workers Regulatory Traffic				
	Number of job sites	Location	1		
1	Officers signs "Stop-Way"	2 Person/day	540		
2	Controlling the speed of the vehicle	2 Person/day	540		
3	Team leader (Foreman)	1 Person/day	270		
III.	Materials & Supplies				
	Number of job sites	Location	1		
1	Signs "Stop-Way"	Unit	2		
2	Other signs (Distric boundary, Causion, etc.)	Unit	3		
3	Flag Yellow / Green / Red	Unit	6		
4	Wooden barricades 1/2 the width of the road	Unit	2		
5	Traffic Cone, the number per location = 5	Unit	5		
6	Material Cat Bouncing + Diluent + Brush	Set	1		
7	Safety tool for labors	Set	5		
8	Other tools	LS	1		

Total Cost of Maintenance and Protection Traffic					0
Note: The number listed on each mobilization item already included over-head and profits as well as all taxes and duties (as applicable), and other expenses.					
Example of Analysis Unit Price for Installation & Maintenance of Temporary Bridge					
PAYMENT ITEM NO. : TYPES OF WORK : Installation & Maintenance of Temporary Bridge					
NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
I.	Data & Assumptions				
1	Bailey type temporary bridge	m2	250.00		
2	Timber temporary bridge	m2	150.00		
3	Rent a bridge Bailey including transport, install and demolition				
4	Detour required length (m) = 300	m2	1,200.00		
5	Total Project Implementation Period	Day	360.00		
6	Effective bridge maintenance period	Day	180.00		
II.	Materials & Supplies				
1	Bailey bridge costs	m2	250.00		
2	Cost of wooden bridges	m2	150.00		
3	Aggregate Class thickness (cm) = 10	m3	120.00		
4	Aggregate Class thickness (cm) = 10	m3	120.00		
5	Prime Coat Detour	Liter	1,200.00		
6	Land rent	m2	1,300.00		
III.	Workers For Maintenance				
1	Worker 9	Person/day	1,620.00		
2	Skilled Labor (Stone / Paint / Weld) 3	Person/day	540.00		
3	Team leader (Foreman) 1	Person/day	180.00		
Total Cost of Maintenance and Protection for Traffic					0
Note: The number listed on each mobilization item already included over-head and profits as well as all taxes and duties (as applicable), and other expenses.					
A.	Basic Unit Price Analysis (HSD) Wage Labor Wage data varies according to the location of the work. The amount depending on the market price or set by the local government. The wages do not include health & safety equipment such as helmets, vests, shoes, raincoats, etc.				

Examples of Cost Analysis Equipment for Health and Safety

NO.	TYPE OF EQUIPMENT	UNIT	PRICE SUMMATION (\$)
1	Helm	Unit	6.00
2	Vest	Unit	7.00
3	shoe	Unit	8.00
4	Mask	Unit	0.50
5	Hat	Unit	2.00
6	Gloves	Unit	1.50
7	Protective glasses	Unit	4.00
8	Rain coat	Unit	3.00
	Total		21.50
	Constructio period	Days	180.00
	Number of hours of use per day		8.00
	Cost per hour = 32.00 / (180 x 8)	USD	0.01

Table - 1 Sample of List of Unit Price Basic of Wages per hour

NO.	DESCRIPTION		CODE	UNIT	UNIT PRICE (\$)	PRICE SUMMATION (\$)
1	Worker		L1	Hour	0.63	
2	Skilled Labor		L2	Hour	1.00	
3	Head of skilled labor		L3	Hour	1.25	
4	Foreman		L4	Hour	1.50	
5	Operator		L5	Hour	2.86	
6	Assistant Operator		L6	Hour	1.71	
7	Driver		L7	Hour	2.29	
8	Driver Helper		L8	Hour	0.71	
9	Mechanics		L9	Hour	2.86	
10	Asistant Mechanic		L10	Hour	1.71	

Note: The unit price includes the cost of wages of health and safety equipment.

B. Basic Unit Price Analysis (BUP) equipment (equipment rental fee per hour)

HSD in calculating equipment, the necessary data:

1. Wage labor
2. Acquisition cost tool
3. The price of fuel / lubricants and other

Table - 2: Sample List Price Acquisition Equipment

NO.	NAME OF EQUIPMENT	PRICE ACQUISITION (USD)	REMARKS
1	Asphalt Mixing Plant	120,377	Year of acquisition
2	Asphalt Finisher	84,667	
3	Asphalt Sprayer	3,341	
4	Asphalt Liquid Mixer		
5	Asphalt Distributor		
6	Cold Milling		
7	Buldozer 100 – 150 Hp	63,587	
8	Dump Truck 3.5 Ton		
9	Dump Truck 110 Hp, 4 Tires, 5.2 Ton, Long chassis	26,825	
10	Dump Truck 10 Ton		
11	Excavator 80 – 140 Hp		
12	Excavator 200 Hp	130,000	
13	Motor Grader >100 Hp	47,761	
14	Track Loader 75-100 Hp		
15	Wheel Loader 1.0 – 1.6 M3	39,848	

NO.	NAME OF EQUIPMENT	PRICE ACQUISITION (USD)	REMARKS
16	Three Wheel Roller		
17	Tandem Roller 6-8 T	84,457	
18	Tire Roller 8-10 T	63,587	
19	Vibratory Roller 5-8 T	64,929	
20	Tamper		
21	Aggregate (chip) Spreader		
22	Flat Bed Truck 3-4 m3		
23	Stone Crusher		
24	Pedestrian Roller		
25	Jack Hammer	2,473	
26	Rock Drill Breaker		
27	Cold Recycler		
28	Hot Recycler		
29	Slip Form Paver		
30	Concrete Mixer 0.3 – 0.6 M3		
31	Concrete Vibrator		
32	Concrete Pump		
33	Concrete Pan Mixer		
34	Concrete Breaker		
35	Concrete Mixer (350)		
36	Truck Mixer		
37	Compressor 4000 – 6500 L/M	7,772	
38	Generator Set	14,625	
39	Water Pump 70-100 Mm		
40	Water Tanker 3000-4500 L	7,418	
41	Fulvi Mixer		
42	Vibrating Rammer		
43	Crane 10 – 15 Ton		
44	Trailer 20 Ton		
45	Pile Driver + Hammer		
46	Crane On Track 35 Ton		
46	Bore Pile Machine		

Example of the Basic Unit Price (BUP) Analysis of Excavator 200 HP

NO.	DESCRIPTION	CODE	PRICE / VALUE	UNIT	REMARKS
I.	EQUIPMENT DESCRIPTION				
	Power	Pw	200.00	Hp	Note: Taxes calculated on gross cost sheet of Recapitulation
	Capacity	Cp	0.93	m3	
	New Equipment a. Economic Lives	A	5.00	Year	
	b. Working hours in 1 year	W	2,000.00	Hour	
	c. Equipment Price	B	130,000.00	USD	Employment costs
II.	OTHERS				
	Interest Rate	i	8.00	% / Year	
	Operator Wage	L5	2.29	\$ / Hour	
	Assistant Operator Wage	L6	0.71	\$ / Hour	
	Petrol Fuel	Mpet	1.29	Liter	
	Diesel Fuel	Mdf	1.25	Liter	
	Lubricating Oil	MIub	4.00	Liter	
	Insurance and others	Ins	0.20	%	
III.	FIXED COST PER HOUR				
	Residual value of the equipment = $10\% \times B$	C	13,000.00	USD	
	Factor Capital Installments $\frac{= (i \times (1+i)^A)}{((1+i)^A - 1)}$	D	0.25	-	
	Fixed Cost per hour $= ((B - C) \times D)$	E	14.65	USD	
	a. Payback Cost				
	b. Insurance, and others $= (Ins \times B)$	F	0.13	USD	
	Fixed Cost per hour = (E + F)	G	14.78	USD	

IV. OPERATION COSTS PER HOUR

NO.	DESCRIPTION	CODE	PRICE	REMARKS
1	Fuel $= (12 \% - 15 \%) \times Pw \times Mdf$ If $W < 1500$, taken 12 %	H	37.50	USD
2	Lubricant Oil $= (2.5 \% - 3 \%) \times Pw \times Mlub$ If $W < 1500$ taken 3 %	I	24.00	USD
3	Workshop cost (including tire) $= (6.25 \% - 8.75 \%) \times B/W$ If $W < 1500$, taken 6.25 %	J	5.69	USD
4	Maintenance & repair $(12.5 \% - 17.5 \%) \times B / W$ If $w = 0$, taken 12.5 %	K	8.13	USD
5	Operator $= (1 \text{ Person} / \text{Hour}) \times L5$	L	2.29	USD
6	Assistant Operator $= (1 \text{ Person} / \text{Hour}) \times L6$	M	0.71	USD
Operation Cost per hour $= (H + I + J + K + L + M)$		P	78.31	USD
THE TOTAL COST OF RENTAL EQUIPMENT / BUP OF EQUIPMENT		S	93.09	USD

Example of the Basic Unit Price (BUP) Analysis of Dump Truck 110 Hp, 5.5 Ton

NO.	DESCRIPTION	CODE	PRICE / VALUE	UNIT	REMARKS
I.	DESCRIPTION EQUIPMENT Power Capacity New Equipment a. Economic age b. Working Hours In 1 Year c. Price Equipment	Pw Cp A W B	110 3.25 5 2,000 26,825	Hp m3 Year Hour USD	Note: Taxes calculated of Recapitulation Employment costs
II.	OTHERS Interest rate Wages operator / driver Wages Assistant Operator / Assistant driver Gasoline Fuel Solar Lubricant Insurance	i L5 L6 Mpet Mdf Mlub Ins	8.00 2.29 0.71 1.29 1.25 4.00 0.20	% / Year \$ / Hour \$ / Hour Liter Liter %	
III.	FIX COST PER HOUR Residual value of the equipment $= 10\% \times B$ Factor Capital Installments $= \frac{(i \times (1+i)^A)}{((1+i)^A - 1)}$ Fixed Cost per hour a. Payback Cost b. Insurance, and others	C D E F	2,682.50 0.25 3.02 0.03	USD - USD USD	
Fixed Cost per hour = (E + F)		G	3.05	USD	

IV. OPERATION COSTS PER HOUR

NO.	DESCRIPTION	CODE	PRICE	REMARKS
1	Fuel $= (12 \% - 15 \%) \times Pw \times Mdf$ If $W < 1500$, taken 12 %	H	20.63	USD
2	Lubricant Oil $= (2.5 \% - 3 \%) \times Pw \times Mlub$ If $W < 1500$ taken 3 %	I	13.20	USD
3	Workshop cost (including tire) $= (6.25 \% - 8.75 \%) \times B/W$ If $W < 1500$, taken 6.25 %	J	1.17	USD
4	Maintenance & repair $(12.5 \% - 17.5 \%) \times B / W$ If $w = 0$, taken 12.5 %	K	1.68	USD

5	Operator	= (1 Person / Hour) x L5	L	2.29	USD
6	Assistant Operator	= (1 Person / Hour) x L6	M	0.71	USD
	Operation Cost per hour	= (H + I + J + K + L + M)	P	39.68	USD
	THE TOTAL COST OF RENTAL EQUIPMENT / BUP OF EQUIPMENT		S	42.73	USD

Tabel – 3 : Example of Equipment Rental Rate / BUP of Equipment

NO.	NAME OF EQUIPMENT	CODE	HORSE POWER (HP)	CAPACITY	UNIT	PRICE, \$	RENTAL RATE \$
1	Asphalt Mixing Plant	E1	294	50.0	Ton/Hour	120,377	90.76
2	Asphalt Finisher	E2	72.4	10.0	Ton	84,667	35.96
3	Asphalt Sprayer	E3	4	850.0	Liter	3,341	6.06
7	Buldozer 100 – 150 Hp	E7	155	-	-	63,587	50.03
8	Dump Truck 3.5 Ton	E8	100	3.5	Ton		
9	Dump Truck 5.2 Ton	E8a	110	5.5	Ton	26,825	42.73
10	Dump Truck 10 Ton	E9	190	10.0	Ton		
11	Excavator 80 – 140 Hp	E10	133	0.9	m3		
12	Excavator 200 Hp	E10	133	0.9	m3	130,000	93.09
13	Motor Grader >100 Hp	E11	135	10,800.0	-	47,761	42.76
14	Track Loader 75-100 Hp	E12	70	0.8	m3		
15	Wheel Loader 1.0 – 1.6 M3	E13	96	1.5	m3	39,848	32.81
16	Three Wheel Roller 6-8 Ton	E14	55	8.0	Ton		
17	Tandem Roller 6-8 T	E15	82	8.1	Ton	84,457	38.01
18	Tire Roller 8-10 T	E16	100.5	9.0	Ton	63,587	38.48
19	Vibratory Roller 5-8 T	E17	82	7.1	Ton	64,929	34.40
20	Aggregate (chip) Spreader	E19	115	3.5	m		
21	Stone Crusher	E21	220	50.0	Ton/Hour		
22	Pedestrian Roller	E22	8.8	835.0	Ton		
23	Jack Hammer	E23	0	1,330.0	-	2,473	5.68
24	Cold Recycler	E25	900	2.2	m		
25	Hot Recycler	E26	400	3.0	m		
26	Concrete Mixer 0.3 – 0.6 M3	E28	134	500.0	Liter		
27	Concrete Vibrator	E29	5.5	25.0	-		
28	Concrete Pump	E30	100	8.0	m3		
29	Concrete Pan Mixer	E31	134	600.0	Liter		
30	Concrete Breaker	E32	290	20.0	m3/Hour		
31	Concrete Mixer (350)	E33	20	350.0	Liter		
32	Truck Mixer (Agitator)	E34	220	5.0	m3		
33	Compressor 4000 – 6500 L/M	E35	60	5,000.0	CPM/(L/m)	7,772	19.06
34	Generator Set	E36	180	135.0	KVA	14,625	46.42
35	Water Tanker 3000-4500 L	E38	100	4,000.0	Liter	7,418	27.69
36	Fulvi Mixer	E39	345	2,005.0	-		
37	Vibrating Rammer	E40	4.2	80.0	kg		
38	Crane 10 – 15 Ton	E41	138	15.0	Ton		
39	Trailer 20 Ton	E42	175	20.0	Ton		
40	Pile Driver + Hammer	E43	25	2.5	Ton		
41	Crane On Track 35 Ton	E44	125	35.0	Ton		
42	Bore Pile Machine	E45	150	60.0	CM		

C. Analysis of the Basic Unit Price (BUP) materials and processed materials

Materials used in the execution of a work can be categorized into three types, namely :

- Raw material is the source material (quarry), the price is the price that has local royalty including retributions cost;
- Processed material at the base camp, the price is also influenced by the distance from the quarry;
- Finished material at the job site, the price is made up of materials plus transportation cost to the work site.

Therefore, the price of raw materials in the quarry, the distance from the quarry to the base camp or to the location of the work, the cost of renting tools or tool BUP per hour, and the production capacity of the tool will determine the price materials at the job site.

Table - 4 : Example of raw material price in Quarry

NO.	DESCRIPTION	UNIT	PRICE ROYALTY, \$	THE DISTANCE FROM THE QUARRY KM	REMARKS
1	M1 - Sand	m3	8.00	10	To Base Camp
2	M2 - Concrete Sand	m3	16.00	20	Into Job Location
3	M3 - Sirtu (sand gravel mix)	m3	10.00	20	Into Job Location
4	M4 - Sand piled	m3	8.00	15	Into Job Location
5	M5 - Gravel	m3	8.00	25	To Base Camp
6	M6 - Stone River	m3	12.00	20	Into Job Location
7	M7 - Stone cleaved	m3	15.00	25	Into Job Location
8	M8 - Soil stockpiling	m3	8.00	10	Into Job Location
9	M9 - Selected Material	m3	8.00	10	Into Job Location
10	M10 - Asphalt Cement	Ton	90.00	150	To Base Camp

Table - 5 : Sample Analysis of the Basic Unit Price (BUP) of cement

NO.	DESCRIPTION OF ACTIVITY	COST		TOTAL (USD)
		\$/ UNIT	SUB TOTAL	
1	Price at the factory	\$ / ton	150.00	150.00
2	Handling	-	-	-
3	Transport to the work site	\$ / ton	-	-
4	Demolition, warehouse	\$ / ton	2.30	2.30
5	Waste 3%	\$ / ton	4.50	4.50
	SUB-TOTAL	\$ / ton	156.80	156.80
6	Advantages & Overhead 5% (only for daily work)	\$ / ton		7.77
	TOTAL	\$ / ton		164.57
7	Price per sack, 50 kg	\$ / sack		8.23
8	Price per kg	\$ / kg		0.16

Note: The price of cement is received at the base camp by taking into account the cost of handling, transporting, unloading, and wasted materials (waste) 2% - 3%

Example of BUP analysis of concrete sand quarry to the site or base camp

The equipment used is Excavator 200 Hp and transported by 5.2 Ton Dump Truck.

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS The road condition : Moderate Distance quarry to the base camp The unit price of concrete sand (standard price) BUP Excavator 200 Hp BUP 5.2 Ton Dump Truck Density of material	L \$ _{M2} \$ _{E10} \$ _{E9} Vd	5 1 1 1 1.4	Kms M3 hour hour Ton/m3	 10.00 93.09 42.73
II.	SEQUENCE OF WORK Excavators dug the sand, as well as loading of sand that are dug into the Dump Truck. Dump Truck hauling sand to the site of Base Camp.				

III.	1.	CALCULATION OF EQUIPMENT COST PER M3 EXCAVATOR Bucket Capacity Bucket factors * Equipment efficiency factor ** Cycle time : - Excavating / load - Others Total Production capacity/Hour = $(V \times Bf \times Ef \times 60) / Ct1$ Cost Excavator / m3 = $1/Q1 \times BUP$	Vt Bf Ef T ₁ T ₂ Ct1 Q1 \$1	0.93 0.9 0.75 0.5 0.5 1 37.67 2.47	m3 Minute Minute Minute m3/Hour USD	Moderate ** Working Condition : Moderate
	2.	DUMP TRUCK Capacity Equipment efficiency factor * The average speed of charged The average speed of empty Cycle time -Loading = $(V \times 60) / (Q1 \times Vd)$ -Time traveled charged = $(L / s1) \times 60$ -Time traveled vacant = $(L / s2) \times 60$ -Others Total Production capacity / hour = $(Vt \times Ef \times 60) / (Q1 \times Vd)$ Dump Truck Cost / m3 = $1/Q2 \times E9$	Vt Ef s1 s2 Total \$2	5.50 0.75 20.00 30.00 6.26 15.00 10.00 1.00 32.26 5.48 7.80	Ton km/Hour km/Hour Minute Minute Minute Minute Minute m3/ Hour USD	* Working condition : Moderate
IV.		BASIC UNIT PRICE (BUP) CONCRETE SAND MATERIAL AT BASE CAMP LOCATION BUP Concrete Sand = $(SM2 + S1 + S2)$	\$2	20.27	USD	
		Rounded to		20.00	USD	

Conclusion :

Materials	quarry Gross price	Distance to Base Camp	Price in Base Camp
Concrete Sand	10	5	20.00
Sand	4	2.5	12.00
		5	16.00

From the table above it can be concluded, that the transport distance from the quarry to the base camp strongly influences materials price.

Example of Analysis of the Basic Unit Price (BUP) Raw Materials River Stone at Base Camp

The equipment used to produce the material in the quarry are Excavator 200 Hp and 5.2 Ton Dump Truck .
Material price at work sites or at base camp is determined by the price of raw materials in the quarry ,
production capacity of the equipment (m3) , the price of rental equipment (BUP of equipment) per hour , and the distance from the quarry to the base camp .
With the same assumptions on the basis of unit price calculation example (BUP) concrete sand , to the following process :

NO.	DESCRIPTION	CODE	COEFFICIENT	UNIT	REMARKS
I.	ASUMSI Density of river stone	Vd	0.95	Ton/m3	
II.	SEQUENCE OF WORK Same with the BUP analysis of concrete sand .				
III. 1.	CALCULATION OF EQUIPMENT COST PER M3 EXCAVATOR Equipment efficiency factor * Cycle time : - Excavating / load - Others Total Production capacity / hour = $(V \times Fb \times Fa \times$ Cost Excavator / M3 = $1/Q_1 \times$	Ef T1 T2 Ct1 Q1 \$1	0.76 0.75 0.5 1.25 30.53 3.05	 Minute Minute Minute m3/Hour USD	* Working Condition : Moderate
2.	DUMP TRUCK -Loading = $(Vt \times 60) / (Q1 \times Vd)$ -Time traveled charged = $(L/s1) \times 60$ -Time traveled vacant = $(L / s2) \times 60$ -Others Total Production capacity / hour = $Vt \times Ef \times 60) / (Ct2 \times Vd)$ Cost Dump Truck / m3 = $(1/Q2) \times E9$	T1 T2 T3 T4 Ct2 Q2 \$2	20.68 15.00 10.00 1.00 46.68 5.58 7.66	Minute Minute Minute Minute m3/Hour USD	
IV.	BASIC UNIT PRICE OF STONE RIVER AT BASE CAMP BUP Stone river = $(\\$_{M6} + \\$_1 + \\$_2)$	M1	22.70	USD	

Example of procurement work OF Course aggregate / fine (BUP processed materials)

Course or fine aggregate made of river stones were gravel nd sand. Required data as follows :

1. Stone raw material price .
2. The cost of rental equipment (BUP equipment) stonecutters per hour .
3. The cost of rental equipment (BUP equipment) Wheel Loader .
4. Wage price

NO.	DESCRIPTION	CODE	COEFFICIENT	UNIT	REMARKS
I.	ASSUMPTIONS The basic material (stone and sand) is received at the Rock breaker (at Base Camp) The activities carried out at the site of Base Camp The production equipment - Fine Aggregate -Course Aggregate Density of materials -Stone / Gravel -Stone Broke Unit Price Basic Materials - Stone River Operating Cost of equipment - Stone Crusher (Stone Crusher) The capacity of the equipment - Wheel Loader Equipment Efficiency Factor : - Stone Crusher (Stone - Wheel Loader Equipment Efficiency Factor : - Stone Crusher (Stone - Wheel Loader - Material Loss Factor	H K Vd1 Vd2 \$1 \$2 \$3 Cp1 Cp2 Ef1 Ef2 Wf	30.00 70.00 1.20 1.35 20.00 13.73 10.86 50.00 1.50 0.70 0.83 1.08	% % Ton/m3 Ton/m3 \$/m3 \$/Hour \$/Hour Ton/Hour m3 - - -	 Hollow Hollow Tables 4 & 5 Table 3 Bucket Capacity Bad condition Good condition

II.	1.	IMPLEMENTATION METHOD Wheel loaders to transport the stone / gravel from piling area and pour it into the breaking stone tool . 2. Stone/gravel split with Stone Crusher Equipment (Stone Crusher) resulting Aggregate Course and Fine rubble stone				
	2.					
III.	1	CALCULATION AGGREGATE PRODUCTION UNIT PRICE STONE CRUSHER				
a.		Stone Crusher work to break stones - Working time Stone Crusher - Production of Stone Crusher in 1 hour = (FA1 x CP1): D3 - Needs stone / gravel 1 hour = (FA1 x CP1): D1	Tst Qb Qg	1.00 25.93 29.17	Hour m3/Hour m3/Hour	crushed stone
b.		Wheel Loader work to serve the Stone Crusher - Capacity / one-way = (FA2 x CP2) - Cycle time (loading, pouring, waiting, etc.) -Time Work Wheel Loader supplying gravel : = ((Qg / Ka) x Ts): 60 minutes	Ka Ct Cw	1.25 2.00 0.78	m3 Minute Hour	
c.		Production cost of gravel / m3 = ((Tst x \$3) + (Cw x \$3)) : Qb	Bp	0.75	\$/m3	
d.		Basic unit price of stone Crusher production / m3 = ((Qg / Qb x Wf x \$1)) + Bp	HSb	25.05	\$/m3	

Example of BUP analysis of materials and processed materials

NO.	NAME OF MATERIALS	CODE	UNIT	PRICE, \$	LOCATION
1	Sand (Medium)	M1	m3	12.00	Base Camp
2	Concrete Sand (Course)	M2	m3	20.27	Base Camp
3	Gravel (sand mixed with gravel)		m3		
4	Piled sand (no element of clay)		m3		
5	Gravel		m3		
6	River stone	M6	m3	22.70	Base Camp
7	Split stone / gravel		m3		
8	Soil Material Stockpiles		m3		
9	Selected material		m3		
10	Asphalt Cement		m3		
11	F i l l e r		kg		
12	Kerosene		liter		
13	Cement PC (50 kg)		zak		
14	Cement / PC (kg)		kg		
15	Reinforcement		kg		
16	Concrete wire		kg		
17	Gabion wire		kg		
18	Paint for marking (Non Thermoplastic)		kg		
19	Paint for marking (Thermoplastic)		kg		
20	Nail		kg		
21	Wood Scaffolding		m3		
22	Gasoline		Liter		
23	Diesel fuel		Liter		
24	Grease / lubricants / Oil		Liter		
25	Plastic Filter		m ²		
26	Galvanized pipe. 1.6 "		rod		
27	Porous pipe		m		
28	Course Aggregates	M28	m3	25.05	Base Camp
29	Fine aggregate	M29	m3	25.05	Process/Base Camp
30	Materials Aggregate Base Class A		m3		
31	Materials Aggregate Base Class B		m3		
32	Materials Aggregate Base Class C		m3		
33	Geotextile		m2		
34	Asphalt emulsion	M34	kg	2.00	Base Camp

Example of Material Volume Calculation on the earth work

Moving natural soil of 1,000 m³:

Each clay and sand material excavated and transported in a loose condition, then spread and compacted.

What volume of excavated soil (in loose condition) to be transported?

What volume of soil after compacted?

By taking a conversion factor obtained the following results:

SOIL TYPE	ORIGINAL	ORIGINAL - LOOSE	LOOSE - COMPACTED
Sand	1,000 m ³	1.11 x 1,000 = 1,110 m ³	0.86 x 1,100 = 935 m ³
Sandy	1,000 m ³	1.25 x 1,000 = 1,250 m ³	0.72 x 1,250 = 900 m ³
Gravel	1,000 m ³	1.13 x 1,000 = 1,130 m ³	0.91 x 1,030 = 1,030 m ³
or soft rock	1,000 m ³	1.65 x 1,000 = 1,650 m ³	0.74 x 1,650 = 1,220 m ³

Example Tree Cutting Unit Price Analysis, diameter / φ 30-50 cm

PAYMENT ITEM NO. :

TYPES OF WORK : Tree Cutting, φ 30-50 cm

PAYMENT UNIT : Tree

NO.	DESCRIPTION	CODE	COEFFICIENT	UNIT	REMARKS
I.	ASSUMPTIONS				
1.	Using manpower / equipment	Ew	7.00	Hour	
2.	Location of work: all the way	Vtr	3.00	m ³	
3.	Road conditions: medium / good	Vd	0.90	Ton/m ³	
4.	Effective working hours per day	L	0.50	km	
5.	1 tree 30-50 cm diameter equivalent to the volume				
6.	Volume Weight of wood				
7.	Distance of the job site to the disposal site of logged				
II.	SEQUENCE OF WORK				
1.	Cutting trees using chainsaw, axe, and machete;				
2.	Trees are cut starting from the top;				
3.	Workers uproot the trees				
4.	Fallen trees are cut into pieces and loaded				
	into the Dump Truck by workers; and Dump Truck				
	dispose of materials from logging out work.				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	None				
2.	EQUIPMENT				
a.	Dump Truck 5.5 Ton	E42			* Working condition : Moderate
	Capacity bathtub	Vt	5.5	Ton	
	The efficiency factor of equipment *	Ef	0.8	-	
	Average speed of the charged	s1	20	km/Hour	
	Average speed empty	s2	40	km/Hour	
	The cycle time, Ct				
	-Loading = (Vt x 60) / (Q1 x Vd)	T1	15	Minute	
	-Time traveled charged = (L/s1) x 60	T2	1.5	Minute	
	-Time traveled vacant = (L / s2) x 60	T3	0.75	Minute	
	-Others	T4	5.00	Minute	Test results
		Ct1	22.25	Minute	
	Production Capacity, Q1 = $\frac{Vt \times Ef \times 60}{Vd \times Vtr \times Ct1}$	Q1	4.39	m ³ /Hr	
	Equipment Coefficient /tree = 1 / Q1		0.2276	Hour	

b.	Chain Saw Determined production Number of trees cut in 1 day Production Capacity / Hour = H / Ew Equipment Coefficient /tree = 1 / Q2	E39 H Q2	 7 1 1	 Tree Tree Hour	
	c. Supporting Tool (Uprooting the trees and backfill the earth) - Shovel - Ax, machete - Hoe - Rope, etc.			 Unit Unit Unit	
	3. LABOR Labor productivity per day, Qt = Q1 x Ew Labor required - Foreman - Worker Coefficient of labor / m2 : Foreman = (Fox Ew) / Qt Workers = (UL x Ew) / Qt	 Qt FO UL L4 L1	 30.76 1 10 0.2276 2.2756	 m2 Person Person Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :

TYPES OF WORK : Tree Cutting, φ 30-50 cm

PAYMENT UNIT : Tree

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	2.2756	0.63	1.43
	Foreman	Hour	0.2276	1.50	0.34
	Sum of the Labour Cost				1.77
B.	MATERIAL				
		-	0.00	0.00	0.00
	Sum of the Materials Cost				0.00
C.	EQUIPMENT				
	Dump Truck	Hour	0.2276	33.45	7.61
	Chain Saw	Hour	1.0000	5.00	5.00
	Tools	Ls	1.0000	0.50	0.50
	Sum of the Equipment Cost				13.11
D.	Work Unit Price (A+B+C)				14.89

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example Tree Cutting Unit Price Analysis, diameter / ϕ > 0.50 - 1.00 m

PAYMENT ITEM NO. :
 TYPES OF WORK : Tree Cutting, ϕ > 0.50 - 1.00 m
 PAYMENT UNIT : Tree

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1.	Using manpower / equipment	Ew	7.00	Hour	
2.	Location of work: all the way	Vtr	4.42	m3	
3.	Road conditions: medium / good	Vd	0.90	Ton/m3	
4.	Effective working hours per day	L	2.00	km	
5.	1 tree of 30-50 cm diameter equivalent to the volume				
6.	Volume Weight of wood				
7.	Distance of the job site to the disposal site of logged				
II.	SEQUENCE OF WORK				
1.	Cutting trees using chainsaw, ax, and machete;				
2.	Trees are cut starting from the top;				
3.	workers uprooting the trees;				
4.	Fallen trees are cut into pieces and loaded				
	into the Dump Truck by workers; and Dump Truck				
	dispose of materials from logging out.				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	None				
2.	EQUIPMENT				
a.	Dump Truck 5.5 Ton	E42			* Working condition:
	Capacity bathtub	Vt	5.5	Ton	Moderate
	The efficiency factor of equipment *	Ef	0.8	-	
	Average speed of the charged	s1	20	km/Hour	
	Average speed empty	s2	40	km/Hour	
	The cycle time, Ct				
	-Loading = (Vt x 60) / (Q1 x Vd)	T1	10	Minute	
	-Time traveled charged = (L/s1) x 60	T2	6	Minute	
	-Time traveled vacant = (L / s2) x 60	T3	3	Minute	
	-Others	T4	5.00	Minute	Test results
		Ct1	24	Minute	
	Production Capacity, Q1 = $\frac{Vt \times Ef \times 60}{Vd \times Vtr \times Ct1}$	Q1	2.77	km/Hour	
	Equipment Coefficient /tree = 1 / Q1		0.3616	Hour	
	Chain Saw	E39			
b.	Determined production				
	Number of trees cut in 1 day	H	3.00	Tree	
	Production Capacity / Hour = H / Ew	Q2	0.43	Tree	
	Equipment Coefficient /tree = 1 / Q2		2.33	Hour	
c.	Hydraulic Excavator 0.90 cu.m.	E54			Moderate
	Bucket Capacity	Vb	0.90	m3	little
	Bucket Factor	Ef	0.75	-	soil is rocky.
	Equipment Efficiency Factor*	Bf	0.95	-	
	Excavation Depth Conversion Factor = 3/6.37= (40 - 75%)	Cf	1.30	-	Maximum 6.37 m
	and somewhat has difficult dumping condition				
	Cycle Time, Ct :				
	-Buckling, lifting, loading	T1	10.00	Minute	
	-Others (delayed time, etc)	T2	2.00	Minute	
	Sum	Ct1	12.00	Minute	

d.	Production Capacity, Q1 = $\frac{Vb \times Bf \times Ef \times 60}{Ct1 \times Cf \times Lf}$	Q1	0.89	m3	
	Equipment Coefficient / m3 = 1 / Q1		1.1212	Hour	
	Tools (cutting the branches, Picking and loading into dump truck - Axe, Machete - Rope / sling, etc			Unit m	
	LABOR Labor productivity per day, Qt = Q1 x Ew Labor required - Foreman - Worker Labor Coefficient / m2 : Foreman = (FO x Ew) / Qt Worker = (UL x Ew) / Qt	Qt FO UL L4 L1	19.36 1 8 0.3616 20.2516	m2 Person Person Hour Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Tree Cutting, $\phi > 0.50 - 1.00$ m
 PAYMENT UNIT : Tree

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	20.2516	0.63	12.76
	Foreman	Hour	0.3616	1.50	0.54
	Sum of the Labour Cost				13.30
B.	MATERIAL	-	0.00	0.00	0.00
	Sum of the Materials Cost				0.00
C.	EQUIPMENT				
	Dump Truck 5.5 Ton	Hour	0.3616	33.45	12.10
	Chain Saw	Hour	2.3333	5.00	11.67
	Hydraulic Excavator 0.90 cu.m.	Hour	1.1212	85.00	95.30
	Tools	Ls	1.0000	2.00	2.00
	Sum of the Equipment Cost				121.06
D.	Work Unit Price (A+B+C)				134.36

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example Tree Cutting Unit Price Analysis, diameter / ϕ 3.00 m

PAYMENT ITEM NO. :
 TYPES OF WORK : Tree cutting , ϕ 3 m
 PAYMENT UNIT : Tree

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1.	Work Effort used/Equipment				
2.	Work Location: along the road				
3.	Road Condition : Moderate				
4.	Effective working hours per day	Ew	7.00	Hour	
5.	Volume Equivalence of 1 tree with diameter 3 m	Vtr	70.71	m3	
6.	Volume weight of the tree	Vd	0.90	Ton/m3	
7.	Distance from work location to tree dumping area	L	2.00	km	
II.	WORK SEQUENCE				
1.	Tree is cut using chainsaw , axe and machete				
2.	Tree is cut starting from the top				
3.	Roots are removed using excavator				
4.	Fallen trees are cut into pieces and loaded into dump trucks using excavator ; Dump Truck unloaded them				
	away from work location as far as L distance				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	None				
2.	EQUIPMENT				
a.	Dump Truck 10 Ton	E44			* Work Condition : Moderate
	Truck Capacity	Vt	10	Ton	
	Equipment Efficiency Factor*	Ef	0.8	-	
	Average speed when loaded	s1	20	km/Hour	
	Average speed when empty	s2	40	km/Hour	
	Cycle Time, Ct				
	- Loading	T1	10	Minute	
	- Travel time when loaded = (L/s1) x 60	T2	6	Minute	
	- Travel time when empty = (L/s2) x 60	T3	3	Minute	
	- Others	T4	5.00	Minute	
		Ct1	24	Minute	
	Production Capacity / hour, Q1 $\frac{Vt \times Ef \times 60}{Vd \times Vtr \times Ct1}$	Q1	0.31	m3/Hour	
	Equipment Coefficient / m3 = 1 / Q1		3.18	Hour	
	Chain Saw	E39			
b.	Determined production				
	Number of trees cut in 1 day	H	0.50	Tree	
	Production Capacity / Hour = H / Ew	Q2	0.07	Tree	
	Equipment Coefficient /tree = 1 / Q2		14.00	Hour	
c.	Hydraulic Excavator 0.90 cu.m.	E54			Moderate
	Bucket Capacity	Vb	0.90	m3	little
	Bucket Factor	Bf	0.95	-	soil is rocky.
	Equipment Efficiency Factor*	Ef	0.75	-	
	Excavation	Cf	1.30	-	Maximum 6.37 m
	and somewhat has difficult dumping condition				
	Cycle Time, Ct :				
	-buckling, lifting, loading	T1	15.00	Minute	
	-Others (delayed time, etc)	T2	2.00	Minute	
	Sum	Ct1	17.00	Minute	

d.	Production Capacity /Hour = $\frac{Vb \times Bf \times Ef \times 60}{Ct1 \times Cf \times Lf}$	Q1	5.54	m3	
	Equipment Coefficient / m3 = 1/Q1		0.1805	Hour	
3.	Tools (cutting dump truck				
	- Axe, Machete			unit	
	- Rope / sling, etc			m	
	LABOR				
	Labor productivity per day, Qt = Q1 x Ew	Qt	2.20	m3	
	Labor required				
	- Foreman	FO	1	Person	
	- Worker	UL	8	Person	
	Labor Coefficient / m2 :				
	Foreman = (FO x Ew) / Qt	L4	3.1820	Hour	
	Worker = (UL x Ew) / Qt	L1	25.4556	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Tree cutting , ϕ 3 m
 PAYMENT UNIT : Tree

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	25.4556	0.63	16.04
	Foreman	Hour	3.1820	1.50	4.77
	Sum of the Labour Cost				20.81
B.	MATERIAL				
		-	0.00	0.00	0.00
	Sum of the Materials Cost				0.00
C.	EQUIPMENT				
	Dump Truck 5.5 Ton	Hour	3.1820	55.75	177.39
	Chain Saw	Hour	14.0000	5.00	70.00
	Hydraulic Excavator 0.90 cu.m.	Hour	0.1805	85.00	15.34
	Tools	Ls	1.0000	3.00	3.00
	Sum of the Equipment Cost				265.74
D.	Work Unit Price (A+B+C)				286.55

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example Analysis Unit Price Clearing and grubbing work (land clearing)

PAYMENT ITEM NO. :
 TYPES OF WORK : Clearing and Grubbing
 PAYMENT UNIT : ha

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Work is done mechanically				
2	Location of work: along the road to be built				
3	Shielded land along the road				
4	Road Conditions: medium / good				
5	Effective working hours per day	Ew	7.00	Hour	
6	Material development factor	Lf	1.10	-	
7	Thick of soil stripping	d	0.20	m	
II.	SEQUENCE OF WORK				
1	Scrape soil along the way				
2	Bulldozer displacing the soil surface and collected around the job site at any distance of 5 m.	L1	5.00	m	
3	Wheel Loader poured waste material into the Dump Truck that will transport it to a disposal area as far as L.	L	0.25	km	
III.	USE OF MATERIALS, EQUIPMENT AND LABOR				
1.	MATERIALS				
	Not required materials				
2.	EQUIPMENT				
a.	Bulldozer 215hp	E12			* Work Condition :
	Blade Factor	Kf	0.90	-	Moderate
	Equipment Efficiency Factor*	Ef	0.80	-	
	Acceleration	Sp	4.00	km/Hour	
	Deceleration	Sr	6.00	km/Hour	
	Blade width	Bw	3.00	m	
	Blade height	Bh	1.20	m	
	Hauling Distance	L1	5.00	m	
	Volume for 1 Time hauling = $Bh^2 \times Bw \times Kf$	V	3.89	m3	Loose
	Cycle Time, Ct				
	- Forward = $(L1 \times 60) / (Sp \times 1000)$	T1	0.08	Minute	
	- Backward = $(L1 \times 60) / (Sr \times 1000)$	T2	0.05	Minute	
	- Others	T3	0.15	Minute	Test results
		Ct1	0.28	Minute	
	Production capacity / hour = $\frac{V \times Ef \times 60}{Ct1 \times d \times 10000}$	Q1	0.3393	ha	Original soil
	Equipment Coefficient per ha = 1 / Q1		2.9471	Hour	
b.	Wheel Loader, 1.8 m3	E82			Moderate
	Bucket capacity	Vb	1.80	m3	machine :
	Equipment Efficiency Factor*	Ef	0.80	-	Moderate
	Bucket factors **	Bf	1.10	-	condition : Easy
	Cycle Time, Ct				
	- Loading	T1	0.20	Minute	Test results
	- Others	T2	0.10	Minute	Test results
		Ct2	0.30	Minute	
	Production capacity / hour = $\frac{Vb \times Bf \times Ef \times 60}{Lf \times Ct2 \times d \times 10000}$	Q2	0.1440	ha	
	Equipment Coefficient per ha = 1 / Q2		6.94	Hour	

Example Analysis Unit Price Excavation For Drainage and Waterways

PAYMENT ITEM NO. :
TYPES OF WORK : Excavation for Drainage and Waterways
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using heavy equipment (mechanically)				
2	Location of work: all the way				
3	Road Conditions: medium / good				
4	Effective working hours per day	Ew	7.00	Hour	
5	Factors material development	Lf	1.20	-	
6.	Heavy volume of soil (loose)	Vd	1.60	Ton/m3	
II.	SEQUENCE OF WORK				
1	Excavations carried out by using Excavator				
2	Then Excavator loads dug out materials into the Dump Truck				
3	Dump Truck disposes dug out materials the location of the road as far as L;	L	4.00	km	
4	A group of workers will smoothen excavation results				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
	No materials needed				
2.	Hydraulic Excavator 0.90 cu.m.				* Working cond.
a.	Bucket Capacity	E54			: Moderate
	Bucket Factor	Vb	0.90	m3	** Operating cond.
	Equipment Efficiency Factor*	Ef	0.75	-	: A little
	Excavation Depth Conversion Factor = 3m/6.37 m (40 - and somewhat has difficult dumping condition	Bf	0.95	-	difficult, Ordinary soil is rocky.
	Cycle Time, Ct :	T1	0.500	Minute	
	-buckling, lifting, loading	T2	0.500	Minute	
	-Others (delayed time, etc)	Ct1	1.000	Minute	
	Sum				
	Production Capacity / Hour = $\frac{Vb \times Bf \times Ef \times 60}{Ct1 \times Lf}$	Q1	32.06	m3/Hour	
	Equipment Coefficient / m3 = 1 / Q1	-	0.0312	Hour	
b.	Dump Truck 5.5 Ton	E42			* Working cond.
	Truck Capacity	Vt	5.50	Ton	: Moderate
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	20.00	km/Hour	
	Average speed when empty	s2	40.00	km/Hour	
	Cycle Time, Ct				
	- Loading = (L / s1) x 60	T1	12.00	Minute	
	- Travel time when loaded = (L / s2) x 60	T2	6.00	Minute	
	- Travel time when empty = (Vt / Q1) x 60	T3	10.29	Minute	
	- Others	T4	0.50	Minute	
		Ct2	28.79	Minute	
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Vd \times Ct2 \times Lf}$	Q2	4.78	m3/Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
d. 3.	Equipment Coefficient / m3 = 1 / Q2		0.2094	Hour	Lump Sump
	Tools				
	Required small Tools				
	- Shovel				
	- Basket + Sweep				
	LABOR				
	Production specify : EXCAVATOR	Q1	32.06	m3/Hour	
	Production Excavation / day = Ew x Q1	Qt	224.44	m3	
	Labor requirements:				
	-Workers	UL	4.00	Person	
	- Foreman	FO	1.00	Person	
	Coefficient of Labor / m3 :				
	-Workers = (Ew x UL) : Qt	L1	0.1248	Hour	
	- Foreman = (Ew x FO) : Qt	L4	0.0312	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
 TYPES OF WORK : Excavation for Drainage and Waterways
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Jam	0.1248	0.63	0.08
	Foreman	Jam	0.0312	1.50	0.05
	Sum of the Labour Cost				0.13
B.	MATERIAL	-	-	-	-
	Sum of the Materials Cost				0.00
C.	EQUIPMENT				
	Hydraulic Excavator 0.90 cu.m.	Jam	0.0312	85.00	2.65
	Dump Truck 5.5 Ton	Jam	0.2094	33.45	7.00
	Alat Bantu	LS	1	0.5	0.50
	Sum of the Equipment Cost				10.16
D.	Work Unit Price (A+B+C)				10.28

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Subgrade preparation (Common material)

PAYMENT ITEM NO. :
TYPES OF WORK : Subgrade preparation (Common material)
PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Work is done only at excavation area				
2	Work done mechanically				
3	Work Location: along the road				
4	Road Condition : Bad/ not compact				
5	Effective working hours/day	Ew	7.00	Hour	
II.	WORK SEQUENCE				
1	Motor Grader levelling the excavated area				
2	Vibro Roller compressed surface that has been levelled by motor grader				
3	A group of workers will level the pavement area				
	using Tools				
III.	MATERIALS, EQUIPMENT AND LABOR using				
1.	MATERIAL				
	None				
2.	EQUIPMENT				
a.	Motor Grader >125 hp	E61			Levelling
	Length of grader for 1 time operation	L	50.00	m	
	Working blade effective size	Bw	2.40	m	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Equipment average speed	Sa	2.00	km/Hour	
	Number of trips	n1	6.00	Trip	
	Cycle Time, Ct				
	- Levelling for 1 time trip = L : (Sa x 1000) x 60	T1	1.50	Minute	
	- Others	T2	1.00	Minute	Test Result
		Ct1	2.50	Minute	
	Production Capacity / Hour = $\frac{L \times Bw \times Ef \times 60}{n1 \times Ct1}$	Q1	384.00	m2	
	Equipment Coefficient / m2 = 1 / Q1		0.0026	Hour	
b.	Vibratory Drum Roller 3-5 Ton	E73			Moderate
	Equipment Average Speed	Sa	2.00	km / Hour	machine :
	Effective width compactness	cw	1.20	m	Moderate
	Number of trips	n1	8.00	Trip	
	Equipment Efficiency Factor*	Ef	0.65	-	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	$\text{Production Capacity / Hour} = \frac{(Sa \times 1000) \times Bw \times Ef}{n1}$ Equipment Coefficient / m2 = 1 / Q2	Q2	195.00	m2	Lump Sum
	c. Water Tank Truck with Pump 5000 liter	E86			
	Water Tank Volume	Vw	5.00	m3	
	Water required / m2 dense surface	Wr	0.01	m3	
	Tank filling/ Hour	n2	1.00	Times	
	Equipment Efficiency Factor*	Ef	0.83	-	
	$\text{Production Capacity / Hour} = \frac{Vw \times n2 \times Ef}{Wr}$ Equipment Coefficient / m2 = 1 / Q3	Q3	415.00	m2	
	d. Tools				
	Required small Tools				
	- Shovel = 3 units				
3.	LABOR				
	Determined Production : VIBRATORY ROLLER	Q2	195.00	m2/Hour	
	Labor productivity / day = Ew x Q1	Qt	1,365.00	m2	
	Labor Required				
	- Worker	UL	2.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient / m2 :				
	- Worker = (Ew x UL) : Qt	L1	0.0103	Hour	
3.	- Foreman = (Ew x FO) : Qt	L4	0.0051	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :

TYPES OF WORK : Subgrade preparation (Common material)

PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0103	0.63	0.01
	Foreman	Hour	0.0051	1.50	0.01
					0.01
B.	MATERIAL				
	None		0.00	0.00	0.00
	Sum of the Materials Cost				0.00
C.	EQUIPMENT				
	Motor Grader >125 hp	Hour	0.0026	90.00	0.23
	Vibratory Drum Roller 3-5 Ton	Hour	0.0051	62.00	0.32
	Water Tank Truck with Pump 5000 liter	Hour	0.0024	25.00	0.06
	Tools	LS	1.0000	0.50	0.50
	Sum of the Equipment Cost				1.11
D.	Work Unit Price (A+B+C)				1.13

Note :

- The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- The unit cost for equipment including fuel, used material and the operator's Cost.
- Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis for Ordinary Soil Excavation

PAYMENT ITEM NO. :
 TYPES OF WORK : Ordinary Soil Excavation
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFFICIENT	UNIT	REMARKS
I.	ASSUMPTION				
1.	Road Condition : Moderate	Ew	7	Hour	
2.	Work done mechanically	Lf	1.2	-	
3.	Location along the Road	Vd	1.6	Ton/m3	
4.	Effective Working hour per day	L	4	km	
5.	Swell factor				
6.	Soil Volume Weight (Loose)				
7.	Location distance to Disposal area				
II.	WORK SEQUENCE				
1.	Soil which is cut generally located on the side of the road;				
2.	Excavation is carried out by means excavator				
3.					
4.	Excavator load the excavated materials into Dump Truck				
	Dump truck dispose of excavated material to the disposal				
	disposal area as far as L (km).				
III.	EQUIPMENT AND LABORS USED				
1.	EQUIPMENT				
a.	Hydraulic Excavator 0.90 cu.m.	E54			
	Bucket Capacity	Vb	0.90	m3	A little
	Bucket Factor *	Bf	0.95	-	soil is rocky.
	Equipment Efficiency Factor**	Ef	0.75	-	condition: Moderate
	Excavation Depth Conversion Factor = 3 m / 6.37 m = 0.47	Cf	1.30	-	Maximum: 6.37 m
	[40-75% and Dumping Condition : Rather difficult]				
	Cycle Time, Ct :				
	- Excavation, Loading	T1	0.32	Minute	Test Result
	-Others (Delayed Time, etc)	T2	0.10	Minute	Test Result
	Sum	Ct1	0.42	Minute	
	Production capacity/hour = $\frac{Vb \times Bf \times Ef \times 60}{Ct1 \times Cf \times Lf}$	Q1	58.72	m3	
	Equipment Coefficient/ m3 = 1/Q1		0.0170	Hour	
b.	Dump Truck 5.5 Ton	E42			
	Tank Capacity	Vt	5.50	Ton	Moderate
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	20.00	km/hour	
	Average Speed When empty	s2	40.00	km/hour	
	Cycle Time, Ct :				
	-Loaded = (Vt x 60) / (Vd x Q1)	T1	3.51	Minute	
	-Travel Time When Loaded = (L / s1) x 60	T2	12.00	Minute	
	-Travel time when empty = (L / s2) x 60	T3	6.00	Minute	
	-Others	T4	2.00	Minute	Test Result
	Sum	Ct2	23.51	Minute	

NO.	DESCRIPTION	CODE	COEFFICIENT	UNIT	REMARKS
2.	Production Capacity/Hour = $\frac{Vt \times Ef \times 60}{Ct2 \times Vd \times Lf}$	Q2	5.85	m3	
	Equipment Coefficient/m3 = 1/Q2		0.1710	Hour	
	LABOR				
	Determined Production: Excavator	Q1	58.72	m3/hour	
	Excavation Production/day = Ew x Q1 = 7 x Q1	Qt	411.06	m3	
	Labor Required:				
	-Worker	UL	2.00	Person	
	-Foreman	FO	1.00	Person	
	Labor Coefficient / m3 :				
	-Labor = (Ew x UL) / Qt	L1	0.0341	Hour	
	-Foreman = (Ew x FO) / Qt	L4	0.0170	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Ordinary Soil Excavation
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	worker	Hour	0.0341	0.63	0.02
	Foreman	Hour	0.0170	1.50	0.03
	Sum of the labor Cost				0.05
B.	MATERIAL	-	-	-	-
	Sum of the materials cost				0.00
C.	EQUIPMENT				
	Hydraulic Excavator 0.90 cu.m.	Hour	0.0170	85.00	1.45
	Dump Truck 5.5 Ton	Hour	0.1710	33.45	5.72
	Sum of the Equipmet Cost				7.17
D.	Unit Price of Work (A+B+C)				7.21

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis for Ordinary Soil Filling

PAYMENT ITEM NO. :
 TYPES OF WORK : Ordinary Soil Filling
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1.	Work done mechanically				
2.	Road Condition: Moderate				
3.	Effective Working Hour per day	Ew	7	Hour	
4.	Swell factor	Lf	1.2	-	
6.	Soil Volume Weight (Loose)	Vd	1.6	Ton/m3	
6.	Thickness Compactness Spreading	t	0.15	m	
7.	Quarry distance to Work Location / Field	L	5	km	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
II.	WORK SEQUENCE				
1.	Wheel loader loads materials to dump truck				
2.	Dump Truck transports material from quarry to work location along L				
3.	Level the Materials using motor grader				
4.	Material is compacted using vibrator roller				
5.	A group of workers will smoothen out the overlay edges and level surface using the supporting tools and level surface using the supporting equipment during compaction				
III.	MATERIALS, EQUIPMENT AND LABOR USED				
1.	MATERIALS				
	Filling Materials = 1 x Lf	M17	1.2	m3	Borrow pit
2.	EQUIPMENT				
a.	Wheel Loader, 1.8 m3	E82			: Easy
	Bucket Capacity	Vb	1.80	m3	Condition :
	Bucket Factor *	Bf	1.00	-	Moderate
	Equipment Efficiency Factor**	Ef	0.65	-	machine :
	Cycle Time, Ct1 :				Moderate
	- Excavation, Loading	T1	0.50	Minute	Test Result
	- Others	T2	0.50	Minute	Test Result
	Sum	Ct1	1.00	Minute	
	Production Capacity/hour = $\frac{(Vb \times Bf \times Ef \times 60)}{(Ct1 \times Lf)}$	Q1	58.50	m3	
	Equipment Efficiency/m3 = 1 / Q1		0.0171	Hour	
b.	Dump Truck 5.5 Ton	E42			
	Truck Capacity	Vt	5.50	Ton	Moderate
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	20.00	km/Hour	
	Average speed when Empty	s2	40.00	km/Hour	
	Cycle Time, Ct :				
	- Travel Time when loaded = (L/s1) x 60	T1	15.00	Minute	
	-Travel Time when empty = (L/s2) x 60	T2	7.50	Minute	
	-Others	T3	2.00	Minute	Test Result
		Ct2	24.50	Minute	
	Production Capacity/hour = $\frac{Vt \times Ef \times 60}{Ct2 \times Vd \times Lf}$	Q2	5.61	m3	
	Equipment Efficiency/ m3 = 1 / Q2		0.1782	Hour	
c.	Motor Grader >125 hp	E61			* Spreading, grading
	Length of Spreading	Ly	50.00	m	
	Width of Blade effective working	Bw	2.40	m	
	Equipment Efficiency Factor*	Ef	0.60	-	
	Equipment Average Speed	Sa	4.00	km/Hour	
	Number of Trip	n1	6.00	Trip	
	Cycle Time, Ct :				
	-1 time trip Levelling = $\frac{Ly \times 60}{Sa \times 1000}$	T1	0.75	Minute	
	- Others	T2	0.30	Minute	Test Result
		Ct3	1.05		
	Production Capacity/Hour = $\frac{Ly \times Bw \times t \times Ef \times 60}{Ct3 \times n1}$	Q3	366.14	m3	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
d.	Equipment Efficiency/ m3 = 1 / Q3 Vibratory Drum Roller 3-5 Ton	E73	0.0027	Hour	Moderate
	Average Speed	Sa	5.00	km/Hour	Maintenance of machine :
	Compaction effective width	cw	1.20	m	Moderate
	Number of Trips	n1	8.00	Times	
	Equipment Efficient Factor*	Ef	0.65	-	
	Production $\frac{Sa \times 1000 \times Ec \times t \times Ef}{n1}$	Q4	73.13	m3	
	Capacity/Hour				
	Equipment Efficiency / m3 = 1 / Q4		0.0137	Hour	
e.	Water Tank Truck with Pump 5000 liter	E86			Moderate
	Water Tank Volume	Vw	5.00	m3	Moderate machine :
	Water Required/m ³ densed material	Wr	0.07	m3	Moderate
	Tank Filling/ hour	n2	4.00	Times	
	Equipment Efficient Factor*	Ef	0.65	-	
	Production Capacity/Hour = $\frac{Vw \times n2 \times Ef}{Wr}$	Q5	185.71	m3	
f.	Equipment Efficiency / m3 = 1 / Q5		0.0054	Hour	
	Tools				
	Spade = 3 pieces				Lump sum
3.	LABOR				
	Determined Production : Motor Grader	Q3	366.14	m3 / hour	
	Filling Production/day= Ew x Q3	Qt	2562.98	m3	
	Labor Required : - Worker	UL	10	Person	
	- Foreman	FO	1	Person	
	Labor Coefficient / m2				
	- Worker = (Ew x UL) / Qt	L1	0.0273	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.0027	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Ordinary Soil Filling
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	Labor				
	Worker	hour	0.0273	0.63	0.02
	Foreman	hour	0.0027	1.50	0.00
	Sum of the Labor Cost				0.02
B.	Materials				
	Soil Filling	m3	1.2000	1.00	1.20
	Sum of the Materials Cost				1.20
C.	Equipment				
	Wheel Loader, 1.8 m3	hour	0.0171	65.00	1.11
	Dump Truck 5.5 Ton	hour	0.1782	33.45	5.96
	Motor Grader >125 hp	Hour	0.0027	90.00	0.25
	Vibratory Drum Roller 3-5 Ton	Hour	0.0137	62.00	0.85
	Water Tank Truck with Pump 5000 liter	Hour	0.0054	25.00	0.13
	Tools	LS	1.0000	0.50	0.50
	Sum of the Equipment Cost				8.80
D.	Works Unit Price (A+B+C)				10.02

Note :

- The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- The unit cost for equipment including fuel, used material and the operator's Cost.
- Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis for Additional Transportation Cost > 5 km

PAYMENT ITEM NO. :
 TYPES OF WORK : Additional Transportation Cost > 5 km
 PAYMENT UNIT : m3 / km

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using heavy equipment (mechanically)				
2	Work Location: along the road				
3	Road Condition : Moderate - Good				
II.	WORK SEQUENCE				
1	Soil which is cut generally located on the side of the road				
2	Dump truck throws excavated materials away from road	L	8.00	km	
3	Additional Distance to be calculated, Le = (L - 5) km	Le	3.00	km	
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	None				
2.	EQUIPMENT				
a.	Dump Truck 5.5 Ton	E42			* Working Condition : Moderate
	Tank Capacity	Vt	3.50	m3	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	20.00	km/Hour	
	Average speed when empty	s2	40.00	km/Hour	
	Cycle Time, Ct				
	- Travel time when loaded = (Le : s1) x 60	T1	9.00	Minute	
	- Travel time when empty = (Le : s2) x 60	T2	4.50	Minute	
		Ct	13.50	Minute	
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Ct}$	Q	12.44	m3/Hour	
	Equipment Coefficient per m3/km = (1 : Q) / Le		0.0268	Hour	
3.	LABOR				
	None				

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Additional Transportation Cost > 5 km
 PAYMENT UNIT : m3 / km

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR None				0.00
	Sum of the Labour Cost				0.00
B.	MATERIAL None				0.00
	Sum of the Materials Cost				0.00
C.	EQUIPMENT Dump Truck 5.5 Ton	Hour	0.0268	33.45	0.90
	Sum of the Equipment Cost				0.90
	Work Unit Price (A+B+C)				0.90
D.					

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

||

Example: Unit Price Analysis of Structure Excavation Work with depth 0 - 2 meters

Location : around the bridge

Equipment used : excavator and bulldozer.

PAYMENT ITEM NO. :
 TYPES OF WORK : Structure Excavation Work with depth 0-2 meters
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
	1. Work done mechanically				
	2. Road Condition: GOOD				
	3. Effective Working Hour per day	Ew	7	hour	
	4. Swell factor	Lf	1.2	-	
II.	5. Backfilling to structure	Fb	50	%/m ³	
	WORK SEQUENCE				
	1. Soil which is cut generally located on the side of the road				
	2. Excavation is carried out by means of Excavator				
	3. Bulldozer transporting/ displacing excavated materials to landfill around work location as far as L=100m				
III.	4. Slope protection is made of wood				
	MATERIALS, EQUIPMENT AND LABORS USED				
	MATERIAL				
	1. Selected filled materials (for backfilling) = Fb x 1 m3	M17	0.5	m3	
2.	EQUIPMENT				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
a.	Hydraulic Excavator 0.90 cu.m.	E54			A little
	Bucket Capacity	Vb	0.90	m3	soil is rocky.
	Bucket Factor *	Bf	0.95		condition:Moderate
	Equipment Efficiency Factor**	Ef	0.75		
	Excavation Depth Conversion Factor = 2 m / 6.37 m (< 40 %) and Normal Dumping Condition	Cf	0.90		
	Cycle Time, Ct :				
	- Excavating, loading, others (Standard)	T1	0.32	Minute	
	- others	T2	0.15	Minute	Test result
	Sum	Ct1	0.47	Minute	Test result
	Production Capacity/hour = $\frac{Vb \times Bf \times Ef \times 60}{Ct1 \times Cf \times Lf}$	Q1	75.80	m3	
	Equipment Coefficient/ m3 = 1 / Q1		0.0132	Hour	
b.	Buldozer 215 hp	E12			Moderate
	Blade Factor	Kf	0.70	-	
	Equipment Efficiency Factor*	Ef	0.75	-	
	Acceleration (husking)	Sp	3.00	km/hour	
	Deceleration	Sr	5.00	km/hour	
	Blade Width	Bw	3.00	m	
	Blade Height	Bh	1.20	m	
	Hauling Distance	L	100.00	m	
	Volume for 1 time haul = $Bh^2 \times Bw \times Kf$	V	3.02	m3	
	Cycle Time, Ct :				
	-Hauling Time = (L x 60) / (Sp x 1000)	T1	2.00	Minute	
	-Returned Time = (L x 60) / (Sr x 1000)	T2	1.20	Minute	
	-extra time	T3	0.05	Minute	Test Result
		Ct2	3.25	Minute	
	Production Capacity/Hour = $\frac{V \times Ef \times 60}{Ct2 \times Lf}$	Q2	34.89	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.0287	Hour	
3.	LABOR				
	Determined Production : Excavator	Q1	75.80	m3/Hour	
	Excavation production/day = Ew x Q1	Qt	530.59	m3	
	Labor Required				
	-Worker	UL	4	Person	
	- Foreman	FO	1	Person	
	Labor Coefficient / m3 :				
	-Worker = (Ew x UL) / Qt	L1	0.0528	Hour	
	-Foreman = (Ew x FO) / Qt	L4	0.0132	Hour	

STANDARD FORM ANALYSIS OF EACH UNIT PRICE					
PAYMENT ITEM NO.	:				
TYPES OF WORK	: Structure Excavation with depth 0-2 meters				
PAYMENT UNIT	: m3				
NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	Labor				
	Worker	Hour	0.0528	0.63	0.03
	Foreman	Hour	0.0132	1.50	0.02
	Sum of the Labor Cost				0.05
B.	Material				
	Selected backfilling material	m3	0.5	5.00	2.50
	Sum of the Materials Cost				2.50
C.	Equipment				
	Hydraulic Excavator 0.90 cu.m.	Hour	0.0132	85.00	1.12
	Bulldozer >215 hp	Hour	0.0287	95.00	2.72
	Sum of the Equipment Cost				3.84
D.	Work Unit Price (A+B+C)				6.40

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Structure Excavation Work with depth 2 - < 4 meters

PAYMENT ITEM NO. : ...
 TYPES OF WORK : Structure Excavation Work with depth 2 - < 4 m
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1.	Work done mechanically				
2.	Work location: along the road				
3.	Road Condition : Moderate/ GOOD				
4.	Effective Working Hour per day	Ew	7.00	Hour	
5.	Swell factor	Lf	1.20	-	
6.	Backfilling to structure	Fb	50.00	%/m3	
II.	WORK SEQUENCE				
1.	Soil which is cut generally located on the side of the road				
2.	Excavation is carried out by means of Excavator				
3.	Bulldozer transporting excavated materials to the disposal area around work location	L	100.00	m	
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	- Selected backfilling material = Fb x 1 m3	M17	0.50	m3	
2.	EQUIPMENT				
a.	Hydraulic Excavator 0.90 cu.m.	E54			
	Bucket Capacity	Vb	0.90	m3	little
	Bucket Factor *	Bf	0.95	-	soil is rocky.
	Equipment Efficiency Factor**	Ef	0.75	-	:Moderate
	Excavation Depth Conversion Factor :	Cf	0.90	-	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. : ...
TYPES OF WORK : Structure Excavation with depth 2 - < 4 m
PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR Worker Foreman	Hour	0.2246	0.63	0.14
		Hour	0.0225	1.50	0.03
		Sum of the Labour Cost			
	B.	MATERIAL Selected backfilling material (calculate each basic unit	m3	0.50	5.00
Sum of the Materials Cost					
C.		EQUIPMENT Hydraulic Excavator 0.90 cu.m. Buldozer 215 hp Tools	Hour	0.0225	85.00
	Hour		0.0250	95.00	2.38
	LS		1.0000	0.50	0.50
	Sum of the Equipment Cost				4.79
D.	Work Unit Price (A+B+C)				7.46

Note :

1

The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2

The unit cost for equipment including fuel, used material and the operator's Cost.

3

Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Structure Excavation Work with depth 4 - 6 meters

PAYMENT ITEM NO. : ...
TYPES OF WORK : Structure Excavation with depth 4 - 6 m
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Work done mechanically				
2	Work location: around bridge				
3	Road Condition : Moderate/ GOOD				
4	Effective Working Hour per day	Ef	7.00	Hour	
5	Swell factor	Lf	1.20	-	
6	Backfilling to structure	Fb	50.00	% / m3	
II.	WORK SEQUENCE				
1	Soil which is cut generally located around the bridge				
2	Excavation is carried out by means of Excavator				
3	Bulldozer transporting excavated materials to the disposal area around the bridge	L	0.10	km	
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	- Selected backfilling material = Uk x 1m3	M17	0.50	m3	

NO. 2.	DESCRIPTION EQUIPMENT	CODE	COEFF.	UNIT	REMARKS
a.	Hydraulic Excavator 0.90 cu.m. Bucket Capacity Bucket Factor * Equipment Efficiency Factor** Depth 6 m / 6.37 m = 0.94 (>75 %) Dumping Condition: Normal Cycle Time, Ct - Excavating/loading - Others $\text{Production Capacity / Hour} = \frac{Vb \times Bf \times Ef \times Cf \times 60}{Ct1 \times Lf}$	E54 Vb Bf Ef Cf T1 T2 Ct1 Q1	0.90 0.95 0.75 1.10 0.65 0.25 0.90 39.19	m3 - - - Minute Minute Minute m3/Hour	A little soil is rocky. Moderate
b.	 bulldozer 215 Blade Factor Equipment Efficiency Factor* Acceleration Deceleration Blade width Blade height Hauling Distance Volume for 1 Time hauling = $Bh^2 \times Bw \times Kf$ Cycle Time, Ct - Forward = $(L \times 60) / (Sp \times 1000)$ - Backward = $(L \times 60) / (Sr \times 1000)$ - Others $\text{Production Capacity / Hour} = \frac{V}{Ct \times Lf}$	E12 Kf Ef Sp Sr Bw Bh L V T1 T2 T3 Ct2 Q2	0.90 0.75 3.00 4.00 3.00 1.20 100.00 3.89 2.00 1.50 0.15 3.65 39.95	- - km/Hour km/Hour m m m m3 Minute Minute Minute Minute m3 / Hour	Moderate Loose Test Result Lump Sump
c.	Tools Required small Tools - Hoe = 2 units - Shovel = 2 units				
3.	LABOR Determined Production : EXCAVATOR Excavation Production / day = $Ew \times Q1$ Labor Required - Worker - Foreman Labor Coefficient / m3 : - Worker = $(Ew \times UL) : Qt$ - Foreman = $(Ew \times FO) : Qt$	Q1 Qt UL FO L1 L4	39.19 274.31 12.00 1.00 0.3062 0.0255	m3/Hour m3 Person Person Hour Hour	

STANDARD FORM
ANALYSIS FOR EACH UNIT PRICE

PAYMENT ITEM NO. : ...
 TYPES OF WORK : Structure Excavation Work with depth 4 - 6 m
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.3062	0.63	0.19
	Foreman	Hour	0.0255	1.50	0.04
	Sum of the Labour Cost				0.23
B.	MATERIAL				
	Selected backfilling material (calculate each basic unit	m3	0.50	5.00	2.50
	Sum of the Materials Cost				2.50
C.	EQUIPMENT				
	Hydraulic Excavator 0.90 cu.m.	Hour	0.0255	85.00	2.17
	Buldozer 215 hp	Hour	0.0250	95.00	2.38
	Tools	LS	1.0000	0.50	0.50
	Sum of the Equipment Cost				5.05
D.	Work Unit Price (A+B+C)				7.78

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Examples : Unit Price Analysis of Cement for Soil Cement Base

ITEM PEMBAYARAN NO. :
 JENIS PEKERJAAN : Cement for Soil Cement Base
 SATUAN PEMBAYARAN : Ton

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Work is done manually				
2	Location of work: all the way				
3	Road Conditions: medium / good				
4	The average distance to the work site Base Camp	L	4.00	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Cement is transported from the Base Camp to the field with using Dump Truck				
7	Number of completed spreading of Soil Cement for 1 day along Lc;	Lc	400.00	m	
8	Material loss factor	Wf	1.05	-	
9	Thick expanse	t	0.15	m	
II.	SEQUENCE OF WORK				
1	Dump Truck carrying cement from Basecamp to the job site				
2	Cement arranged / arranged in a stretch of soil / land by labors.				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL Cement required / Ton = (1 x Wf) x 1000	M27	1,050.00	kg	
2.	EQUIPMENT				
a.	Dump Truck 5.5 Ton	E42			* Work Condition : Moderate
	Tank Capacity	Vt	3.50	m3	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	20.00	km/Hour	
	Average speed when empty	s2	40.00	km/Hour	
	The cycle time, Ct				
	- Travel time when loaded = (Le : s1) x 60	T1	12.00	Minute	
	- Travel time when empty = (Le : s2) x 60	T2	6.00	Minute	
	- When filling	T3	20.00	Minute	
	- Time of loading	T4	15.00	Minute	
	- Others	T5	10.00	Minute	
		Ct1	63.00	Minute	Test Result
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Wf \times Ct1}$	Q1	2.54	Ton	
	Equipment Coefficient / Ton = 1 / Q1		0.3938	Jam	
3.	LABOR				
	Wide expanse of Soil Cement	Lo	6.00	m	
	Cement content (3-12)%	Cr	7.50	%	
	Volume weight	Vd	1.60	Ton / m3	
	Every day with production =	Qt	43.20	Ton	
	{(Cr: 100) XTX Lo x Lc} x Vd				
	Labor Required				
	- Worker	UL	15.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient / Ton :				
	- Worker = (Ew x UL) / Qt	L1	2.4306	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.1620	Hour	

STANDARD FORM
ANALYSIS FOR EACH UNIT PRICE

PAYMENT ITEM NO. : ...
 TYPES OF WORK : Cement for Soil Cement Base
 PAYMENT UNIT : Ton

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Jam	2.4306	0.63	1.53
	Foreman	Jam	0.1620	1.50	0.24
	Sum of the Labour Cost				1.77
B.	MATERIAL				
	Cement	kg	1,050.00	0.16	168.00
	Sum of the Materials Cost				168.00
C.	EQUIPMENT				
	Dump Truck 5.5 Ton	Jam	0.3938	33.45	13.17
	Sum of the Equipment Cost				13.17
D.	Work Unit Price (A+B+C)				182.95

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Examples : Unit Price Analysis of Soil Cement Base

PAYMENT ITEM NO. :
 TYPES OF WORK : Soil Cement Base
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Work done mechanically				
2	Work location: along the road				
3	Road Condition : MODERATE / GOOD				
4	Average distance from Base Camp to work location	L	4.00	km	
5	Effective Working Hour per day	Ew	7.00	Hour	
6	payment price does not include cement (cement is paid in different price item)				
7	Capacity to spread soil cement in 1 day	Lc	400.00	m	
8	Material Swell factor	Lf	1.20	-	
9	Thickness	t	0.15	m	
II.	WORK SEQUENCE				
1	Wheel Loader load the materials into dump truck at the location				
2	Dump Truck Transports the materials to work location				
3	Motor Grader spreads the materials at the work location				
4	Cement and soil are mixed using Vulvi Mixer				
5	Material is moistened prior to compaction using water tank truck				
6	Compaction is done using Vibrator Roller and Pneumatic Tire Roller				
7	A group of workers will level the overlay				
	trimmed edge during compaction using Tools				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	For each m3 densed Soil Cement , required soil = 1 x Lf	M17	1.20	m3	
2.	EQUIPMENT				
a.	Wheel Loader, 1.8 m3	E82			
	Bucket Capacity	Vb	1.80	m3	Moderate machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Bucket Factor **	Bf	1.00	-	condition. Easy,
	Cycle Time :				dry soil.
	- Loading	T1	0.50	Minute	Test Result
	- Others	T2	0.50	Minute	Test Result
		Ct1	1.00	Minute	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
b.	Production Capacity/Hour = $\frac{Vb \times Bf \times Ef \times 60}{Lf \times Ct1}$	Q1	58.50	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.0171	Hour	
	Dump Truck 5.5 Ton	E42			Moderate
	Tank Capacity	Vt	3.50	m3	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	30.00	km/Hour	
	Average speed when empty	s2	50.00	km/Hour	
	Cycle Time, Ct2				
	- Loading time = Vt : Q1 x 60	T1	3.59	Minute	
	- Travel time when loaded = (L : s1) x 60	T2	8.00	Minute	
c.	- Travel time when empty = (L : s2) x 60	T3	4.80	Minute	
	- Others	T4	3.00	Minute	Test Result
		Ct2	19.39	Minute	
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Lf \times Ct2}$	Q2	7.22	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.1385	Hour	
	Motor Grader >125 hp	E61			* Spreading, grading
	Length of Spreading	Ly	100.00	m	
	Working blade effective width	Bw	2.40	m	
	Equipment Efficiency Factor*	Ef	0.60	-	
	equipment Average Speed	Sa	4.00	km/Hour	
d.	Number of trips	n1	6.00	Trip	3 x round trip
	Cycle Time, Ct3				
	- Levelling for 1 Trip = Ly : (Sa x 1000) x 60	T1	1.50	Minute	Test Result
	- Others	T2	1.00	Minute	Test Result
		Ct3	2.50	Minute	
	Production Capacity/Hour = $\frac{Ly \times Bw \times t \times Ef \times 60}{n1 \times Ct3}$	Q3	86.40	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.0116	Hour	
	Tandem Roller 6-8 Ton	E69			Moderate
	equipment Average Speed	Sa	3.00	km / Hour	machine :
	Compaction effective width	cw	1.20	m	Moderate
	Number of trips	n1	8.00	Trip	4 x round trips
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity/Hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q4	43.88	m3	
	Equipment Coefficient / m3 = 1 / Q4		0.0228	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
e.	Pneumatic Tire Roller 10 Ton	R71			Moderate
	Equipment Average Speed	Sa	5.00	km / Hour	Maintenance of machine :
	Compaction effective width	cw	1.50	m	Moderate
	Number of trips	n1	8.00	Trip	4 x round trip
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity/ Hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q5	91.41	m3	
	Equipment Coefficient / m3 = 1 / Q5		0.0109	Hour	
f.	Water Tank Truck with Pump 5000 liter	E86			Moderate
	Water Tank Volume	Vw	4.00	m3	Maintenance of machine :
	Water needed / m3 densed materials	Wr	0.07	m3	Moderate
	Tank filling / Hour	n2	3.00	Times	
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity/Hour = $\frac{Vw \times n2 \times Ef}{Wr}$	Q6	111.43	m3	
	Equipment Coefficient / m3 = 1 / Q6		0.0090	Hour	
g.	Fulvi mixer	E23			Moderate
	equipment Average Speed	Sa	2.50	km/Hour	machine :
	Effective width of compaction	cw	1.00	m	Moderate
	Number of trips	n1	6.00	Trip	3 x pp
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity/ Hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q7	40.63	m3	
	Equipment Coefficient / m3 = 1 / Q7		0.0246	Hour	
h.	Tools				
	Required :				Lump Sump
	- Push Cart = 2 units				
	- Shovel = 3 units				
3.	LABOR				
	Determined Production : VIBRATOR ROLLER	Q4	43.88	m3/Hour	
	Soil cement production/ day = Ew x Q4	Qt	307.13	m3	
	Labor Required				
	- Worker	UL	7.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient / m3 :				
	- Worker = (Ew x UL) : Qt	L1	0.1595	Hour	
	- Foreman = (Ew x FO) : Qt	L4	0.0228	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Soil Cement Base
PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.1595	0.63	0.10
	Foreman	Hour	0.0228	1.50	0.03
	Sum of the Labour Cost				0.13
B.	MATERIAL				
	Backfilled soil	m3	1.20	5.00	6.00
	Sum of the Materials Cost				6.00
C.	EQUIPMENT				
	Wheel Loader, 1.8 m3	Hour	0.02	65.00	1.11
	Dump Truck 5.5 Ton	Hour	0.14	33.45	4.63
	Motor Grader >125 hp	Hour	0.01	90.00	1.04
	Tandem Roller 6-8 Ton	Hour	0.02	57.50	1.31
	Pneumatic Tire Roller 10 Ton	Hour	0.01	70.00	0.77
	Water Tank Truck with Pump 5000 liter	Hour	0.01	25.00	0.22
	Fulvi mixer	Hour	0.02	21.00	0.52
	Tools	LS	1.0000	0.50	0.50
	Sum of the Equipment Cost				10.10
D.	Work Unit Price (A+B+C)				16.24

Note :

- The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- The unit cost for equipment including fuel, used material and the operator's Cost.
- Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Aggregate Base Class A , CBR Minimum 80 %

PAYMENT ITEM NO. :
TYPES OF WORK : Aggregate Base Class A , CBR Minimum 80 %
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
	1. Using Heavy Equipment (Mechanically)				
	2. Work Location : along the road				
	3. Existing road condition : Moderate				
	4. Average distance from base camp to work location	L	3.0	km	
	5. Course Aggregate layer thickness	t	0.15	m	
	6. Material swell factor	Lf	1.40	-	
	7. Effective working hours per day	Ew	7.00	Hour	
	8. Mixture proportion:				
	- Course aggregate	Ak	55.00	%	
	- Fine Aggregate	Ah	45.00	%	
II.	WORK SEQUENCE				
	1. Wheel Loader mixed and loaded aggregate into Dump Truck at Base Camp				
	2. Dump Truck transports aggregate to work location and spread using Motor Grader				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	Aggregate overlay is moistened with Water Tank Truck before compacted with Tandem Roller & PTR				
4.	A group of workers will level the overlay trimmed edge during compaction using Tools				
III.	MATERIAL, LABOR, AND EQUIPMENT using				
1.	MATERIAL				
	- Course Aggregate = $A_k \times 1 \text{ m}^3 \times L_f$	M7	0.7700	m3	
	- Fine Aggregate = $A_h \times 1 \text{ m}^3 \times L_f$	M6	0.6300	m3	
2.	EQUIPMENT				
a.	Wheel Loader 1.8 m3	E82			* Operation condi
	Bucket Capacity	Vb	1.80	m3	: Moderate
	Bucket Factor	Bf	1.00		Maintenance of machine :
	Equipment Efficiency Factor*	Ef	0.65		Moderate
	Cycle Time, Ct				
	- Mixing	T1	3.00	Minute	Test Result
	- Loading and others	T2	2.00	Minute	Test Result
	Sum	Ct1	5.00	Minute	
	Production Capacity/hour = $\frac{Vb \times Bf \times Ef \times 60}{Lf \times Ct1}$	Q1	10.03	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.0997	Hour	
b.	Dump Truck 5.5 Ton	E42			Moderate
	Tank Capacity	Vt	3.50	m3	
	Equipment Efficiency Factor*	Ef	0.80		
	Average Speed when loaded	s1	20.00	km/Hour	
	Average Speed when Empty	s2	40.00	km/Hour	
	Cycle Time, Ct				
	- Loading = $Vt : Q1 \times 60$	T1	20.94	Minute	
	- Travel Time when loaded = $(L : s1) \times 60 \text{ Minute}$	T2	9.00	Minute	
	- Travel Time when empty= $(L : s2) \times 60 \text{ Minute}$	T3	4.50	Minute	
	-others including unloading the aggregate	T4	2.00	Minute	Test Result
	SUM	Ct2	36.44	Minute	
	Production Capacity/hour = $\frac{Vt \times Ef \times 60}{Lf \times Ct2}$	Q2	3.29	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.3037	Hour	
c.	Motor Grader >125 hp	E61			* Spreading, grading
	Expasion length	Ly	50.00	m	
	width of Effective working blade	Bw	2.40	m	
	Equipment Efficiency Factor*	Ef	0.60	-	
	equipment Average Speed	Sa	3.00	km/Hour	
	Number of trip	n1	6.00	Trip	
	Cycle Time, Ct :				
	- levelling 1 Trip = $(Ly \times 60) / (Sa \times 1000)$	T1	1.00	Minute	
	- others	T2	1.00	Minute	Test Result
	Sum	Ct	2.00	Minute	
	Production Capacity/hour = $\frac{Ly \times Bw \times t \times Ef \times 60}{n \times Ct3}$	Q3	54.00	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.0185	Hour	
d.	Tandem Roller 6-8 Ton	E69			Moderate
	Average speed	Sa	3.00	km/Hour	machine :
	Compaction effective width	cw	1.20	m	Moderate
	Number of Trips	n1	4.00	Trip	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
e.	Equipment Efficiency Factor*	Ef	0.65	-	Moderate machine : Moderate
	Production $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q4	87.75	m3	
	Capacity/hour =		0.0114	Hour	
	Equipment Coefficient / m3 = 1 / Q4				
	Water Tank Truck with Pump 5000 liter	E86			
	Water Tank Volume	Vw	5.00	m3	
	Water demand / m3 solid aggregate	Wr	0.07	m3	
	Number of tank fillings / hour	n2	1.00	Times	
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity/hour = $\frac{Vw \times n2 \times Ef}{Wr}$	Q5	46.43	m3/Hour	
	Equipment Coefficient/ m3 = 1 / Q5		0.0215	Hour	
	f. Tools				
	Required				
	- Push cart = 2 Units				
	- Shovel = 3 Units				
	- Fork = 2 Units				
3.	LABOR				Lump Sum
	Determined Production : Wheel Loader	Q1	10.03	m3/Hour	
	Aggregate production/day = $Ew \times Q1$	Qt	70.20	m3	
	Labor Required:				
	- Worker	UL	10.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient/ m3 :				
	- Worker = $(Ew \times UL) / Qt$	L1	0.9972	Hour	
	- Foreman = $(Ew \times FO) / Qt$	L4	0.0997	Hour	

Example: Unit Price Analysis of Aggregate Base Class B , CBR Minimum 35%

PAYMENT ITEM NO. :
 TYPES OF WORK : Aggregate Base Class B , CBR Minimum 35%
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I	ASSUMPTION				
	1. Using Heavy Equipment (Mechanically)				
	2. Work Location : Along the road				
	3. Existing road condition : Moderate				
	4. Average distance from Base Camp to work location	L	3.0	km	
	5. Thickness of aggregate dense layer	t	0.15	m	
	6. Material swell factor	Lf	1.20	-	
	7. effective working hours per day	Ew	7.00	Hour	
	8. Mixture of Proportion :				
	- Course Aggregate	Ak	35.00	%	
	- Fine Aggregate	Ah	20.00	%	
	- Sand-Gravel Mixture	St	45.00	%	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
II.	WORK SEQUENCE				
1.	Wheel Loader mixed and loaded aggregate into Dump Truck at Base Camp				
2.	Dump Truck transports aggregate to work location and spread using Motor Grader				
3.	Aggregate overlay is moistened with Water Tank				
4.	Truck before compacted with Tandem Roller & PTR A group of workers will level the overlay trimmed edge during compaction using Tools				
III.	MATERIAL, LABOR, AND EQUIPMENT USED				
1.	MATERIAL - Course Aggregate = $A_k \times 1 \text{ m}^3 \times L_f$ - Fine Aggregate = $A_h \times 1 \text{ m}^3 \times L_f$ - Sand-Gravel Mixture	M7 M6 M5	0.42 0.24 0.54	m3 m3 m3	
2.	EQUIPMENT				
a.	Wheel Loader 1.8 m3 Bucket Capacity Bucket Factor * Equipment Efficiency Factor** Cycle Time, Ct - Mixing - Loading and others Sum Production Capacity/hour = $\frac{V_b \times B_f \times E_f \times 60}{L_f \times C_t1}$ Equipment Coefficient/ m3 = 1 / Q1	E82 Vb Bf Ef T1 T2 Ct1 Q1	 1.80 1.00 0.65 3.00 2.00 5.00 11.70	 m3 - - Minute Minute Minute m3	Easy Maintenance GOOD Moderate machine : Moderate Test Result Test Result
			0.0855	km/Hour	
b.	Dump Truck 5.5 Ton Truck Capacity Equipment Efficiency Factor* Average speed when loaded Average speed when empty Cycle Time, Ct : - Loading Time = $V_t : Q1 \times 60$ - Travel Time when loaded = $(L : s1) \times 60 \text{ Minute}$ - Travel Time when empty = $(L : s2) \times 60 \text{ Minute}$ - others include unloading the aggregate Sum Production Capacity / Hour = $\frac{V_t \times E_f \times 60}{L_f \times C_t2}$ Equipment Coefficient / m3 = 1 / Q2	E42 Vt Ef s1 s2 T1 T2 T3 T4 Ct2 4.18551	 3.50 0.80 20.00 40.00 17.95 9.00 4.50 2.00 33.45 4.19	 m3 - km/Hour km/Hour Minute Minute Minute Minute Minute m3	Moderate
			0.2389	Hour	
c.	Motor Grader >125 hp Expansion Length Width of Effective working blade Equipment Efficiency Factor* equipment Average Speed Number of Trip Cycle Time, Ct : - Levelling 1 Trip = $(L_y \times 60) : (S_a \times 1000)$ - Others Sum	E61 Ly Bw Ef Sa n1 T1 T2 Ct3	 50.00 2.40 0.60 4.00 6.00 0.75 1.00 1.75	 m m - km/hr Trip Minute Minute Minute	* Spreading, grading 3 times trip

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
	$\text{Production Capacity / Hour} = \frac{Ly \times Bw \times t \times Ef \times 60}{n1 \times Ct3}$	Q3	61.71	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.0162	Hour	
d.	Tandem Roller 6-8 Ton Average Speed Compaction effective width Number of Trips Equipment Efficiency Factor*	E69 Sa cw n1 Ef	3.00 1.20 4.00 0.65	km/Hour m Trip -	Moderate Moderate
	$\text{Production Capacity/Hour} = \frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q4	87.75	m3	
	Equipment Coefficient / m3 = 1 / Q4		0.0114	Hour	
e.	Water Tank Truck with Pump 5000 liter Water Tank Volume Water required / M3 densed aggregate Tank Filling / Hour Equipment Efficiency Factor*	E86 Vw Wr n2 Ef	5.00 0.07 1.0000 0.65	m3 m3 Times -	Moderate machine : Moderate
	$\text{Production Capacity / Hour} = \frac{Vw \times n2 \times Ef}{Wr}$	Q5	46.43	m3	
	Equipment Coefficient / m3 = 1 / Q5		0.0215	Hour	
f.	Tools Required : - Push Cart = 2 units - Shovel = 3 Units - Fork = 2 Units				Lump Sum
3.	LABOR Determined Production : WHEEL LOADER Aggregate Production / day = Ew x Q1 Labor Required: - Worker - Foreman	Q1 Qt UL FO	11.7000 81.90 7.00 1	m3/Hour m3/Hour Person Person	
	Labor Coefficient / m3 : - Worker = (Ew x UL) : Qt - Foreman = (Ew x FO) : Qt	L1 L4	0.5983 0.0855	Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
 TYPES OF WORK : Aggregate Base Class B , CBR Minimum 35%
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.5983	0.63	0.38
	Foreman	Hour	0.0855	1.50	0.13
	Sum of the Labour Cost				0.51
B.	MATERIAL				
	- Course Aggregate	m3	0.4200	25.00	10.50
	- Fine Aggregate	m3	0.2400	23.00	5.52
	- Sand-Gravel Mixture	m3	0.5400	10.00	5.40
	Sum of the Materials Cost				21.42
C.	Equipment				
	Wheel Loader 1.8 m3	Hour	0.0855	65.00	5.56
	Dump Truck 5.5 Ton	Hour	0.2389	33.45	7.99
	Motor Grader >125 hp	Hour	0.0162	90.00	1.46
	Tandem Roller 6-8 Ton	Hour	0.0114	57.50	0.66
	Water Tank Truck with Pump 5000 liter	Hour	0.0215	25.00	0.54
	Tools	Ls	1.0000	0.50	0.50
	Sum of the Equipment Cost				16.70
D.	Work Unit Price (A+B+C)				38.62

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Aggregate Base Class C

PAYMENT ITEM NO. :
 TYPES OF WORK : Aggregate Base Class C
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
	1. Using Heavy Equipment (mechanically)				
	2. Work location: along the road				
	3. Existing Road Condition: MODERATE				
	4. Average distance from Base Camp to work location	L	4.2	km	
	5. Aggregate base thickness	t	0.15	m	
	6. Material Swell Factor	Lf	1.35	-	
	7. Effective Working Hour per day	Ew	7.00	Hour	
II.	WORK SEQUENCE				
	1. Wheel Loader loads Aggregate into dump truck in the base camp;				
	2. Dump Truck transports aggregate to work location and spread the aggregate using motor grader;				
	3. Spreaded aggregates is moistened using Water Tank Truck then the aggregate is compacted using Tandem Roller and PTR;				
	4. A group of workers will level the overlay				
	trimmed edge during compaction using Tools .				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL Material aggregate Class C is produced in base camp Required Aggregate for every 1 m3 = 1 x Lf		1.35	m3	Loose aggregate
2.	EQUIPMENT				*Operation condi :
a.	Wheel Loader, 1.8 m3	E82			Moderate
	Bucket Capacity	Vb	1.80	m3	machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Bucket Factor **	Bf	1.00	-	** Dumping cond.
	Cycle Time, Ct				: Easy
	- Loading	T1	0.25	Minute	Test Result
	- Others	T2	0.25	Minute	Test Result
		Ct1	0.50	Minute	
	Production Capacity / Hour = $\frac{Vb \times Bf \times Ef \times 60}{Lf \times Ct1}$	Q1	104.00	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.0096	Hour	
b.	Dump Truck 5.5 Ton	E42			Moderate
	Tank Capacity	Vt	3.50	m3	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	45.00	km/Hour	
	Average speed when empty	s2	60.00	km/Hour	
	Cycle Time : - Loading Time = Vt : Q1 x 60	T1	2.02	Minute	
	- Travel time when loaded = (L : s1) x 60 Minute	T2	5.60	Minute	
	- Travel time when empty = (L : s2) x 60 Minute	T3	4.20	Minute	
	- Dump, etc.	T4	3.00	Minute	Test Result
		Ct2	14.82	Minute	
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Lf \times Ct2}$	Q2	8.40	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.1191	Hour	
c.	Motor Grader >125 hp	E61			* Spreading, grading
	Length of Spreading	Ly	50.00	m	
	Working blade effective width	Bw	2.40	m	
	Equipment Efficiency Factor*	Ef	0.60	-	
	equipment Average Speed	Sa	4.00	km/Hour	
	Number of trips	n1	6.00	Trip	3 x pp
	Cycle Time :	Ct3			
	- Levelling for 1 Trip = (Ly x 60) : (Sa x 1000)	T1	0.75	Minute	Test Result
	- Others	T2	1.00	Minute	Test Result
		Ct3	1.75	Minute	
	Production Capacity / Hour = $\frac{Ly \times Bw \times t \times Ef \times 60}{n1 \times Ct3}$	Q3	61.71	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.0162	Hour	
d.	Vibratory Drum Roller 3-5 Ton	E73			Moderate
	Average speed	Sa	2.50	km / Hour	machine :
	Compaction effective width	cw	1.20	m	Moderate
	Number of trips	n1	8.00	Trip	
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity/Hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q4	36.56	m3	

e.	Equipment Coefficient / m3 = 1 / Q4 Pneumatic Tire Roller 10 Ton Equipment Average Speed Compaction effective width Number of trips Equipment Efficiency Factor* Production Capacity/Hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$ Equipment Coefficient / m3 = 1 / Q5	E71 Sa cw n1 Ef Q5	0.0274 5.00 1.50 4.00 0.65 182.81	Hour km / Hour m Trip - m3	Moderate machine : Moderate
f.	Water Tank Truck with Pump 5000 liter Water Tank Volume Water needed / m3 densed aggregate Tank filled/ Hour Equipment Efficiency Factor* Production Capacity / Hour = $\frac{Vw \times n2 \times Ef}{Wr}$ Equipment Coefficient / m3 = 1 / Q6	E86 Vw Wr n2 Ef Q6	5.00 0.01 1.00 0.65 325.00	Hour m3 m3 Times - m3	Moderate machine : Moderate
g.	Tools Required : - Push Cart = 2 units - Shovel = 3 units - Fork = 2 Units				Lump Sum
3.	LABOR Determined Production : WHEEL LOADER Aggregate production/ day = Ew x Q1 Labor Required - Worker - Foreman Labor Coefficient / m3 : - Worker = (Ew x UL) : Qt - Foreman = (Ew x FO) : Qt	Q1 Qt UL FO L1 L4	104.00 728.00 7.00 1.00 0.0673 0.0096	m3/Hour m3 Person Person Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Aggregate base class C
PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0673	0.63	0.04
	Foreman	Hour	0.0096	1.50	0.01
	Sum of the Labour Cost				0.06
B.	MATERIAL				
	Aggregate Class C1	m3	1.3500	20.00	27.00
	Sum of the Materials Cost				27.00

C.	EQUIPMENT				
	Wheel Loader, 1.8 m3	Hour	0.0096	65.00	0.63
	Dump Truck 5.5 Ton	Hour	0.1191	33.45	3.98
	Motor Grader >125 hp	Hour	0.0162	90.00	1.46
	Vibratory Drum Roller 3-5 Ton	Hour	0.0274	62.00	1.70
	Pneumatic Tire Roller 10 Ton	Hour	0.0055	70.00	0.38
	Water Tank Truck with Pump 5000 liter	Hour	0.0031	25.00	0.08
	Tools	LS	1.0000	0.50	0.50
Sum of the Equipment Cost					8.72
D.	Work Unit Price (A+B+C)				35.78

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Examples Unit Price Analysis for Aggregates Cover BURTU (Sprinkling a layer of asphalt)

PAYMENT ITEM NO. :
 TYPES OF WORK : Aggregate Cover (Sprinkling a layer of asphalt)
 PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Asphalt is not included in this work				
5	Average distance from Base Camp to work location	L	4.0	km	
6	Effective Working Hour per day	Ew	7.00	Hour	
7	Material Compactness factor	Sf	1.15	-	
8	Spread thickness / dense layer	t	1.50	cm	
9	Layer composed of (based on specification) : - Using measured material	Ld	1.30	cm	
II.	WORK SEQUENCE				
1	Wheel Loader loads the aggregate into dump truck in the base camp				
2	Dump Truck transports the aggregate to work location and immediately spread them manually ;				
3	Spread material is compacted using Pneumatic Tire Roller				
4	A group of workers will level the overlay trimmed edge during compaction using Tools.				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Chipping Aggregate Aggregate Chipping Density	Vdc	1.90		
	Volume Chipping per m2 $= \{ (t/100) \times 1 \text{ m}^2 \times Sf \} \times Vdc \times 1000$		33	kg	
2.	EQUIPMENT				
a.	Wheel Loader, 1.8 m3	E82			
	Bucket Capacity	Vb	1.80	m3	Moderate machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Bucket Factor **	Bf	1.00	-	Easy
	Cycle Time :	Ct			
	- Loading	T1	1.50	Minute	Test Result
	- Others	T2	0.50	Minute	Test Result

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
 TYPES OF WORK : Aggregate Cover (Sprinkling a layer of asphalt)
 PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0410	0.63	0.03
	Foreman	Hour	0.0021	1.50	0.00
	Sum of the Labour Cost				0.03
B.	MATERIAL				
	Chipping	kg	32.7750	2.00	65.55
	Sum of the Materials Cost				65.55
C.	EQUIPMENT				
	Wheel Loader, 1.8 m3	Hour	1.5000	65.00	97.50
	Dump Truck 5.5 Ton	Hour	0.0005	33.45	0.02
	Pneumatic Tire Roller, 10 Ton	Hour	0.0021	70.00	0.14
	Tools	LS	1.0000	0.50	0.50
	Sum of the Equipment Cost				98.16
D.	Work Unit Price (A+B+C)				163.74

Note :

1The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2The unit cost for equipment including fuel, used material and the operator's Cost.

3Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Examples Unit Price Analysis for Aggregates Cover BURDA (Sprinkling of two layers of asphalt)

PAYMENT ITEM NO. :
 TYPES OF WORK : Aggregate Cover (Sprinkling of two layers of asphalt)
 PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Asphalt is not included in this work				
5	Average distance from Base Camp to work location	L	4.0	km	
6	Effective Working Hour per day	Ew	7.00	Hour	
7	Material Compactness factor	Sf	1.15	-	
8	Spread thickness / densed layer	t	2.50	cm	
9	Layer composition (based on specification) :				
	- First layer size = 13 mm				
	- Second layer size	Ld	6.00	mm	
II.	WORK SEQUENCE				
1	Wheel Loader loads the aggregate into dump truck in the base camp				
2	Dump Truck transports the aggregate to work location and immediately spread them manually				
3	Spread material is compacted using Pneumatic Tire Roller				
4	A group of workers will level the overlay trimmed edge during compaction using Tools				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
III. 1.	MATERIALS, EQUIPMENT AND LABORS USED				
	MATERIAL				
	Aggregate Chipping Density	Vdc	1.90		
	Chipping First Layer				
	ALD = between 6.4 - 9.5 mm	ALD	6.70	-	
	Proportion = $\frac{666}{ALD}$ m2/m3	V1	99.40	m2/m3	
	Volume per m2 = 1/V1	V2	0.0101	m3	
	Densed material required = Sf x V2	B1	0.0116	m3	
	Chipping Second Layer				
	Required densed material / m2 = Sf x Ld : 1000	B2	0.0069	m3	
	Total Chipping per m2 = (B1 + B2) * Vdc * 1000	Bt	35	kg	
	EQUIPMENT				
	Wheel Loader, 1.8 m3	E82			
	Bucket Capacity	Vb	1.80	m3	Moderate
	Equipment Efficiency Factor*	Ef	0.65	-	machine :
	Bucket Factor **	Bf	1.00	-	Moderate
	Cycle Time	Ct1			Easy
	- Loading	T1	1.50	Minute	Test Result
	- Others	T2	0.50	Minute	Test Result
		Ct1	2.00	Minute	
	Production $\frac{Vb \times Bf \times Ef \times 60 \times 100}{Sf \times Ct \times t}$	Q1	1,220.87	m2/Hour	
	Capacity / Hour =				
	Equipment Coefficient / m2 = 1 / Q1		0.0008	Hour	
	b. Dump Truck 5.5 Ton	E42			Moderate
	Tank Capacity	Vt	3.50	m3	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km/Hour	
	Average speed when empty	s2	50.00	km/Hour	
	Cycle Time	Ct2			
	- Travel time when loaded = (L : s1) x 60 Minute	T1	6.00	Minute	
	- Travel time when empty = (L : s2) x 60 Minute	T2	4.80	Minute	
	- Waktu Loading = Vt : (Q1 x t/100) x 60	T3	6.88	Minute	
	- Spreading, Waiting, and others	T4	50.00	Minute	Test Result
		Ct2	67.68	Minute	
	Production $\frac{Vt \times Ef \times 60 \times 100}{Sf \times Ct2 \times t}$	Q2	86.34	m2/Hour	
	Capacity / Hour =				
	Equipment Coefficient / m2 = 1 / Q2		0.0116	Hour	
	c. Pneumatic Tire Roller, 10 Ton	E71			Moderate
	Average speed	Sa	4.00	km/Hour	machine :
	Compaction effective width	cw	1.50	m	Moderate
	Number of trips /day	n1	8.00	Trip	
	Equipment Efficiency Factor*	Ef	0.75		

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	Production Capacity / Hour $\frac{(Sa \times 1000) \times cw \times Ef}{n1 \times 2}$ = Equipment Coefficient / m2 = 1 / Q3	Q3	281.25 0.0036	m2 Hour	Lump Sum
	d. Tools				
	Required :				
	- Push Cart = 2 units				
	- Shovel = 3 units				
	- Broom stick = 2 units				
	LABOR				
	Determined Production : PNEUMATIC TIRE ROLLER	Q3	281.25	m2/Hour	
	Production/ day = Ew x Q3	Qt	1,968.75		
	Labor Required :				
	- Worker	UL	20.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient / m2 :				
	- Worker = (Ew x UL) / Qt	L1	0.0711	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.0036	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :

TYPES OF WORK : Aggregate Cover (Sprinkling of two layers of asphalt)

PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0711	0.63	0.04
	Foreman	Hour	0.0036	1.50	0.01
	Sum of the Labour Cost				0.05
B.	MATERIAL				
	Chipping	kg	35.0912	2.00	70.18
	Sum of the Materials Cost				70.18
C.	EQUIPMENR				
	Wheel Loader, 1.8 m3	Hour	0.0008	65.00	0.05
	Dump Truck 5.5 Ton	Hour	0.0116	33.45	0.39
	Pneumatic Tire Roller, 10 Ton	Hour	0.0036	70.00	0.25
	Tools	LS	1.0000	0.50	0.50
	Sum of the Equipment Cost				1.19
D.	Work Unit Price (A+B+C)				71.42

Note :

- The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- The unit cost for equipment including fuel, used material and the operator's Cost.
- Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Latasir (Tin layer Asphalt-Sand) Class A

PAYMENT ITEM NO. :
 TYPES OF WORK : Asphalt-Sand Sheet Class A
 PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Average distance from Base Camp to work location	L	4.0	km	
5	Sand sheet thickness	t	0.015	m	
6	Effective Working Hour per day	Ew	7.00	Hour	
7	Material Loss factor : - Aggregate	Lf1	1.05	-	
	- Asphalt	Lf2	1.03	-	
8	Sand sheet class A mixture composition				Gradation should meet specification
	- Course Aggregate	CA	7.80	%	
	- Fine Aggregate	FA	82.00	%	
	- Asphalt minimum 10 %	As	10.20	%	
9	Material Density:				
	- Sand sheet Class A	Vd1	2.20	Ton / m3	
	- Course Aggregate & Fine Aggregate	Vd2	1.80	Ton / m3	
	- Asphalt	Vd3	1.03	Ton / m3	
II.	WORK SEQUENCE				
1	Wheel Loader loads Aggregate and Asphalt into				
	Cold Bin AMP				
2	Aggregate and Asphalt are mixed and heated in AMP and load immediately to dump truck and transport to work location				
3	Sand sheet mixture is spreaded with Finisher and densed using Tandem & Pneumatic Tire Roller				
4	A group of workers will level the overlay trimmed edge during compaction using Tools				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Course Aggregate = $(CA/100 \times (Vd1 \times t \text{ m3}) \times Lf1) : Vd2$	M7	0.0015	m3	
b.	Fine Aggregate = $(FA/100 \times (Vd1 \times t \text{ m3}) \times LF1) : Vd2$	M6	0.0158	m3	
d.	Asphalt = $(AS/100 \times (Vd1 \times t \text{ m3}) \times Lf2) \times 1000$	M18	3.4670	kg	
2.	EQUIPMENT				
a.	Wheel Loader 1.8 m3	E82			Moderate machine :
	Bucket Capacity	V	1.80	m3	
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Bucket Factor **	Bf	1.00	-	Easy
	Cycle Time	Ct1			
	- Loading	T1	1.50	Minute	Test Result
	-Others	T2	0.50	Minute	Test Result

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
	$\text{Production Capacity / Hour} = \frac{Vd2 \times V \times Bf \times Ef \times 60}{Vd1 \times t \times Ct1}$	Ct1	2.00	Minute	
		Q1	1,914.55	m2	
	Equipment Coefficient / m2 = 1 / Q1		0.0005	Hour	
b.	Asphalt mixing Plant	E1			Moderate
	Production Capacity	V	50.00	Ton / Hour	machine : Moderate
	Equipment Efficiency Factor*	Ef	0.65	-	
	$\text{Production Capacity / Hour} = \frac{V \times Ef}{Vd1 \times t}$	Q2	984.85	m2	
	Equipment Coefficient / m2 = 1 / Q2		0.0010	Hour	
c.	Generator Set	E56			
	Production capacity / Hour = AMP	Q3	984.85	m2	
	Equipment Coefficient / m2 = 1 / Q3		0.0010	Hour	
d.	Dump Truck 5.5 Ton	E42			Moderate
	Tank Capacity	Vt	5.50	Ton	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km/Hour	
	Average speed when empty	s2	50.00	km/Hour	
	AMP capacity / batch	Q2b	0.50	Ton	
	Preparation time for 1 batch sand sheet	Tb	1.00	Minute	
	Cycle Time	Ct2			
	- Filling tank = (V : Q2b) x Tb	T1	11.00	Minute	
	- Loading = (L : s1) x 60 Minute	T2	6.00	Minute	
	- Waiting + Dumping + Rotating	T3	15.00	Minute	
	- Returned = (L : s2) x 60 Minute	T4	4.80	Minute	Test Result
	$\text{Production Capacity / Hour} = \frac{V \times Fa \times 60}{D1 \times t \times Ts2}$	Ct2	36.80	Minute	
		Q4	217.39	m2	
	Equipment Coe = 1 / Q4		0.0046	Hour	
e.	Asphalt Finisher 4 m width	E2			*Operation condi : Moderate
	Production Capacity	V	40.00	Ton/Hour	Maintenance of machine : Moderate
	Equipment Efficiency Factor*	Ef	0.75	-	
	$\text{Production Capacity / Hour} = \frac{V \times Fa}{D1 \times t}$	Q5	909.09	m2	
	Equipment Coefficient / m2 = 1 / Q5		0.0011	Hour	
f.	Tandem Roller 6-8 Ton	E69			Moderate
	equipment Average Speed	Sa	3.50	km/Hour	machine :

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	Compaction effective width	cw	1.20	m	Moderate
	Number of trips	n1	6.00	Trip	
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity / Hour $\frac{(Sa \times 1000) \times cw \times Ef}{n1}$	Q6	455.00	m2	Moderate machine : Moderate
	Equipment Coefficient / m2 = 1 / Q6		0.0022	Hour	
	g. Pneumatic Tire Roller 10 Ton	E71			
	equipment Average Speed	Sa	5.00	km/Hour	Moderate machine : Moderate
	Compaction effective width	cw	1.50	m	
	number of trips	n1	8.00	Trip	
	Equipment Efficiency Factor*	Ef	0.65	-	Lump Sum
	Production Capacity / Hour $\frac{(Sa \times 1000) \times cw \times Ef}{n1}$	Q7	609.38	m2	
	Equipment Coefficient / m2 = 1 / Q7		0.0016	Hour	
	h. Tools				
	Required :				
	- Push Cart = 2 Units				
	- Shovel = 3 Units				
	- Fork = 2 Units				
	- Control stick for Thickness layer				
	LABOR				
	Determined Production : Asphalt mixing Plant (AMP)	Q2	984.85	m2/Hour	
	Sand sheet production / day = Ew x Q2	Qt	6,893.94	m2	
	Labor Required				
	- Worker	UL	7.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient/ m2 :				
	- Worker = (Ew x UL) / Qt	L1	0.0071	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.0010	Hour	

**STANDARD FORM
ANALYSIS FOR EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Asphalt-Sand Sheet Class A
 PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0071	0.63	0.00
	Foreman	Hour	0.0010	1.50	0.00
	Sum of the Labour Cost				0.01
B.	MATERIAL				
	Course Aggregate	m3	0.0015	25.00	0.04
	Fine Aggregate	m3	0.0158	23.00	0.36
	Asphalt	kg	3.4670	2.00	6.93
	Sum of the Materials Cost				7.33

C.	EQUIPMENT				
	Wheel Loader 1.8 m3	Hour	0.0005	65.00	0.03
	Asphalt mixing Plant	Hour	0.0010	400.00	0.41
	Generator Set	Hour	0.0010	50.00	0.05
	Dump Truck 5.5 Ton	Hour	0.0046	33.45	0.15
	Asphalt Finisher 4 m width	Hour	0.0011	120.00	0.13
	Tandem Roller 6-8 Ton	Hour	0.0022	57.50	0.13
	Pneumatic Tire Roller 10 Ton	Hour	0.0016	70.00	0.11
D.	Tools	Ls	1.0000	0.50	0.50
	Sum of the Equipment Cost				1.52
	Work Unit Price (A+B+C)				8.86

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Latasir (Tin layer Asphalt-Sand) Class B

PAYMENT ITEM NO. :
 TYPES OF WORK : Asphalt-Sand Sheet Class B
 PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Average distance from Base Camp to work location	L	4.0	km	
5	Sand sheet thickness	t	0.015	m	
6	Effective Working Hour per day	Ew	7.00	Hour	
7	Material Loss factor : - Aggregate - Asphalt	Lf1 Lf2	1.05 1.03	- -	
8	Sand sheet class mixture composition - Course Aggregate - Fine Aggregate - Asphalt minimum 9%	CA FA As	15.00 76.00 9.00	% % %	Gradation should meet specification
9	Material Density: - Sand sheet A - Course Aggregate & Fine Aggregate - Asphalt	Vd1 Vd2 Vd3	2.20 1.80 1.03	Ton / m3 Ton / m3 Ton / m3	
II.	WORK SEQUENCE				
1	Wheel Loader loads Aggregate and Asphalt into Cold Bin AMP				
2	Aggregate and Asphalt are mixed and heated in AMP and load immediately to dump truck and transport to work location				
3	Sand sheet mixture is spreaded with Finisher and densed using Tandem & Pneumatic Tire Roller				
4	A group of workers will level the overlay trimmed edge during compaction using Tools				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Course Aggregate = (CA/100 x (Vd1 x t m3) x Lf1) : Vd2	M7	0.0029	m3	
b.	Fine Aggregate = (FA/100 x (Vd1 x t m3) x LF1) : Vd2	M6	0.0146	m3	
d.	Asphalt = (AS/100 x (Vd1 x t m3) x Lf2) x 1000	M18	3.0591	kg	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
2.	EQUIPMENT				
	a. Wheel Loader 1.8 m3	E82			
	Bucket Capacity	V	1.80	m3	Moderate machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Bucket Factor **	Bf	1.00	-	Easy
	Cycle Time	Ct1			
	- Loading	T1	1.50	Minute	Test Result
	- Others	T2	0.50	Minute	Test Result
		Ct1	2.00	Minute	
	Production Capacity/Hour = $\frac{Vd2 \times Vb \times Bf \times Ef \times 60}{Vd1 \times t \times Ct1}$	Q1	1,914.55	m2	
	Equipment Coefficient / m2 = 1 / Q1		0.0005	Hour	
	b. Asphalt Mixing Plant	E1			
	Production Capacity	V	50.00	Ton/Hour	Moderate machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Production Capacity/Hour = $\frac{V \times Ef}{Vd1 \times t}$	Q2	984.85	m2	
	Equipment Coe = 1 / Q2		0.0010	Hour	
	c. Generator Set	E56			
	Production Capacity / Hour = AMP	Q3	984.85	m2	
	Equipment Coefficient / m2 = 1 / Q3		0.0010	Hour	
	d. Dump Truck 5.5 Ton	E42			* Work Condition : Moderate
	Tank Capacity	Vt	5.50	Ton	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km/Hour	
	Average speed when empty	s2	50.00	km/Hour	
	AMP Capacity / batch	Q2b	0.50	Ton	
	Preparation time for 1 batch sand sheet	Tb	1.00	Minute	
	Cycle Time	Ct2			
	- Filling tank = (Vt : Q2b) x Tb	T1	11.00	Minute	
	-Loading = (L : s1) x 60 Minute	T2	6.00	Minute	
	- Waiting + Dumping + Rotating	T3	15.00	Minute	
	-Returned = (L : s2) x 60 Minute	T4	4.80	Minute	Test Result
		Ct2	36.80	Minute	
	Production Capacity/Hour = $\frac{Vt \times Ef \times 60}{Vd1 \times t \times Ct2}$	Q4	217.39	m2	
	Equipment Coefficient / m2 = 1 / Q4		0.0046	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
e.	Asphalt Finisher 4 m width Production Capacity Equipment Efficiency Factor* $\text{Production Capacity/Hour} = \frac{V \times Ef}{Vd1 \times t}$ Equipment Coefficient / m2 = 1 / Q5	E2 V Ef Q5	40.00 0.65 787.88 0.0013	Ton / Hour - m2 Hour	Moderate Maintenance of machine : Moderate
f.	Tandem Roller 6-8 Ton equipment Average Speed Compaction Effective width Number of trips Equipment Efficiency Factor* $\text{Production Capacity /Hour} = \frac{(Sa \times 1000) \times cw \times Ef}{n1}$ Equipment Coefficient / m2 = 1 / Q6	E69 Sa cw n1 Ef Q6	3.50 1.20 6.00 0.65 455.00 0.0022	km / Hour m Trip - m2 Hour	Moderate machine : Moderate
g.	Pneumatic Tire Roller 10 Ton Average speed Compaction effective width Number of trips Equipment Efficiency Factor* $\text{Production Capacity /Hour} = \frac{(Sa \times 1000) \times cw \times Ef}{n1}$ Equipment Coefficient / m2 = 1 / Q7	E71 Sa cw n1 Ef Q7	5.00 1.50 8.00 0.65 609.38 0.0016	km / Hour m Trip - m2 Hour	condi : of machine : Moderate
h.	Tools Required : - Push Cart = 2 Units - Shovel = 3 Units - Fork = 2 Units - Control stick for Thickness layer				Lump Sum
3.	LABOR Determined Production : Asphalt mixing Plant (AMP) Sand Sheet production / day = Ew x Q2 Labor Required - Worker - Foreman Labor Coefficient / m2 : - Worker = (Ew x UL) / Qt - Foreman = (Ew x FO) / Qt	Q2 Qt UL FO L1 L4	984.85 6,893.94 7.00 1.00 0.0071 0.0010	m2/Hour m2 Person Person Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Asphalt-Sand Sheet Class B
PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0071	0.63	0.00
	Foreman	Hour	0.0010	1.50	0.00
	Sum of the Labour Cost				0.01
B.	MATERIAL				
	Course Aggregate	m3	0.0029	25.00	0.07
	Fine Aggregate	m3	0.0146	23.00	0.34
	Asphalt	kg	3.0591	2.00	6.12
Sum of the Materials Cost				6.53	
C.	EQUIPMENT				
	Wheel Loader 1.8 m3	Hour	0.0005	65.00	0.03
	Asphalt Mixing Plant	Hour	0.0010	400.00	0.41
	Generator Set	Hour	0.0010	50.00	0.05
	Dump Truck 5.5 Ton	Hour	0.0046	33.45	0.15
	Asphalt Finisher 4 m width	Hour	0.0013	120.00	0.15
	Tandem Roller 6-8 Ton	Hour	0.0022	57.50	0.13
	Pneumatic Tire Roller 10 Ton	Hour	0.0016	70.00	0.11
	Tools	Ls	1.0000	0.50	0.50
Sum of the Equipment Cost				1.54	
D.	Work Unit Price (A+B+C)				8.07

Note :

1

The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2

The unit cost for equipment including fuel, used material and the operator's Cost.

3

Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Lataston (Hot Rolled Sheet / HRS)

PAYMENT ITEM NO. :
TYPES OF WORK : Lataston (HRS)
PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Average distance from Base Camp to work location	L	4.0	km	
5	Tebal Lapis (HRS) padat	t	0.03	m	
6	Effective Working Hour per day	Ew	7.00	Hour	
7	Material Loss factor : - Aggregate - Asphalt	Lf1 Lf2	1.05 1.03	- -	
8	HRS Mixture Composition - Course Aggregate - Fine Aggregate - Asphalt	CA FA As	45.00 47.50 7.50	% % %	Gradation should meet specification
9	Material Density: - HRS	Vd1	2.24	Ton / m3	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
	- Course Aggregate & Fine Aggregate	Vd2	1.80	Ton / m3	
	- Fraction Filler	Vd3	2.00	Ton / m3	
	- Asphalt	Vd4	1.03	Ton / m3	
II.	WORK SEQUENCE				
1	Wheel Loader loads Aggregate and Asphalt into Cold Bin AMP				
2	Aggregate and Asphalt are mixed and heated in AMP and load immediately to dump truck and transport to work location;				
3	HRS hot mixture is spreaded using finisher and compacted using Tandem (Start & Finish) and Pneumatic Tire Roller (Intermediate Rolling)				
4	A group of workers will level the overlay trimmed edge				
	during compaction using Tools				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Course Aggregate = $(CA \times (Vd1 \times t \text{ m3}) \times Lf1) : Vd2$	CA	0.018	m3	
b.	Fine Aggregate = $(FA \times (Vd1 \times t \text{ m3}) \times Lf1) : Vd2$	FA	0.019	m3	
d.	Asphalt = $(AS \times (Vd1 \times t \text{ m3}) \times Lf2) \times 1000$	AS	5.191	kg	
2.	EQUIPMENT				
a.	Wheel Loader 1.8 m3	E82			Moderate
	Bucket Capacity	V	1.80	m3	machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Bucket Factor **	Bf	1.00	-	Easy
	Cycle Time	Ct1			
	- Loading	T1	1.50	Minute	Test Result
	- Others	T2	0.50	Minute	Test Result
		Ct1	2.00	Minute	
	Production Capacity / Hour = $\frac{Vd2 \times Vb \times Lf1 \times Ef \times 60}{Vd1 \times t \times Ct1}$	Q1	940.18	m2	
	Equipment Coefficient / m2 = $1 / Q1$		0.0011	Hour	
b.	Asphalt Mixing Plant	E1			*Operation condi : Moderate
	Production Capacity	V	50.00	Ton / Hour	Maintenance of machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Production Capacity / Hour = $\frac{V \times Ef}{Vd1 \times t}$	Q2	483.63	m2	
	Equipment Coefficient / m2 = $1 / Q2$		0.0021	Hour	
c.	Generator Set	E56			
	Production capacity. / Hour = AMP	Q3	483.63	m2	
	Equipment Coefficient / m2 = $1 / Q3$		0.0021	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
d.	Dump Truck 5.5 Ton	E42			Moderate
	Tank Capacity	Vt	5.50	Ton	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km / Hour	
	Average speed when empty	s2	50.00	km / Hour	
	AMP Capacity / batch	Q2b	0.50	Ton	
	Preparation time for 1 batch HRS	Tb	1.00	Minute	
	Cycle Time	Ct2			
	- Tank Filling = (Vt : Q2b) x Tb	T1	11.00	Minute	
	- Loading = (L : s1) x 60	T2	6.00	Minute	
	- waiting + dumping + rotating	T3	15.00	Minute	Test Result
	- Returned = (L : s2) x 60	T4	4.80	Minute	
		Ct2	36.80	Minute	
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Vd1 \times t \times Ct2}$	Q4	106.75	m2	
e.	Equipment Coefficient / m2 = 1 / Q4		0.0094	Hour	
	Asphalt Finisher 4 m width	E2			*Operation condi : Moderate
	Production Capacity	V	40.00	Ton / Hour	Maintenance of machine : Moderate
	Equipment Efficiency Factor*	Ef	0.65	-	
f.	Production Capacity / Hour = $\frac{V \times Ef}{Vd1 \times t}$	Q5	386.90	m2	
	Equipment Coefficient / m2 = 1 / Q5		0.0026	Hour	
	Tandem Roller 6-8 Ton	E69			Moderate
	Equipment Average Speed	Sa	3.50	km / Hour	machine : Moderate
g.	Compaction effective width	cw	1.20	m	4 starts & 4 finishes
	number of trips	n1	8.00	Trip	
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity / Hour = $\frac{(Sa \times 1000) \times cw \times Ef}{n1}$	Q6	341.25	m2	
g.	Equipment Coefficient / m2 = 1 / Q6		0.0029	Hour	
	Pneumatic Tire Roller 10 Ton	E71			*Operation condi : Moderate
	Average speed	Sa	5.00	km / Hour	Maintenance of machine : Moderate
	Compaction effective width	cw	1.50	m2	
g.	Number of trips	n1	8.00	Trip	
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity / Hour = $\frac{(Sa \times 1000) \times cw \times Ef}{n1}$	Q7	609.38	m2	
	Equipment Coefficient / m2 = 1 / Q7		0.0016	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	h. Tools Required : - Push Cart = 2 Units - Shovel = 3 Units - Fork = 2 Units - Control stick for thickness layer				Lump Sum
	LABOR Determined Production : Asphalt Mixing Plant (AMP) HRS production / day = Ew x Q2 Labor Required	Q2 Qt	483.63 3,385.42	m2/Hour m2	
	- Worker	UL	7.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient / m2 :				
	- Worker = (Ew x UL) / Qt	L1	0.0145	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.0021	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Lataston (HRS)
 PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0145	0.63	0.01
	Foreman	Hour	0.0021	1.50	0.00
	Sum of the Labour Cost				0.01
B.	MATERIAL				
	Course Aggregate	m3	0.0176	25.00	0.44
	Fine Aggregate	m3	0.0186	23.00	0.43
	Asphalt	kg	5.1912	2.00	10.38
	Sum of the Materials Cost				11.25
C.	EQUIPMENT				
	Wheel Loader 1.8 m3	Hour	0.0011	65.00	0.07
	Asphalt Mixing Plant	Hour	0.0021	400.00	0.83
	Generator Set	Hour	0.0021	50.00	0.10
	Dump Truck 5.5 Ton	Hour	0.0094	33.45	0.31
	Asphalt Finisher 4 m width	Hour	0.0026	120.00	0.31
	Tandem Roller 6-8 Ton	Hour	0.0029	57.50	0.17
	Pneumatic Tire Roller 10 Ton	Hour	0.0016	70.00	0.11
	Tools	Ls	1.0000	0.50	0.50
	Sum of the Equipment Cost				2.41
D.	Work Unit Price (A+B+C)				13.67

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Asphalt Treated Base (ATB)

PAYMENT ITEM NO. :

TYPES OF WORK : Asphalt Treated Base (ATB)

PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Average distance from Base Camp to work location	L	4.0	km	
5	Asphalt Treated base thickness	t	0.04	m	
6	Effective Working Hour per day	Ew	7.00	Hour	
7	Material Loss factor : - Aggregate	Lf1	1.10	-	
	- Asphalt	Lf2	1.05	-	
8	Asphalt Treated base mixture composition:				
	- Course Aggregate	CA	55.00	%	Gradation should meet specification
	- Fine Aggregate	FA	38.50	%	
	- Asphalt minimum 6 %	As	6.50	%	
9	Material density :				
	- ATB	Vd1	2.30	Ton / m3	
	- Course Aggregate & Fine Aggregate	Vd2	1.80	Ton / m3	
	- Asphalt	Vd3	1.03	Ton / m3	
II.	WORK SEQUENCE				
1	Wheel Loader loads Aggregate and Asphalt into Cold Bin AMP				
2	Aggregate and Asphalt are mixed and heated in AMP and load immediately to dump truck and transport to work location;				
3	ATB hot mixture is spreaded using finisher and compacted using Tandem (Start & Finish) and Pneumatic Tire Roller (Intermediate Rolling)				
4	A group of workers will level the overlay trimmed edge during compaction using Tools				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Course Aggregate = (CA x (Vd1 x 1 m3) x Lf1) : Vd2	M7	0.773	m3	
b.	Fine Aggregate = (FA x (Vd1 x 1 m3) x Lf1) : Vd2	M6	0.541	m3	
d.	Asphalt = (AS x (Vd1 x 1 m3) x Lf2) x 1000	M18	156.975	kg	
2.	EQUIPMENT				
a.	Wheel Loader 1.8 m3	E82			Moderate
	Bucket Capacity	V	1.80	m3	machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Bucket Factor **	Bf	1.00	-	Easy
	Cycle Time, Ct				
	- Loading	T1	1.50	Minute	Test Result
	- Others	T2	0.50	Minute	Test Result
		Ct1	2.00	Minute	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
	$\text{Production Capacity / Hour} = \frac{Vd2 \times V \times Lf \times Ef \times 60}{Vd1 \times Ct1}$	Q1	27.47	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.0364	Hour	
b.	Asphalt Mixing Plant	E1			
	Production Capacity	V	50.00	Ton / Hour	Moderate machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	$\text{Production Capacity / Hour} = \frac{V \times Ef}{Vd1}$				
	Equipment Coefficient / m3 = 1 / Q2		0.0708	Hour	
c.	Generator Set	E56			
	Production capacity/ Hour = AMP	Q3	14.13	m2	
	Equipment Coefficient / m3 = 1 / Q3		0.0708	Hour	
d.	Dump Truck 5.5 Ton	E42			Moderate
	Truck Capacity	Vt	5.50	Ton	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km / Hour	
	Average speed when empty	s2	50.00	km / Hour	
	AMP capacity/ batch	Q2b	0.50	Ton	
	Preparation time for 1 batch ATB	Tb	1.00	Minute	Test Result
	Cycle Time	Ct2			
	- Tank Filling = (V : Q2b) x Tb	T1	11.00	Minute	
	- Loading = (L : s1) x 60 Minute	T2	6.00	Minute	
	- Waiting + dumping + rotating	T3	15.00	Minute	Test Result
	- Returned = (L : s2) x 60 Minute	T4	4.80	Minute	
	$\text{Production Capacity / Hour} = \frac{Lt \times Ef \times 60}{Vd1 \times Ct2}$	Ct2	36.80	Minute	
	Equipment Coefficient / m3 = 1 / Q4	Q4	3.12	m3	
	Equipment Coefficient / m3 = 1 / Q4		0.3206	Hour	
e.	Asphalt Finisher 4 m width	E2			
	Production Capacity	V	50.00	Ton / Hour	Moderate maintenance or machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	$\text{Production Capacity / Hour} = \frac{V \times Ef}{Vd1}$				
	Equipment Coefficient / m3 = 1 / Q5		0.0708	Hour	
f.	Tandem Roller 6-8 Ton	E69			
	equipment Average Speed	Sa	3.50	km / Hour	Moderate machine :
	Compaction effective width	cw	1.20	m	Moderate
	Number of trips	n1	8.00	Trip	4 starts & 4 finish
	Equipment Efficiency Factor*	Ef	0.65	-	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	$\text{Production Capacity / Hour} = \frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$ Equipment Coefficient / m3 = 1 / Q6	Q6	13.65	m3	
	g. Pneumatic Tire Roller 10 Ton	E71		Hour	
	Average speed	Sa	5.00	km / Hour	Moderate
	Compaction effective width	cw	1.50	m	Maintenance of machine :
	Number of trips	n1	8.00	Trip	Moderate
	Equipment Efficiency Factor*	Ef	0.65	-	
	$\text{Production Capacity / Hour} = \frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$ Equipment Coefficient / m3 = 1 / Q7	Q7	24.38	m3	
	h. Tools			Hour	
	Required :				Lump Sum
	- Push Cart = 2 Units				
	- Shovel = 3 Units				
	- Fork = 2 Units				
	- Control stick for thickness layer				
	LABOR				
	Determined Production : Asphalt Mixing Plant (AMP)	Q2	14.13	m3/Hour	
	ATB Production / day = Ew x Q2	Qt	98.91	m3	
	Labor Required :				
	- Worker	UL	7.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient / m3 :				
	- Worker = (Ew x UL) / Qt	L1	0.4954	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.0708	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :

TYPES OF WORK : Asphalt Treated Base (ATB)

PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.4954	0.63	0.31
	Foreman	Hour	0.0708	1.50	0.11
	Sum of the Labour Cost				0.42
B.	MATERIAL				
	Course Aggregate	m3	0.7731	25.00	19.33
	Fine Aggregate	m3	0.5411	23.00	12.45
	Asphalt	kg	156.9750	2.00	313.95
	Sum of the Materials Cost				345.72

C.	EQUIPMENT				
	Wheel Loader 1.8 m3	Hour	0.0364	65.00	2.37
	Asphalt Mixing Plant	Hour	0.0708	400.00	28.31
	Generator Set	Hour	0.0708	50.00	3.54
	Dump Truck 5.5 Ton	Hour	0.3206	33.45	10.72
	Asphalt Finisher 4 m width	Hour	0.0708	120.00	8.49
	Tandem Roller 6-8 Ton	Hour	0.0733	57.50	4.21
	Pneumatic Tire Roller 10 Ton	Hour	0.0410	70.00	2.87
	Tools	Ls	1.0000	0.50	0.50
	Sum of the Equipment Cost				61.01
D.	Work Unit Price (A+B+C)				407.15

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Macadam Surface Penetration

PAYMENT ITEM NO. :
TYPES OF WORK : Macadam Surface Penetration
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Average distance from Base Camp to work location	L	4.00	km	
5	Macadam Average thickness	t	0.070	m	
6	Effective Working Hour per day	Ew	7.00	Hour	
7	Material Swell Factor : - Aggregate	Lf1	1.20	-	
	- Asphalt	Lf2	1.01	-	
8	macadam Mixture Composition (Specification) :				
	- Main Aggregate	Ak	133.00	kg/m2	
	- Agregate Lock	Ap1	25.00	kg/m2	
	- Agregat Penutup	Ap2	14.00	kg/m2	
	- Asphalt - Post Aggregate Principal	As1	5.20	kg/m2	
	- Post Aggregate Lock	As2	1.50	kg/m2	
		As	95.71	kg/m3	
9	Material density				
	- Aggregate	Vd1	1.80	Ton / m3	
	- Asphalt	Vd2	1.01	Ton / m3	
II.	WORK SEQUENCE				
1	Based surface is cleaned and sprayed with				
	liquid asphalt as necessary				
2	Course Aggregate is loaded into dump truck using				
	Wheel Loader (in Base Camp)				
3	Course Aggregate is spreaded manually in				
	accordance with required thickness and compacted				
4	using Three Wheel Roller (6-8 Ton) minimum 6 trips				
	Asphalt is sprayed on Course Aggregate layer where				
	its surface has been levelled using Asphalt Sprayer.				
5	Agregat Lock is spreaded and compacted using				
	the same process followed by compacting				
	the Course Aggregate.				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Course Agreg; = $\{(Ak/1000 : t\ m3) \times Lf1\} : Vd1$	M7	1.2667	m3	
b.	Agregate Lock = $\{(Ap1/1000 : t\ m3) \times Lf1\} : Vd1$	M6	0.2381	m3	
c.	Closing Agrega = $\{(Ap2/1000 : t\ m3) \times Lf1\} : Vd1$	M12	0.1333	m3	
d.	Asphalt = $\{((As1+As2) : t\ m3) \times Lf2\}$	M18	96.67	kg	
2.	EQUIPMENT				
a.	Wheel Loader, 1.8 m3	E82			Easy
	Bucket Capacity	Vb	1.80	m3	**Operation condi : Moderate
	Bucket Factor *	Bf	1.00	-	Maintenance of machine :
	Equipment Efficiency Factor**	Ef	0.65	-	Moderate
	Cycle Time				
	- Loading, unloading, Returned	T1	1.50	Minute	Test results
	- Waiting, etc.	T2	0.50	Minute	Test results
		Ct1	2.00	Minute	
	Production Capacity / Hour $\frac{Vb \times Bf \times Ef \times 60}{Ct1}$	Q1	35.10	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.0285	Hour	
b.	Dump Truck 5.5 Ton	E44			* Work Condition : Moderate
	Truck Capacity	Vt	5.50	m3	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km / Hour	
	Average speed when empty	s2	50.00	km / Hour	
	Cycle Time, Ct				
	- Tank Filling = $Vt / Q1 \times 60$	T1	9.40	Minute	
	-Transporting = $(L : s1) \times 60$ Minute	T2	6.00	Minute	
	-Waiting+Dumping+Rotating	T3	15.00	Minute	
	-Returned = $(L : s2) \times 60$ Minute	T4	4.80	Minute	
		Ts2	35.20	Minute	
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Ts2 \times Ct2}$	Q2	7.50	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.1333	Hour	
c.	Three Wheel Roller	E82			Moderate
	Equipment Average Speed	Sa	3.50	km/Hour	machine :
	Compaction Effective width	cw	1.20	m	Moderate
	Number of trips	n1	18.00	Trip	3 Phases at 6 trips
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production capacity / Hour $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q3	10.62	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.0942	Hour	
d.	Asphalt Spreader	E3			Moderate
	equipment Capacity	V	800.00	Liter	machine :

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Cycle Time (Includes heating process)	Ct3	2.00	Hour	
	Capacity / Hour $\frac{V \times Ef \times Vd2}{Ct3 \times (As)}$	Q4	2.74	m3	
	=				
	Equipment Coe = 1 : Q4		0.3645	Hour	
3.	e. Tools For every 75 m3, required: - Push Cart = 3 Units - Shovel = 5 Units - Broom = 5 Units - Brush = 3 Units - Sack = 5 Units - Asphalt kettle = 3 Units - Asphalt Drum = 3 Units LABOR Determined Production (Produksi Wheel Loader) Macadam Production/ day = Q1 x Ew Labor Required : - Worker - Foreman Labor Coefficient/ M3 : - Worker = (Ew x UL) / Qt - Foreman = (Ew x FO) / Qt	Q1 Qt UL FO L1 L4	35.10 245.70 20.00 2.00 0.5698 0.0570	m3/Hour m3 Person Person Hour Hour	Lump Sum

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
 TYPES OF WORK : Macadam Surface Penetration
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.5698	0.63	0.36
	Foreman	Hour	0.0570	1.50	0.09
	Sum of the Labour Cost				0.44
B.	MATERIAL				
	Course Aggregate	m3	1.5048	45.00	67.71
	Fine Aggregate	m3	0.1333	40.00	5.33
	Asphalt	kg	96.6714	2.00	193.34
	Sum of the Materials Cost				266.39
C.	EQUIPMENT				
	Wheel Loader 1.8 m3	Hour	0.0285	65.00	1.85
	Dump Truck 5.5 Ton	Hour	0.1333	33.45	4.46
	Three Wheel Roller	Hour	0.0942	21.22	2.00
	Asphalt Sprayer	Hour	0.3645	5.54	2.02
	Tools	Ls	1.0000	1.50	1.50
	Sum of the Equipment Cost				11.83
D.	Work Unit Price (A+B+C)				278.66

Note :

- The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- The unit cost for equipment including fuel, used material and the operator's Cost.
- Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Penetration Macadam grading

PAYMENT ITEM NO. :
 TYPES OF WORK : Penetration Macadam grading
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Average distance from Base Camp to work location	L	4.00	km	
5	Macadam Average thickness	t	0.075	m	
6	Effective Working Hour per day	Ew	7.00	Jam	
7	Material density factor - Agregat	Sf	1.20	-	
	Material loss factor - Aspal	Wf	1.01	-	
8	Komposisi campuran Lapen (spesifikasi) :				
	- Agregat Pokok	Ak	180.00	kg/m2	
	- Agregat Pengunci	Ap1	25.00	kg/m2	
	- Aspal - Paska Agregat Pokok	As1	7.50	kg/m2	
		As	100.00	kg/m3	
9	Material volume weight :				
	- Agregat	Vd1	1.80	Ton / m3	
	- Aspal	Vd2	1.03	Ton / m3	
II.	WORK SEQUENCE				
1	The bottom surface is cleaned and spray liquid asphalt if necessary				
2	Course aggregate is loaded into the Dump Truck using Wheel Loader (at Base Camp)				
3	Course aggregate spread (manual) according thick necessary and compacted with Three Wheel Roller (6-8 Ton) minimum 6 tracks				
4	Asphalt is sprayed over the Course aggregate that has been leveled using Asphalt Sprayer (evenly)				
5.	Lock aggregate spread and compacted the same way with the compaction of Course aggregate.				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Course Aggregate = $\{(Ak/1000 : t\ m3) \times Lf1\} : Vd1$	M7	1.6000	m3	
b.	Agregate Lock = $\{(Ap1/1000 : t\ m3) \times Lf1\} : Vd1$	M6	0.2222	m3	
c.	Asphalt = $(As1 : t\ m3) \times Lf2$	M18	101.00	kg	
2.	EQUIPMENT				
a.	Wheel Loader, 1.8 m3	E82			Moderate
	Bucket Capacity	Vb	1.80	m3	machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Faktor bucket **	Bf	1.00	-	Easy

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
b.	Cycle Time	T1	1.50	Minute	Test result
	- Loading, unloading, Returned	T2	0.50	Minute	Test result
	- Waiting, etc.	Ct1	2.00	Minute	
	Production Capacity / Hour = $\frac{Vb \times Bf \times Ef \times 60}{Ct1}$	Q1	35.10	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.0285	Hour	
	Dump Truck 10 Ton	E44			Moderate
	Truck Capacity	Vt	5.50	m3	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km/Hour	
	Average speed when empty	s2	50.00	km/Hour	
c.	Cycle Time, Ct				
	- Tank Filling = \ = Vt : Q1 x 60	T1	9.40	Minute	
	-Transporting = (L : s1) x 60 menit	T2	6.00	Minute	
	-Waiting+Dumping+Rotating	T3	15.00	Minute	
	-Returned = (L : s2) x 60 menit	T4	4.80	Minute	
		Ct2	35.20	Minute	
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Ct2}$	Q2	7.50	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.1333	Hour	
	Three Wheel Roller	E82			Moderate
	Equipment Average Speed	Sa	3.50	km/Hour	machine :
d.	Compaction Effective width	cw	1.20	m	Moderate
	Number of trips	n1	12.00	Trip	3 Phases at 6 trips
	Equipment Efficiency Factor*	Ef	0.65	-	
	Capacity / Hour $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q3	17.06	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.0586	Hour	
	Asphalt Sprayer	E3			Moderate
	Equipment Capacity	V	800.00	Liter	machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Cycle Time (Includes heating process)	Ct3	2.00	Hour	
	Production Capacity / Hour = $\frac{V \times Ef \times Vd2}{Ct3 \times As}$	Q4	2.68	m3	
e.	Tools				
	For every 75 m3, required:				
	- Push Cart = 3 unit				
	- Shovel = 5 unit				
	- Broom = 5 unit				
	- Brush = 3 unit				
	Equipment Coefficient / m3 = 1 / Q4		0.3734	Hour	
					Lump Sum

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	-Sack = 5 unit				
	-Asphalt kettle = 3 unit				
	-Asphalt Drum = 3 unit				
	LABOR				
	Determined Production (Produksi Wheel Loader)	Q1	35.10	m3/Hour	
	Macadam Production/ day = Q1 x Ew	Qt	245.70	m3	
	Labor Required :				
	- Worker	UL	20.00	Person	
	- Foreman	FO	2.00	Person	
	Labor Coefficient/ M3 :				
	- Worker = (Ew x UL) / Qt	L1	0.5698	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.0570	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Penetration Macadam grading
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.5698	0.63	0.36
	Foreman	Hour	0.0570	1.50	0.09
	Sum of the Labour Cost				0.44
B.	MATERIAL				
	Course Aggregate	m3	1.8222	45.00	82.00
	Fine Aggregate	m3	0.0000	40.00	0.00
	Asphalt	kg	101.0000	2.00	202.00
	Sum of the Materials Cost				284.00
C.	EQUIPMENT				
	Wheel Loader 1.8 m3	Jam	0.0285	65.00	1.85
	Dump Truck	Jam	0.1333	55.75	7.43
	Three Wheel Roller	Jam	0.0586	21.22	1.24
	Asphalt Sprayer	Jam	0.3734	5.54	2.07
	Tools	Ls	1.0000	1.50	1.50
	Sum of the Equipment Cost				14.10
D.	Work Unit Price (A+B+C)				298.54

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Lasbutag (Coating Mix Asphalt Concrete and Aggregates)

PAYMENT ITEM NO. :
TYPES OF WORK : LASBUTAG (Coating Mix Asphalt Concrete and Aggregates)
PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using mechanical means				
2	Work location: along the road				
3	Existing condition of the road: moderate				
4	At this work does not include bitumen Asbuton fluxing;				
5	The average distance to the work site Base Camp	L	4.0	km	
6	Effective working hours per day	Ew	7.00	Jam	
7	Material compaction factor	Sf	1.15	-	
8	Thickness of Lasbutag	t	3.00	cm	
9	Lasbutag consists of (specs):				
	- Course Aggregates	CA	30.00	%	Total Mixed
	- Sand	Ps	49.50	%	Total Mixed
	- Asbuton	Asb	16.00	%	Total Mixed
	- Fluxing, comprising differences	Md	4.50	%	Total Mixed
	- Bunker Oil (BO)	Bo	47.00	%	Total Modifier
	- Asphalt Cement	Asp	38.00	%	Total Modifier
	- Kerosene	Mt	15.00	%	Total Modifier
	- Material Anti Stripping (rarely used)	As	0.00	%	Total Modifier
10	Mixture preparation carried out at Base Camp				
11	Material Volume - Course Aggregates	Vd1	1.80	Ton/m3	
	Weight : - Sand	Vd2	1.80	Ton/m3	
	- Asbuton	Vd3	1.05	Ton/m3	
	- Modifier	Vd4	0.99	Ton/m3	
	- Bunker Oil (BO)	Vd5	0.97	Ton/m3	
	- Asphalt Cement	Vd6	1.03	Ton/m3	
	- Kerosene	Vd7	0.80	Ton/m3	
	- Lasbutag	Vd8	2.20	Ton/m3	
II.	SEQUENCE OF WORK				
1	Asbuton and fluxing prepared / are paid separately				
2	Course aggregate, sand, fluxing materials and Asbuton evenly mixed using a Concrete Mixer				
	and curing is done according to the provisions				
3	Lasbutag loaded into the Loader and Dump Truck transported to the work site				
4	Lasbutag laid with the finisher above surface which had been prepared beforehand.				
5	Overlays mixture compacted using Steel Wheel Compactor compactor continued Rubber Wheel;				
6	During compaction, a group of workers will smoothed by using a Tool.				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a	Course aggregate = $(CA \times (Vd8 \times tm3) \times 1.025) / Vd1$	M7	0.0113	m3	
b	Sand = $(Ps \times (Vd8 \times tm3) \times 1.025) / Vd2$	M1	0.0186	m3	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
c	Asbuton (paid separately)				
d	Fluxing (paid separately)				
2	EQUIPMENT				
a.	Wheel Loader, 1.8 m3 Bucket Capacity Equipment Efficiency Factor* Bucket Factor ** Cycle Time - Muat Returned - Lain lain - Waiting, etc. $\text{Production Capacity/Hour} = \frac{Vb \times Bf \times Ef \times 60 \times 100}{Sf \times Ct1 \times t}$ Equipment Coefficient / m2 = 1 / Q1	E82 Vb Ef Bf T1 T2 Ct1 Q1	1.80 0.65 1.00 1.50 0.50 2.00 1,017.39	m3 - - Minute Minute Minute m2	*Operation condi : Moderate machine : Moderate Easy Test Result Test Result
b.	Dump Truck 5.5 Ton Truck Capacity Equipment Efficiency Factor* Average speed when loaded Average speed when empty AMP capacity/ batch Preparation time for 1 batch ATB Cycle Time - Tank Filling - Loading - Waiting + dumping + rotating - Returned $\text{Production Capacity / Hour} = \frac{Vt \times Ef \times 60 \times 100}{Vd8 \times Ct2 \times t}$ Equipment Coefficient / m3 = 1 / Q2	E44 Vt Ef s1 s2 T1 T2 T3 T4 Ct2 Q2	5.50 0.80 40.00 50.00 6.00 4.80 4.91 15.00 30.71 130.23	Ton - km / Hour km / Hour Minute Minute Minute Minute Minute m2 Hour	Moderate Test Result
c.	Pneumatic Tire Roller 10 Ton Average speed Effective width compacting Number of trips Equipment Efficiency Factor * $\text{Production capacity / hour} = \frac{(Sa \times 1000) \times cw \times Ef}{n1}$ Coefficient Tools / m2 = 1 / Q3	E71 Sa cw n1 Ef Q3	4.00 1.50 6.00 0.65 650.00	km/Hour m Passing m2 Hour	Moderate machine : Moderate
d.	Tandem Roller 6-8 Ton Average speed tool Effective width compacting Number of passes	E69 Sa cw n1	2.50 1.20 4.00	km/Hour m Passing	Moderate machine : Moderate

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	Equipment Efficiency Factor *	Ef	0.65	-	Moderate Maintenance of machine : Moderate Test result Test result Test result Test result Lump Sum
	Production capacity / hour $\frac{(Sa \times 1000) \times cw \times Ef}{n1}$	Q4	487.50	m2	
	= Coefficient Tools / m2 = 1 / Q4		0.0021	Hour	
	e. Asphalt Finisher 4 m width	E2			
	Production Capacity	V	25.00	Ton / Hour	
	Equipment Efficiency Factor *	Ef	0.65	-	
	Production capacity / hour = $\frac{V \times Ef \times 100}{Vd8 \times t}$	Q5	246.21	m2	
	= Coefficient Tools / m2 = 1 / Q5		0.0041	Hour	
	f. Concrete Mixer 0.3 – 0.6 m3	E15			
	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor *	Ef	0.80	-	
	The cycle time, Ct:				
	- Load	T1	3.00	Minute	
	- Stir	T2	10.00	Minute	
	- Pouring	T3	3.00	Minute	
	- Wait, etc.	T4	3.00	Minute	
		Ct3	19.00	Minute	
	Production capacity / hour $\frac{V \times Ef \times 60 \times 100}{1000 \times Sf \times Ct3 \times t}$	Q6	36.61	m2/Hour	
	= Coefficient Tools / m2 = 1 / Q6		0.0273	Hour	
	g. Tools				
	Required:				
	- Stroller = 2 pieces				
	- Spades = 3 pieces				
	- Sweep stick = 5 pieces				
	LABOR				
	Production specify: ASPHALT FINISHER	Q5	246.21	m2	
	Production / day = EWX Q5	Qt	1,723.48	m2	
	Labor requirements:				
	- Workers	UL	20.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient / m2 :				
	- Workers = (Ew x UL) / Qt	L1	0.0812	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.0041	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
 TYPES OF WORK : LASBUTAG (Coating Mix Asphalt Concrete and Aggregates)
 PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0812	0.63	0.0512
	Foreman	Hour	0.0041	1.50	0.0061
	Sum of the Labour Cost				0.0573
B.	MATERIAL				
	Course aggregates	m3	0.0113	45.00	0.5074
	Sand	m3	0.0186	40.00	0.7442
	Sum of the Materials Cost				1.2515
C.	EQUIPMENT				
	Wheel Loader, 1.8 m3	Hour	0.0010	65.00	0.0639
	Dump Truck 5.5 Ton	Hour	0.0077	33.45	0.2569
	Pneumatic Tire Roller 10 Ton	Hour	0.0015	70.00	0.1077
	Tandem Roller 6-8 Ton	Hour	0.0021	57.50	0.1179
	Asphalt Finisher 4 m width	Hour	0.0041	120.00	0.4874
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.0273	10.53	0.2876
	Tools	LS	1.0000	1.00	1.0000
	Sum of the Equipment Cost				1.3214
D.	Work Unit Price (A+B+C)				2.63

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Latasbusir Class A (Coating Mix Asphalt Concrete and Aggregates)

PAYMENT ITEM NO. :
 TYPES OF WORK : Latasbusir Class A
 PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using mechanical means				
2	Work location: along the road				
3	Existing condition of the road: moderate				
4	At this work does not include bitumen Asbuton fluxing;				
5	The average distance to the work site Base Camp	L	4.0	km	
6	Effective working hours per day	Ew	7.00	Hour	
7	Material compaction factor	Sf	1.15	-	
8	Thickness of Latasbusir	t	1.50	cm	
9	Latasbusir consists of (specs):				
	- Course Aggregates (rarely used)	CA	0.00	%	Total Mixed
	- Sand	Ps	73.00	%	Total Mixed
	- Asbuton	Asb	21.00	%	Total Mixed
	- Fluxing, comprising differences	Md	6.00	%	Total Mixed
	- Bunker Oil (BO)	Bo	44.00	%	Total Modifier
	- Asphalt Cement	Asp	38.00	%	Total Modifier
	- Kerosene	Mt	18.00	%	Total Modifier

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
c.	Pneumatic Tire Roller 10 Ton Average speed Effective width compacting Number of trips Equipment Efficiency Factor * $\text{Capacity/Hour} = \frac{(Sa \times 1000) \times cw \times Ef}{n1}$ Equipment Coefficient / m2 = 1 / Q3	E71 Sa cw n1 Ef Q3	 6.00 1.50 6.00 0.65 975.00	 km/Hour m Passing m2	Moderate Maintenance of machine : Moderate
d.	Tandem Roller 6-8 Ton Equipment Average speed Effective width compacting Number of passes Equipment Efficiency Factor * $\text{Capacity/Hour} = \frac{(Sa \times 1000) \times cw \times Ef}{n1}$ Equipment Coefficient / m2 = 1 / Q4	E69 Sa cw n1 Ef Q4	 3.50 1.20 4.00 0.65 682.50	 km /Hour m Passing - m2	*Operation condi : Moderate Maintenance of machine : Moderate
e.	Asphalt Finisher 4 m width Production Capacity Equipment Efficiency Factor * $\text{Production Capacity/Hour} = \frac{V \times Ef \times 100}{Vd8 \times t}$ Equipment Coefficient / m2 = 1 / Q5	E2 V Ef Q5	 40.00 0.65 787.88	 Ton/Hour - m2	Moderate Maintenance of machine : Moderate
f.	Concrete Mixer 0.3 – 0.6 m3 Equipment Capacity Equipment Efficiency Factor * The cycle time, Ct: - Load - Stir - Pouring - Wait, etc. $\text{Production Capacity/Hour} = \frac{V \times Ef \times 60 \times 100}{1000 \times cw \times Ct3 \times t}$ Equipment Coefficient / m2 = 1 / Q6	E15 V Ef T1 T2 T3 T4 Ct3 Q6	 500.00 0.80 3.00 10.00 3.00 3.00 19.00 70.18	 Liter - Minute Minute Minute Minute Minute m2/Hour	
g.	Tools Required: - Stroller = 2 pieces - Spades = 3 pieces - Sweep stick = 5 pieces				Lump Sum
3.	LABOR Production specify: ASPHALT FINISHER Production / day = EWX Q5 Labor requirements: - Workers - Foreman Labor Coefficient / m2 : - Workers = (Ew x UL) / Qt - Foreman = (Ew x FO) / Qt	Q5 Qt UL FO L1 L4	 787.88 5,515.15 16.00 1.00 0.0203 0.0013	 m2 m2 Person Person Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Latasbusir Class A
PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0203	0.63	0.0128
	Foreman	Hour	0.0013	1.50	0.0019
	Sum of the Labour Cost				0.0147
B.	MATERIAL				
	Sand	m3	0.0137	40.00	0.5487
	Sum of the Materials Cost				0.5487
C.	EQUIPMENT				
	Wheel Loader, 1.8 m3	Hour	0.0004	65.00	0.0266
	Dump Truck 5.5 Ton	Hour	0.0039	33.45	0.1302
	Pneumatic Tire Roller 10 Ton	Hour	0.0010	70.00	0.0718
	Tandem Roller 6-8 Ton	Hour	0.0015	57.50	0.0842
	Asphalt Finisher 4 m width	Hour	0.0013	120.00	0.1523
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.0143	10.53	0.1501
	Tools	LS	1.0000	1.00	1.0000
	Sum of the Equipment Cost				1.6152
D.	Work Unit Price (A+B+C)				2.18

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Latasbusir Class B (Coating Mix Asphalt Concrete and Aggregates)

PAYMENT ITEM NO. :
TYPES OF WORK : Latasbusir Class B
PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using mechanical means				
2	Work location: along the road				
3	Existing condition of the road: moderate				
4	At this work does not include bitumen Asbuton fluxing;				
5	The average distance to the work site Base Camp	L	4.0	km	
6	Effective working hours per day	Ew	7.00	Hour	
7	Material compaction factor	Sf	1.15	-	
8	Thickness of Latasbusir	t	2.00	cm	
9	Latasbusir consists of (specs):				
	- Course Aggregates	CA	14.00	%	Total Mixed
	- Sand	Ps	63.00	%	Total Mixed
	- Asbuton	Asb	18.00	%	Total Mixed
	- Fluxing, comprising differences	Md	5.00	%	Total Mixed
	- Bunker Oil (BO)	Bo	44.00	%	Total Modifier
	- Asphalt Cement	Asp	38.00	%	Total Modifier
	- Kerosene	Mt	18.00	%	Total Modifier
	- Material Anti Stripping	As	0.00	%	Total Modifier

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
10	Mixture preparation carried out at Base Camp				
11	Material Volume - Course Aggregates	Vd1	1.80	Ton/m3	
	Weight :	Vd2	1.80	Ton/m3	
	- Sand	Vd3	1.05	Ton/m3	
	- Asbuton	Vd4	0.99	Ton/m3	
	- Modifier	Vd5	0.97	Ton/m3	
	- Bunker Oil (BO)	Vd6	1.03	Ton/m3	
	- Asphalt Cement	Vd7	0.80	Ton/m3	
	- Kerosene	Vd8	2.20	Ton/m3	
	- Latasbusir				
II.	SEQUENCE OF WORK				
1	Asbuton and fluxing prepared / are paid separately				
2	Course aggregate, sand, fluxing materials and Asbuton evenly mixed using a Concrete Mixer				
	and curing is done according to the provisions				
3	Latasbusir loaded into the Loader and Dump Truck transported to the work site				
4	Latasbusir laid with the finisher above surface which had been prepared beforehand.				
5	Overlays mixture compacted using Steel Wheel Compactor compactor continued Rubber Wheel;				
6	During compaction, a group of workers will smoothed by using a Tool.				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a	Course aggregat = (CA x (Vd8 x tm3) x 1.025) / Vd1	M7	0.0016	m3	
b	Sand = (Ps x (Vd8 x tm3) x 1.025) / Vd2	M1	0.0158	m3	
c	Asbuton (paid separately)				
d	Fluxing (paid separately)				
2	EQUIPMENT				
	Wheel Loader 1.8 m3	E82			
a.					*Operation condi : Moderate
	Bucket Capacity	V	1.80	m3	
	Bucket Factor *	Bf	0.90	-	Maintenance of machine : Moderate
	Equipment Efficiency Factor**	Ef	0.65	-	
	Cycle Time - Loading, unloading, Returned	T1	1.00	Minute	
	- Waiting, etc.	T2	0.50	Minute	
		Ct1	1.50	Minute	
	Production Capacity/Hour = $\frac{V \times Sf \times Ef \times 60 \times 100}{Sf \times Ct1 \times t}$	Q1	1,831.30	m2	
	Equipment Coefficient / m2 = 1 / Q1		0.0005	Hour	
b.	Dump Truck 5.5 Ton	E44			Moderate
	Truck Capacity	Vt	5.50	Ton	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km /Hour	
	Average speed when empty	s2	50.00	km /Hour	
	Cycle Time, Ct2				
	- The travel time content = (L: s1) x 60 Minutes	T1	6.00	Minute	
	- It takes an empty = (L: s2) x 60 Minutes	T2	4.80	Minute	
	- Load time = (Vt: VD8) / (Q1 xt / 100) x 60	T3	7.12	Minute	
	- Pour into the finisher and others	T4	15.00	Minute	
		Ts2	32.92	Minute	Test Result
	Production Capacity/Hour = $\frac{V \times Ef \times 60 \times 100}{Vd8 \times Ct2 \times t}$	Q2	182.25	m2	
	Equipment Coefficient / m2 = 1 / Q2		0.0055	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
c.	Pneumatic Tire Roller 10 Ton Average speed Effective width compacting Number of trips Equipment Efficiency Factor * $\text{Production Capacity/Hour} = \frac{(Sa \times 1000) \times cw \times Ef}{n1}$ Equipment Coefficient / m2 = 1 / Q3	E71 Sa cw n1 Ef Q3	 6.00 1.50 6.00 0.65 975.00	 km /Hour m Passing m2 Hour	Moderate machine : Moderate
d.	Tandem Roller 6-8 Ton Equipment Average speed Effective width compacting Number of passes Equipment Efficiency Factor * $\text{Production Capacity/Hour} = \frac{(Sa \times 1000) \times cw \times Ef}{n1}$ Equipment Coefficient / m2 = 1 / Q4	E69 Sa cw n1 Ef Q4	 3.50 1.20 4.00 0.65 682.50	 km /Hour m Passing - m2 Hour	Moderate machine : Moderate
e.	Asphalt Finisher 4 m width Production Capacity Equipment Efficiency Factor * $\text{Kapasitas Produksi / Jam} = \frac{V \times Ef \times 100}{Vd8 \times t}$ Koefisien Alat / m2 = 1 / Q5	E2 V Ef Q5	 40.00 0.65 590.91	 Ton/Hour - m2 Hour	*Operation condi : Moderate Maintenance of machine : Moderate
f.	Concrete Mixer 0.3 – 0.6 m3 Production Capacity Equipment Efficiency Factor * The cycle time, Ct: - Load - Stir - Pouring - Wait, etc. $\text{Production Capacity/Hour} = \frac{V \times Ef \times 60 \times 100}{1000 \times cw \times Ct3 \times t}$ Equipment Coefficient / m2 = 1 / Q6	E15 V Ef T1 T2 T3 T4 Ct3 Q6	 500.00 0.80 3.00 10.00 3.00 3.00 19.00 42.11	 Liter - Minute Minute Minute Minute Minute m2/Hour Hour	
g.	Tools Required: - Stroller = 2 pieces - Spades = 3 pieces - Sweep stick = 5 pieces				Lump Sum
3.	LABOR Production specify: PNEUMATIC TIRE ROLLER Production / day = EWX Q5 Labor requirements: - Workers - Foreman Labor Coefficient / m2 : - Workers = (Ew x UL) / Qt - Foreman = (Ew x FO) / Qt	Q3 Qt UL FO L1 L4	 975.00 6,825.00 20.00 1.00 0.0205 0.0010	 m2 m2 Person Person Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :

TYPES OF WORK : Latasbusir Class B

PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0205	0.63	0.0129
	Foreman	Hour	0.0010	1.50	0.0015
	Sum of the Labour Cost				0.0145
B.	MATERIAL				
	Sand	m3	0.0158	40.00	0.6314
	Sum of the Materials Cost				0.6314
C.	EQUIPMENT				
	Wheel Loader, 1.8 m3	Hour	0.0005	65.00	0.0355
	Dump Truck 5.5 Ton	Hour	0.0055	33.45	0.1835
	Pneumatic Tire Roller 10 Ton	Hour	0.0010	70.00	0.0718
	Tandem Roller 6-8 Ton	Hour	0.0015	57.50	0.0842
	Asphalt Finisher 4 m width	Hour	0.0017	120.00	0.2031
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.0238	10.53	0.2501
	Tools	LS	1.0000	1.00	1.0000
	Sum of the Equipment Cost				1.8282
D.	Work Unit Price (A+B+C)				2.47

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Prime Coat (Absorbing layer Binder)

PAYMENT ITEM NO. :

TYPES OF WORK : Prime Coat

PAYMENT UNIT : Liter

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (mechanically)				
2	Work location: along the road				
3	Average distance from Base Camp to work location	L	4.0	km	
4	Effective Working Hour per day	Ew	7.00	Hour	
5	Material Loss factor	Lf	1.02	-	
6	Mixture Composition :				
	- Asphalt AC-10 or AC-20	As	56	%	
	- Kerosene	K	44	%	
	-Asphalt Consumption,a=1.00-1.50 kg/m2	a	1.25	kg/m2	taken
7	Material density:				
	- Asphalt AC-10 or AC-20	Vd1	1.03	kg / Liter	
	- Flux oil / liquidifier	Vd2	0.80	kg / Liter	
8	Base Material (Ashphalt/Flux Oil)				
	all are accepted in work location				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
II.	WORK SEQUENCE				
1	Asphalt and flux oil are mixed and heated to become Liquid asphalt				
2	Surface to be coated should be cleaned from dust and dirt using Air Compressor				
3	Liquid Asphalt mixture is sprayed using Asphalt Sprayer on the surface to be coated				
4	Asphalt & Flux oil are transported by Dump Truck				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL to get 1 liter of prime coat Required : (1 liter x Lf)	PC	1.02	liter	Mixture
a.	Asphalt = As x PC x Vd1 x a		0.7296	kg	
b.	Kerosene = K x PC x a		0.5667	Liter	
2	EQUIPMENT				
a.	Asphalt Sprayer equipment Capacity Equipment Efficiency Factor* Cycle Time (includes heating process)	E3 V Ef Ct	800.00 0.65 2.00	Liter - Hour	Moderate machine : Moderate Test Result
	Production Capacity/Hour = $\frac{V \times Ef}{Ct}$	Q1	260.00	Liter	
	Equipment Coefficient / Liter = 1 / Q1		0.0038	Hour	
b.	Air Compressor equipment Capacity ----->> taken Average application of asphaltic layer binder (Specification)	E30 V Ap	400.00 0.80	m2 / Hour Liter / m2	
	Production Capacity/Hour = (V x Ap)	Q2	320.00	Liter	
	Coefficient / = 1 / Q2		0.0031	Hour	
c.	Dump Truck 5.5 Ton An Equipment to transport material in the work location, Dump Truck supports Asphalt Sprayer. Production capa Equal to Asphalt Sprayer	E42 Q3	 260.00	 Liter	
	Equipment Coefficient / Liter = 1 / Q3		0.0038	Hour	
3	LABOR Determined Production : ASPHALT FINISHER Prime coat prodction / day = Ew x Q4 Labor Required - Worker - Foreman	Q4 Qt UL FO	260.00 1,820.00 6.00 1.00	Liter Liter Person Person	
	Labor Coefficient - Worker = (Ew x UL) : Qt - Foreman = (Ew x FO) : Qt	L1 L4	0.0231 0.0038	Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Prime Coat
PAYMENT UNIT : Liter

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0231	0.63	0.01
	Foreman	Hour	0.0038	1.50	0.01
	Sum of the Labour Cost				0.02
B.	MATERIAL				
	Asphalt	kg	0.7296	2.00	1.46
	Kerosene	Liter	0.5667	1.00	0.57
	Sum of the Materials Cost				2.03
C.	EQUIPMENT				
	Asphalt Sprayer	Hour	0.0038	5.54	0.02
	Air Compressor	Hour	0.0031	19.80	0.06
	Dump Truck 5.5 Ton	Hour	0.0038	33.45	0.13
	Sum of the Equipment Cost				0.21
D.	Work Unit Price (A+B+C)				2.26

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Teak Coat (Adhesives layer Binder)

PAYMENT ITEM NO. :
TYPES OF WORK : Tack Coat
PAYMENT UNIT : Liter

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (mechanically)				
2	Work location: along the road				
3	Average distance from Base Camp to work location	L	4.0	km	
4	Effective Working Hour per day	Ew	7.00	Hour	
5	Material Loss factor	Lf	1.06	-	
6	Mixture Composition :				
	- Asphalt AC-10 or AC-20	As	77	%	
	-Flux Oil/Liquidifier	K	23	%	
7	Material density:				
	- Asphalt AC-10 or AC-20	Vd1	1.03	kg / Liter	
	- Kerosene	Vd2	0.80	kg / Liter	
8	asphaltic consumption, a=0.75 -1.00 kg/m2	a	0.90	kg/m2	
	Base Material (Ashphalt/Flux Oil)				
	all are accepted in work location				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
II.	WORK SEQUENCE				
1	Asphalt and flux oil are mixed and heated to become Liquid asphalt				
2	Surface to be coated should be cleaned from dust and dirt using Air Compressor				
3	Liquid Asphalt mixture is sprayed using Asphalt Sprayer on the surface to be coated				
4	Asphalt & Flux oil are transported using Dump Truck				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	To get 1 liter of prime coat Required : (1 liter x Lf)	PC	1.06	Liter	Mixture
a.	Asphalt = As x PC x Vd1 x a		0.7566	kg	
b.	Kerosene = K x PC x a		0.2194	Liter	
2.	EQUIPMENT				
a.	Asphalt Sprayer	E3			*Operation condi :
	equipment Capacity	V	800.00	Liter	Moderate
	Equipment Efficiency Factor*	Ef	0.65	-	Maintenance
	Cycle Time (includes heating process)	Tc	2.00	Hour	of machine :
	Production Capacity/Hour = $\frac{V \times Ef}{Tc}$	Q1	260.00	Liter	Moderate
	Equipment Coefficient / Liter = 1 / Q1		0.0038	Hour	Test Result
b.	Air Compressor	E30			
	equipment Capacity ----->> Taken	V	400.00	m2 / Hour	
	Application Layer absorbing binder average (Spec.)	Ap	0.40	Liter / m2	
	Production Capacity / Hour = (V x Ap)	Q2	160.00	Liter	
	Equipment Coefficient / Liter = 1 / Q2		0.0063	Hour	
c.	Dump Truck 5.5 Ton	E42			
	An Equipment to transport material in the work location, Dump Truck supports Asphalt Sprayer.				
	Production capa Equal to Asphalt Sprayer	Q3	260.00	Liter	
	Equipment Coefficient / Liter = 1 / Q3		0.0038	Hour	
3.	LABOR				
	Determined Production : ASPHALT FINISHER	Q4	260.00	Liter	
	Prime Coat production/ day = Ew x Q4	Qt	1,820.00	Liter	
	Labor Required				
	- Worker	UL	8.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient/ liter :				
	- Worker = (Ew x UL) : Qt	L1	0.0308	Hour	
	- Foreman = (Ew x FO) : Qt	L4	0.0038	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Tack Coat
PAYMENT UNIT : Liter

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	EQUIPMENT				
	Worker	Hour	0.0308	0.63	0.02
	Foreman	Hour	0.0038	1.50	0.01
	Sum of the Labour Cost				0.03
B.	MATERIAL				
	Asphalt	kg	0.7566	2.00	1.51
	Kerosene	Liter	0.2194	1.00	0.22
	Sum of the Materials Cost				1.73
C.	EQUIPMENT				
	Asphalt Sprayer	Hour	0.0038	5.54	0.02
	Air Compressor	Hour	0.0063	19.80	0.12
	Dump Truck 5.5 Ton	Hour	0.0038	33.45	0.13
	Sum of the Equipment Cost				0.27
D.	Work Unit Price (A+B+C)				2.03

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Asphaltic Concrete Binder (AC-BC)

PAYMENT ITEM NO. :
TYPES OF WORK : Asphaltic Concrete Binder (AC-BC)
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Existing road condition : MODERATE				
4	Average distance from Base Camp to work location	L	4.0	km	
5	Asphaltic Concrete binder (AC-BC) Thickness	t	0.06	m	
6	Effective Working Hour per day	Ew	7.00	Hour	
7	Material Loss factor : - Aggregate	Lf1	1.20	-	
	- Asphalt	Lf2	1.10	-	
8	AC-BC Mixture Composition : - Course Aggregate	CA	50.00	%	Gradation should
	- Fine Aggregate	FA	44.30	%	meet specification
	- Asphalt minimum 5 %	As	5.70	%	
9	Material Density : - AC-BC	Vd1	2.25	Ton / m3	
	- Course Aggregate & Fine Aggregate	Vd2	1.80	Ton / m3	
	- Asphalt	Vd3	1.03	Ton / m3	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
II.	WORK SEQUENCE				
1	Wheel Loader loads Aggregate and Asphalt into Cold Bin AMP				
2	Aggregate and Asphalt are mixed and heated in AMP and load immediately to dump truck and transport to work location				
3	ATB hot mixture is spreaded using finisher and compacted using Tandem and Pneumatic Tire Roller				
4	A group of workers will level the overlay trimmed edge during compaction using Tools				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Course Aggregate = (CA x (Vd1 x 1 m3) x Lf1) : Vd2	M7	0.7500	m3	
b.	Fine Aggregate = (FA x (Vd1 x 1 m3) x Lf1) : Vd2	M6	0.6645	m3	
d.	Asphalt = (AS x (Vd1 x 1 m3) x Lf2) x 1000	M18	141.075	kg	
2.	EQUIPMENT				
a.	Wheel Loader 1.8 m3	E82			Moderate machine :
	Bucket Capacity	V	1.80	m3	
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Bucket Factor **	Bf	1.00	-	** Dumping cond. : Easy
	Cycle Time	Ct1			
	- Loading	T1	1.50	Minute	Test Result
	- Others	T2	0.50	Minute	Test Result
		Ct1	2.00	Minute	
	Production Capacity / Hour = $\frac{Vd2 \times Vb \times Bf \times Ef \times 60}{Vd1 \times Ct1}$	Q1	28.08	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.0356	Hour	
b.	Asphalt Mixing Plant	E1			Moderate machine :
	Production Capacity	V	50.00	Ton / Hour	
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Production Capacity / Hour = $\frac{V \times Ef}{Vd1}$	Q2	14.44	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.0692	Hour	
c.	Generator Set	E56			
	Production Capacity / Hour = AMP	Q3	14.44	m2	
	Equipment Coefficient / m3 = 1 / Q3		0.0692	Hour	
d.	Dump Truck 10 Ton	E44			* Work Condition : Moderate
	Tank Capacity	Vt	10.00	Ton	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km / Hour	
	Average speed when empty	s2	50.00	km / Hour	
	AMP Capacity / batch	Q2b	50.00	Ton	
	Preparation time for 1 batch AC-BC	Tb	1.00	Minute	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	Cycle Time - Tank Filling = $(V : Q2b) \times Tb$ - Loading = $(L : v1) \times 60 \text{ minute}$ - Waiting+dumping+rotating - Returned = $(L : v2) \times 60 \text{ minute}$	Ct2 T1 T2 T3 T4	0.20 6.00 12.00 4.80	Minute Minute Minute Minute Minute	
	Production Capacity / Hour = $\frac{Vt \times Ef \times 60}{Vd1 \times Ct2}$	Q4	9.28	m3	
	Equipment Coefficient / m3 = 1 / Q4		0.1078	Hour	
	Asphalt Finisher 4 m width	E2			*Operation condi : Moderate
	Production Capacity Equipment Efficiency Factor*	V Ef	50.00 0.65	Ton / Hour -	Maintenance of machine : Moderate
	Production Capacity / Hour = $\frac{V \times Ef}{Vd1}$	Q5	14.44	m3	
	Equipment Coefficient / m3 = 1 / Q5		0.0692	Hour	
	Tandem Roller 6-8 Ton	E69			*Operation condi : Moderate
	equipment Average Speed Compaction effective width Number of trips Equipment Efficiency Factor*	Sa cw n1 Ef	5.00 1.50 6.00 0.65	km / Hour m Trip -	Maintenance of machine : Moderate
	Production Capacity / Hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q6	48.75	m3	
	Equipment Coefficient / m3 = 1 / Q6		0.0205	Hour	
	Pneumatic Tire Roller 10 Ton	E71			Moderate
3.	Average speed Compaction effective width Number of trips Equipment Efficiency Factor*	Sa cw n1 Ef	5.00 1.50 6.00 0.75	km / Hour m Trip -	Maintenance of machine : Moderate
	Production Capacity / Hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1}$	Q7	56.25	m3	
	Equipment Coefficient / m3 = 1 / Q7		0.0178	Hour	
	Tools				
	Required : - Push Cart = 2 Units - Shovel = 3 Units - Fork = 2 Units - Control stick for thickness layer				Lump Sum
	LABOR				
	Determined Production : Asphalt Mixing Plant (AMP) AC-BC Production / day = $Ew \times Q2$ Labor Required	Q2 Qt	14.44 101.11	m3/Hour m3	
	- Worker - Foreman	UL FO	8.00 1.00	Person Person	
	Labor Coefficient/ m3 :				
	- Worker = $(Ew \times UL) / Qt$	L1	0.5538	Hour	
	- Foreman = $(Ew \times FO) / Qt$	L4	0.0692	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Asphaltic Concrete Binder (AC-BC)
PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.5538	0.63	0.35
	Foreman	Hour	0.0692	1.50	0.10
	Sum of the Labour Cost				0.45
B.	MATERIAL				
	Course Aggregate	m3	0.7500	25.00	18.75
	Fine Aggregate	m3	0.6645	23.00	15.28
	Asphalt	kg	141.0750	2.00	282.15
	Sum of the Materials Cost				316.18
C.	EQUIPMENT				
	Wheel Loader 1.8 m3	Hour	0.0356	65.00	2.31
	Asphalt Mixing Plant	Hour	0.0692	400.00	27.69
	Generator Set	Hour	0.0692	50.00	3.46
	Dump Truck 10 Ton	Hour	0.1078	55.75	6.01
	Asphalt Finisher 4 m width	Hour	0.0692	120.00	8.31
	Tandem Roller 6-8 Ton	Hour	0.0205	57.50	1.18
	Pneumatic Tire Roller 10 Ton	Hour	0.0178	70.00	1.24
	Tools	Ls	1.0000	0.50	0.50
	Sum of the Equipment Cost				50.71
D.	Work Unit Price (A+B+C)				367.35

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

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Example: Unit Price Analysis of Bituminous Coldmix

PAYMENT ITEM NO. :
TYPES OF WORK : Bituminous Coldmix
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Average distance from Base Camp to work location	L	4.0	km	
4	Effective Working Hour per day	Ew	7.00	Hour	
5	Specification :				
	- Aggregate maximum nominal size	An	19.00	mm	
	- Asphalt content in total mixture	As	7.00	%	
	- Compaction nominal thickness	t	0.04	m	
6	Material Density :				
	-Bituminous Coldmix mixture	Vd1	2.01	Ton/m3	
	- Asphalt	Vd2	1.03	Ton/m3	
	- Aggregate	Vd3	1.60	Ton/m3	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
II.	WORK SEQUENCE				
1	Aggregate and asphalt are mixed in Concrete Mixer				
2	The Mixture is transported to work location by dump truck				
3	The Mixture is spreaded manually using Tools				
4	the spreaded mixture is compacted by Pedestrian Roller				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
a.	Fine Aggregate = $\{(100\% - A_s) \times 1\text{m}^3 \times V_d1\} : V_d3$	M6	1.1683	m3	
b.	Emulsion Bitum = $\{A_s \times 1\text{m}^3 \times V_d1\} \times 1000$	M19	140.700	kg	
2.	EQUIPMENT				
a.	Concrete Mixer 0.3 – 0.6 m3	E15			Moderate
	equipment Capacity	V	500.00	Liter	Maintenance of machine :
	Equipment Efficiency Factor*	Ef	0.75	-	Moderate
	Cycle Time :	Ct1			
	-Loading	T1	5.00	Minute	Test Result
	- Stirring	T2	3.50	Minute	Test Result
	- Pouring	T3	3.00	Minute	Test Result
	- Waiting, etc.	T4	2.00	Minute	Test Result
		Ct1	13.50	Minute	
	Production Capacity / Hour = $\frac{V \times Ef \times 60}{1000 \times Ct1}$	Q1	1.667	m3	
	Equipment Coefficient / m3 = $1 / Q1$		0.6000	Hour	
b.	Tandem Roller 6-8 Ton	E69			Moderate
	equipment Average Speed	v	2.50	km / Hour	machine :
	Compaction effective width	cw	1.20	m	Moderate
	Number of trips	n1	8.00	Trip	
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity / Hour = $\frac{(v \times 1000) \times b \times t \times Ef}{n}$	Q2	9.75	m3	
	Equipment Coefficient / m3 = $1 / Q2$		0.1026	Hour	
c.	Dump Truck 10 Ton	E42			Moderate
	Tank Capacity	Vt	10.00	Ton	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average speed when loaded	s1	40.00	km / Hour	
	Average speed when empty	s2	50.00	km / Hour	
	Concrete mixture capacity	Q1b	0.38	m3	
	Preparation time for 1 time mixture	Tb	13.50	Minute	
	Cycle Time	Ct2			
	- Tank Filling = $(Vt : Q1b) \times Tb$	T1	360.00	Minute	
	- Loading = $(L : s1) \times 60 \text{ Minute}$	T2	6.00	Minute	
	- Waiting+Dumping+Rotating	T3	10.00	Minute	
	- Returned = $(L : s2) \times 60 \text{ Minute}$	T4	4.80	Minute	
		Ct2	380.80	Minute	
	Production Capacity / Hour = $\frac{t \times Ef \times 60}{Vd1 \times Ct2}$	Q3	0.63	m3	Serve 1 unit concrete mixture
	Equipment Coefficient / m3 = $1 / Q3$		1.5946	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
d.	Tools Required : - Shovel = 3 Units - Broom = 4 Units - Leveller = 3 Unit - Push cart = 2 Units				
3.	LABOR Determined Production (Concrete Mixer) Mixture production in 1 day = $Ew \times Q1$ Labor Required - Foreman - Worker Labor Coefficient/ M3 : - Foreman = $(Ew \times UL) : Qt$ - Worker = $(Ew \times FO) : Qt$	Q1 Qt UL FO L4 L1	1.667 11.67 1.00 12.00 0.6000 7.2000	m3/Hour m3 Person Person Hour Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Bituminous Coldmix
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	7.2000	0.63	4.54
	Foreman	Hour	0.6000	1.50	0.90
	Sum of the Labour Cost				5.44
B.	MATERIAL				
	Fine Aggregate	m3	1.1683	23.00	26.87
	Emulsion Aggregate	kg	140.7000	1.50	211.05
	Sum of the Materials Cost				237.92
C.	EQUIPMENT				
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.6000	10.50	6.30
	Tandem Roller 6-8 Ton	Hour	0.1026	57.50	5.90
	Dump Truck 10 Ton	Hour	1.5946	55.75	88.90
	Tools	Ls	1.0000	0.50	0.50
	Sum of the Equipment Cost				101.60
D.	Work Unit Price (A+B+C)				344.95

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis of Asphalt Surface Dressing

PAYMENT ITEM NO. :
 TYPES OF WORK : Asphalt Surface Dressing
 PAYMENT UNIT : Liter

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1	Using Heavy Equipment (Mechanically)				
2	Work location: along the road				
3	Average distance from Base Camp to work location	L	4.0	km	
4	Effective Working Hour per day	Ew	7.00	Hour	
5	Material Loss factor	Lf	1.10	-	
6	Material Composition :				
	- Asphalt AC - 10 or AC - 20	As	95.24	%	95 parts
	- Kerosene/liquidifier	K	4.76	%	5 parts
7	Material Density :				
	- Asphalt AC - 10 atau AC - 20	Vd1	1.03	kg / Ltr	
	- Kerosene/liquidifier	Vd2	0.80	kg / Ltr	
8	Base Material (Asphalt & Liquidifier lubricant) all accepted in the work location				
II.	WORK SEQUENCE				
1	Asphalt and Kerosene are mixed and heated to become Liquid asphalt				
2	Surface to be coated should be cleaned from dust and dirt using Air Compressor				
3	Liquid Asphalt mixture is sprayed using Asphalt Sprayer on the surface to be coated				
4	Asphalt & kerosene are transported using Dump Truck				
III.	MATERIALS, EQUIPMENT AND LABORS USED				
1.	MATERIAL				
	To get 1 liter of tack coat				
	Required : (1 liter x Lf)	Pc	1.10	Liter	Mixed
	Asphalt = As x Pc x Vd1 : 100	M18	1.08	kg	
	Kerosene = K x Pc : 100	M20	0.052	Liter	
2.	EQUIPMENT				
a.	Asphalt Sprayer	E3			*Operation condi :
	equipment Capacity	V	800.00	Liter	Moderate
	Equipment Efficiency Factor*	Ef	0.65	-	Maintenance
	Cycle Time (Includes heating process)	Ct	2.00	Hour	of machine :
	Production Capacity / Hour = $\frac{V \times Ef}{Ct}$	Q1	260.00	Liter	Moderate
	Equipment Coefficient / Liter = 1 / Q1		0.0038	Hour	Test Result
b.	Compressor 4000-6500 l/m	E30			
	equipment Capacity----->> Taken	V	600.00	m2 / Hour	
	Average application	Ap	0.80	Liter / m2	
	Production Capacity / Hour = (V x Ap)	Q2	480.00	Liter	
	Equipment Coefficient / Liter = 1 / Q2		0.0021	Hour	
c.	Dump Truck 5.5 Ton	E42			
	An equipment to transport material in the work location				
	Dump Truck supports Asphalt Sprayer.				
	Production capacity / Hour = Equal to Asphalt Sprayer	Q1	260.00	Liter	
	Equipment Coefficient / Liter = 1 / Q1		0.0038	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	LABOR				
	Determined Production : ASPHALT SPRAYER	Q1	260.00	Liter	
	Productivity / day = $E_w \times Q1$	Qt	1,820.00	Liter	
	Labor Required				
	- Worker	UL	10.00	Person	
	- Foreman	FO	1.00	Person	
	Labor Coefficient/ Liter :				
	- Worker = $(E_f \times UL) / Qt$	L1	0.0385	Hour	
	- Foreman = $(E_f \times FO) / Qt$	L4	0.0038	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Asphalt Surface Dressing
 PAYMENT UNIT : Liter

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	0.0385	0.63	0.02
	Foreman	Hour	0.0038	1.50	0.01
	Sum of the Labour Cost				0.03
B.	MATERIAL				
	Asphalt	kg	1.08	2.00	2.16
	Kerosene	Liter	0.0524	1.00	0.05
	Sum of the Materials Cost				2.21
C.	EQUIPMENT				
	Asphalt Sprayer	Hour	0.0038	5.54	0.02
	Compressor 4000-6500 l/m	Hour	0.0021	19.80	0.04
	Dump Truck 5.5 Ton	Hour	0.0038	33.45	0.13
	Sum of the Equipment Cost				0.19
D.	Work Unit Price (A+B+C)				2.43

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example of Unit Price Analysis of Asphalt Concrete AC-WC (gradation Course / fine)

PAYMENT ITEM NO. :
 TYPES OF WORK : Asphalt Concrete AC-WC (gradation Course / fine)
 PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1.	Equipment Operation(Mechanically)				
2.	Existing road condtion: Moderate				
3.	Work Location: along the road				
4.	Average distance from base camp to work location	L	4.00	km	
5.	Solid pavement AC-WC thickness	t	0.04	m	
6.	Effective working hours per day	Ew	7.00	Hour	
7.	Material loss factor :				
	- Aggregate	Lf1	1.20	-	
	- Asphalt	Lf2	1.05	-	
8.	Mixture Composition AC-WC				
	- Course Aggregate 5 – 10 & 10 – 20 mm	M7	40.00	%	
	- Fine Aggregate 0 – 5 mm (Fine Aggregatee)	M6	53.80	%	
	- Asphalt (Minimum 5%)	M18	6.20	%	
9.	Material density :				
	- AC-BC	Vd1	2.25	Ton/m3	
	- Course Aggregate & Fine Aggregate	Vd2	1.80	Ton/m3	
	- Asphalt	Vd3	1.03	Ton/m3	
II.	WORK SEQUENCE				
1.	Wheel Loader load aggregate into Cold Bin AMP				
2.	Aggregates and asphalt are mixed and heated on AMP				
3.	to be loaded directlv into a dump truck and transported				
4.	the mixture is spread with a Finisher air conditioning heat				
	A group of workers will level the overlay trimmed edge during compaction using Tools				
III.	MATERIAL, LABOR, AND EQUIPMENT USED				
1.	MATERIAL				
	Course (M7 x (Vd1 x t) x Lf1) /Vd2	M7	0.0240	m3	
	Intermediate Aggregate (M6 x (Vd1 x t) x Lf1) / Vd2	M6	0.0323	m3	
	Asphalt (M18 x (Vd1 x t) x Lf2) x 1000	M18	5.8590	kg	
2.	EQUIPMENT				
a.	Wheel Loader, 1.8 m3	E82			
	Bucket Capacity	Vb	1.80	m3	Moderate machine :
	Bucket Factor	Bf	1.00	-	Moderate
	Equipment Efficiency Factor*	Ef	0.65	-	
	Cycle Time, Ct				
	- Loading		3.00	Minute	Test Result
			1.00	Minute	Test Result
	Sum		4.00	Minute	
	Production $\frac{Vd2 \times Vb \times Bf \times Ef \times 60}{Vd1 \times Ct1 \times t}$	Q1	351.00	m3/Hour	
	Capacity/hour =				
	Equipment Coefficient / ton = 1 / Q1 298		0.0028	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
b.	Asphalt Mixing Plant	E1			
	Production Capacity	V	50.00	Ton/Hour	Moderate machine :
	Equipment Efficiency Factor*	Ef	0.65	-	Moderate
	Production Capacity/hour = $\frac{V \times Ef}{Vd1 \times t}$	Q2	361.11	m2/Hour	
	Equipment Coefficient / ton = 1 / Q2		0.0028	Hour	
c.	Generator Set	E56			
	Production Capacity= AMP	Q3	361.11	m2/Hour	
	Equipment Coefficient / ton = 1 / Q3		0.0028	Hour	
d.	Dump Truck 10 Ton	E44			Moderate
	Tank Capacity	Vt	10.00	m3	
	Equipment Efficiency Factor*	Ef	0.80	-	
	Average Speed when Loaded	s1	20.00	km/Hour	
	Average Sped when Empty	s2	40.00	km/Hour	
	AMP Capacity / batch	Q2b	0.50	Ton/m3	
	Preparation Time for 1 batch AC-WC	Tb	1.00	Minute	
	Cycle Time, Ct				
	- Tank Filling = (V : Q2b) x Tb	T1	20.00	Minute	
	- Transporting = (L : s1) x 60	T2	12.00	Minute	
	-Wait + dump + Rotate	T3	15.00	Minute	
	- Returned = (L : s2) x 60	T4	6.00	Minute	
	Sum	Ct2	53.00	Minute	
	Production Capacity/hour = $\frac{Vt \times Ef \times 60}{Vd1 \times t \times Ct2}$	Q4	100.63	m2	
	Equipment Coefficient/ Ton = 1 / Q4		0.0099	Hour	
e.	Asphalt Finisher, 4 m width	E2			Moderate machine :
	Production Capacity	V	10	Ton / Hour	Moderate
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity/hour = $\frac{V \times Ef}{t \times Vd1}$	Q5	72.22	m2	
	Equipment Coefficient / Ton = 1 / Q5		0.0138	Hour	
f.	Tandem Roller 6-8 Ton	E69			Moderate machine :
	Equipment Average Speed	Sa	2.5	km/Hour	Moderate
	Effective Compaction Width	cw	1.2	m	
	Number of trips	n1	4	trip	
	Equipment Efficiency Factor*	Ef	0.65	-	
	Production Capacity/hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1 \times t}$	Q6	487.50	m2	
	Equipment Coefficient / Ton = 1 / Q6		0.0021	Hour	
g.	Pneumatic Tire Roller 10 Ton	E71			Moderate machine :
	Average Speed	Sa	3.5	km/Hour	Moderate
	Compaction effective width	cw	1.2	m	
	Number of trips	n1	4	Trip	
	Equipment Efficiency Factor*	Ef	0.65	-	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
h.	Production $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1 \times t}$	Q7	682.50	m2	Lumpsum
	Capacity/hour = $\frac{(Sa \times 1000) \times cw \times t \times Ef}{n1 \times t}$		0.0015	Hour	
	Equipment Coefficient / Ton = 1 / Q7				
	Tools				
	- Traffic Sign				
	- Cart				
	- Shovel				
	- Fork				
	- Thickness Control Stick				
	Spreading				
3.	LABOR				
	Determined Production : Asphalt Mixing Plant	Q2	361.11	m2/Hour	
	Production AC-WC / day = Ew x Q2	Qt	2527.78	m2	
	Labor Required :	UL	10	Person	
	- Worker	FO	1	Person	
	- Foreman				
	Labor Coefficient / m2 :				
	- Worker = (Ew x UL) / Qt	L1	0.0277	Hour	
	- Foreman = (Ew x FO) / Qt	L4	0.0028	Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Asphalt Concrete AC-WC (gradation Course / fine)
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	Labor				
	Worker	Hour	0.0277	0.63	0.02
	Foreman	Hour	0.0028	1.50	0.00
					0.02
B.	Material				
	Course	m3	0.0240	25.00	0.60
	Aggregate	m3	0.0323	23.00	0.74
	Fine Aggregate	kg	5.8590	2.00	11.72
	Asphalt				
	Sum of the Materials Cost				13.06
C.	Equipment				
	Wheel Loader, 1.8 m3	Hour	0.0028	65.00	0.19
	Asphalt Mixing Plant	Hour	0.0028	400.00	1.11
	Generator Set	Hour	0.0028	50.00	0.14
	Dump Truck 10 Ton	Hour	0.0099	55.75	0.55
	Asphalt Finisher 4 m width	Hour	0.0138	120.00	1.66
	Tandem Roller 6-8 Ton	Hour	0.0021	57.50	0.12
	Pneumatic Tire Roller 10 Ton	Hour	0.0015	70.00	0.10
	Tools	Ls	1.0000	0.50	0.50
	Sum of the Equipment Cost				4.37
D.	Work Unit Price (A+B+C)				17.45

Note :

- The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- The unit cost for equipment including fuel, used material and the operator's Cost.
- Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example: Unit Price Analysis for reinstatement and minor work :

Examples of thermoplastic road marking

PAYMENT ITEM NO. :
 TYPES OF WORK : Thermoplastic road marking
 PAYMENT UNIT : m2

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTION				
1.	Work is carried out using Paint marker machine				
2.	Work Location : along the road				
3.	Basic materials (paint markers and glass beads) are all accepted at work location				
4.	Average distance from Base Camp to work location	L	8	km	
5.	Effective working hour/ day	Ew	7	Hour	
6.	Material Loss factor	Wf	1.05	-	
7.	Manual painted thickness	t	0.003	m	
8.	Paint density	Vdp	1.3	kg/liter	
9.	Paint weight per m ² = 1 m ² x 0.003 m x 1000 x D cat	Wp	3.9	kg	
II.	WORK SEQUENCE				
1.	Road surface is cleaned from dust / dirt				
2.	Measured and Marked the road surface to be painted				
3.	Paint marker poured into the machine , heated until liquidified				
4.	Paint and at the same time sprinkling glass bead				
III.	MATERIAL, LABOR, AND EQUIPMENT USED				
1.	MATERIAL				
	Thermoplastic paint Marker = Wcat x Wf		4.095	kg	
	Glass bead		0.45	kg	
2.	EQUIPMENT				
a.	Paint Stripping Machine	E64			
	Painting Capacity	V	40	kg/Hour	
	Production Capacity / Hour = V / W paint	Q1	10.26	m ²	
	Equipment Coefficient / m² = 1 / Q1		0.0975	Hour	
b.	Dump Truck 5.5 Ton	E42			
	Machine is using together with marking machine	Q2	10.26		
	Equipment Coefficient / m² = 1 / Q2		0.0975	Hour	
c.	Tools				
	Required :				
	Roll meter 5 m = 2 units				
	Broom Stick = 3 sticks				
	Brush = 3 units				
	Traffic Signs = 2 units				
3.	LABOR				
	Labor productivity per day = Q1 x Ew	Qt	71.79	m ²	
	Labor Required				
	- Worker	UL	8	Person	
	-Skilled Labor	SL	3	Person	
	- Foreman	FO	1	Person	
	Labor Coefficient :				
	- Worker = (UL x Ew) / Qt		0.7800	Hour	
	- Skilled Labor = (SL x Ew) / Qt		0.2925	Hour	
	- Foreman = (FO x Ew) / Qt		0.0975	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : thermoplastic road marking
PAYMENT UNIT : m2

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)	
A.	LABOR					
	Worker	Hour	0.7800	0.63	0.49	
	Skilled Labor	Hour	0.2925	1.00	0.29	
	Foreman	Hour	0.0975	1.50	0.15	
	Sum of the Labour Cost					0.93
B.	MATERIAL					
	thermoplastic Paint marker	kg	4.095	8.00	32.76	
	Glass bead	kg	0.45	5.00	2.25	
	Sum of the Materials Cost					35.01
C.	EQUIPMENT					
	Paint Stripping Machine	Hour	0.0975	21.22	2.07	
	Dump Truck 5.5 Ton	Hour	0.0975	33.45	3.26	
	Tools	Ls	1.0000	0.50	0.50	
	Sum of the Equipment Cost					5.83
D.	Work Unit Price (A+B+C))					41.77

Note :

1

The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2

The unit cost for equipment including fuel, used material and the operator's Cost.

3

Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Concrete Class K-500

PAYMENT ITEM NO. :
TYPES OF WORK : Concrete Class K-500
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using tools (mechanically)				
2	Location of work: all the way				
3	Basic materials (stone, sand and cement) accepted entirely on the location of the job				
4	The average distance to the work site Base camp	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Minimum levels Cement (Specifications)	Ks	450	kg/m3	
7	The ratio of water / cement maximum (Spec.)	Wcr	0.375	-	
8	The mixing ratio 1.00 : Cement	Sm	20.2	%	Based on JMF & fit with Specifications
	1.40 : Sand	Ps	28.3	%	
	2.54 : Course Aggregates	Kr	51.4	%	
9	Material Volume Weight :				
	- Concrete	Vd1	2.25	Ton/m3	
	- Cement	Vd2	1.44	Ton/m3	
	- Sand	Vd3	1.80	Ton/m3	
	- Course Aggregates	Vd4	1.80	Ton/m3	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
II.	SEQUENCE OF WORK				
1	Cement, sand, gravel and water are mixed and stirred into concrete using Concrete Mixer				
2	Concrete casted into the formwork prepared				
3	Completing and tidying up after installation				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Cement (PC) = $\{S_m \times V_{d1} \times 1000\} \times 1.025$	M27	466.852	kg	
b.	Concrete sand = $\{(P_s \times V_{d1}) / V_{d3}\} \times 1.025$	M2	0.3631	m3	
c.	Course aggregate = $\{(K_r \times V_{d1}) / V_{d4}\} \times 1.025$	M7	0.6588	m3	
d.	Scaffolding wood and / or Formwork	M40	0.1500	m3	
e.	Nail	M34	1.5000	kg	
2.	EQUIPMENT				
a.	Concrete Mixer 0.3 - 0.6 m3	E15			
	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	The cycle time, ((T1 + T2 + T3 + T4)				
	- Load	T1	3.00	Minute	
	- Stir	T2	2.00	Minute	
	- Pouring	T3	3.00	Minute	
	- Wait, etc.	T4	3.00	Minute	
		Ct1	11.00	Minute	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct1}$	Q1	2.045	m3/Hour	
	Koefisien Alat / m3 = 1 / Q1		0.4889	Hour	
b.	Water Tank Truck with Pump 5000 liter	E86			
	Water Tank Volume	Vw	5.00	m3	
	The need for water/m3 of concrete	Wr	0.18	m3	
	Equipment Efficiency Factor *	Ef	0.75	-	
	Charging Tang/Hour	n2	1.00	Time	
	Production Capacity/Hour = $\frac{V \times Ef \times n2}{Wr}$	Q2	21.42	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.0467	Hour	
c.	Concrete Vibrator	E24			
	The needs of the concrete vibrator is proportional to the production capacity of Concrete Mixer;				
	Production Capacity/Hour =				
	Production Capacity/Hour of Concrete Mixer.	Q3	2.045	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.4889	Hour	
d.	Concrete Pump	E25			
	Equipment Capacity	V	8.00	m3	
	Equipment Efficiency Factor *	Ef	0.83	-	
	Production Capacity/Hour =				
	Production Capacity/Hour of Concrete Mixer.	Q2	2.045	m3	
	Equipment Coefficient / m3 = 1 / Q4		0.4889	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
e.	Tools Required : - Shovel = 2 pieces - Hoe = 2 pieces - Spoon Cement = 3 pieces - Buckets = 8 pieces				
3.	LABOR Concrete Production in 1 day = Ew x Q1 Labor Requiremer - Foreman - Skilled Labor - Workers Coefficient of Labor / m3: - Foreman = (Ew x FO) / Qt - Skilled Labor = (Ew x SL) / Qt - Workers = (Ew x UL) / Qt	Qt FO SL UL L4 L2 L1	14.32 1.00 4.00 12.00 0.4889 1.9556 5.8667	m3 Person Person Person Hour Hour Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Concrete Class K-500
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	5.8667	0.63	3.70
	Skilled Labor	Hour	1.9556	1.00	1.96
	Foreman	Hour	0.4889	1.50	0.73
	Sum of the Labour Cost				6.38
B.	MATERIAL				
	Cement	kg	466.852	0.16	74.70
	Sand	m3	0.3631	20.00	7.26
	Course Aggregat	m3	0.6588	45.00	29.65
	Wood Scaffolding / Formwork	m3	0.1500	350.00	52.50
	Nail	kg	1.5000	2.00	3.00
	Sum of the Materials Cost				167.10
C.	EQUIPMENT				
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.4889	10.53	5.15
	Water Tank Truck with Pump 5000 liter	Hour	0.0467	25.00	1.17
	Concrete Vibrator	Hour	0.4889	5.00	2.44
	Concrete Pump	Hour	0.4889	29.83	14.58
	Tools	Ls	1.0000	1.00	1.00
	Sum of the Equipment Cost				24.34
D.	Work Unit Price (A+B+C))				197.83

Note :

- The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- The unit cost for equipment including fuel, used material and the operator's Cost.
- Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Concrete Class K-400

PAYMENT ITEM NO. :
 TYPES OF WORK : Concrete K- 400
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using tools (mechanically)				
2	Location of work: all the way				
3	Basic materials (stone, sand and cement) accepted entirely on the location of the job	L	4.0	km	
4	The average distance to the work site Base camp	Ew	7.00	Hour	
5	Effective working hours per day	Ks	400	kg/m3	
6	Minimum levels Cement (Specifications)	Ag	19	mm	
7	The ratio of water / cement maximum (Spec.)	Wcr	0.45	-	
8	The mixing ratio 1.00 : Cement	Sm	17.9	%	Based on JMF & fit with Specifications
	2.00 : Sand	Ps	35.7	%	
	2.60 : Course Aggregates	Kr	46.4	%	
9	Material Volume Weight :				
	- Concrete	Vd1	2.25	Ton/m3	
	- Cement	Vd2	1.44	Ton/m3	
	- Sand	Vd3	1.80	Ton/m3	
	- Course Aggregates	Vd4	1.80	Ton/m3	
II.	SEQUENCE OF WORK				
1	Cement, sand, gravel and water are mixed and stirred				
	into concrete using Concrete Mixer				
2	Concrete casted into the formwork prepared				
3	Completing and tidying up after installation				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Cement (PC) = {Sm x Vd1 x 1000} x 1.025	M27	411.830	kg	
b.	Concrete sand = {(Ps x Vd1) : Vd3} x 1.025	M2	0.4576	m3	
c.	Course aggregate {(Kr x Vd1) : Vd4} x 1.025	M7	0.5949	m3	
d.	Scaffolding wood and / or Formwork	M40	0.1500	m3	
e.	Nail	M34	1.5000	kg	
2.	EQUIPMENT				
	Concrete Mixer 0.3 - 0.6 m3	E15			
a.	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	The cycle time, Ct (T1 + T2 + T3 + T4)				
	- Load	T1	3.00	Minute	Test result
	- Stir	T2	2.00	Minute	Test result
	- Pouring	T3	3.00	Minute	Test result
	- Wait, etc.	T4	3.00	Minute	Test result
		Ct1	11.00	Minute	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct1}$	Q1	2.045	m3/Hour	
	Equipment Coefficient / m3 = 1 / Q1		0.4889	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
b.	Water Tank Truck with Pump 5000 liter Water Tank Volume The need for water/m3 of concrete Equipment Efficiency Factor * Charging Tang/Hour Production Capacity/hour = $\frac{Vw \times Ef \times n2}{Wr}$ Equipment Coefficient / m3 = 1 / Q2	E86 Vw Wr Ef n2 Q2	 5.00 0.19 0.75 1.00 20.23 0.0494	 m3 m3 - Time m3 Hour	Moderate Maintenance of machine : Moderate
c.	Concrete Vibrator The needs of the concrete vibrator is proportional to the production capacity of Concrete Mixer; Production Capacity/Hour = Production Capacity/Hour of Concrete Mixer. Equipment Coefficient / m3 = 1 / Q3	E24 Q3	 2.045 0.4889	 m3 Hour	
d.	Concrete Pump Equipment Capacity Equipment Efficiency Factor * Prod. Cap. /hr = Prod. Cap./hr of Con. Mixer Equipment Coefficient / m3 = 1 / Q3	E25 V Ef Q2	 8.00 0.83 2.045 0.4889	 m3 - m3 Hour	Moderate Maintenance of machine : Moderate
e.	Tools Required : - Shovel = 2 pieces - Hoe = 2 pieces - Spoon Cement = 3 pieces - Buckets = 8 pieces				
3.	LABOR Concrete Production in 1 day = Ew x Q1 Labor Requirement - Foreman - Skilled Labor - Workers Coefficient of Labor / m3: - Foreman = (Ew x FO) / Qt - Skilled Labor = (Ew x SL) / Qt - Workers = (Ew x UL) / Qt	Qt FO SL UL L4 L2 L1	14.32 1.00 4.00 12.00 0.4889 1.9556 5.8667	m3 Person Person Person Hour Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Concrete K- 400
PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR Worker Skilled Labor Foreman	Hour Hour Hour	5.8667 1.9556 0.4889	0.63 1.00 1.50	3.70 1.96 0.73
Sum of the Labour Cost					6.38

B.	MATERIAL					
	Cement	kg	411.830	0.16	65.89	
	Sand	m3	0.4576	20.00	9.15	
	Course Agreggat	m3	0.5949	45.00	26.77	
	Wood Scaffolding / Formwork	m3	0.1500	350.00	52.50	
	Nail	kg	1.5000	2.00	3.00	
	Sum of the Materials Cost					157.31
C.	Peralatan					
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.4889	10.53	5.15	
	Water Tank Truck with Pump 5000 liter	Hour	0.0494	25.00	1.24	
	Concrete Vibrator	Hour	0.4889	5.00	2.44	
	Concrete Pump	Hour	0.4889	29.83	14.58	
	Tools	Ls	1.0000	1.00	1.00	
	Sum of the Equipment Cost					24.41
D.	Work Unit Price (A+B+C))					188.11

Note :

1

The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2

The unit cost for equipment including fuel, used material and the operator's Cost.

3

Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Concrete Class K-350

PAYMENT ITEM NO. :
 TYPES OF WORK : Concrete Class K-350 (Structural Concrete Class "A" - 30 Mpa)
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using tools (mechanically)				
2	Location of work: all the way				
3	Basic materials (stone, sand and cement) accepted				
4	entirely on the location of the job				
4	The average distance to the work site Base camp	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Minimum levels Cement (Specifications)	Ks	365	kg/m3	
7	The ratio of water / cement maximum (Spec.)	Ag	19	mm	
		Wcr	0.45	-	
8	The mixing ratio	M27	16.7	%	Based on JMF & fit with Specifications
	1.00 Cement	M2	33.3	%	
	2.00 sand	M7	50.0	%	
	3.00 Coarse Aggregate				
9	Material Volume Weight :				
	- Concrete	Vd1	2.40	Ton/m3	
	- Cement	Vd2	1.44	Ton/m3	
	- Sand	Vd3	1.80	Ton/m3	
	- Course Aggregates	Vd4	1.80	Ton/m3	
II.	URUTAN KERJA				
1	Cement, sand, gravel and water are mixed and stirred into concrete using Concrete Mixer				
2	Concrete casted into the formwork prepared				
3	Completing and tidying up after installation				
III.	MATERIALS USED, TOOLS AND LABOR				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
1.	MATERIAL				
a.	Cement (PC) = {Sm x Vd1 x 1000} x 1.025	M27	410.000	kg	& fit Specifications
b.	Concrete Sand = {(Ps x Vd1) : Vd3} x 1.025	M2	0.4556	m3	
c.	aggregate = {(Ak x Vd1) : Vd4} x 1.025	M7	0.6833	m3	
d.	wood and / or	M40	0.2300	m3	
e.	Nail	M34	1.9000	kg	
2.	EQUIPMENT				
a.	Concrete Mixer 0.3 - 0.6 m3	E15			
	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	The cycle time, Ct (T1 + T2 + T3 + T4)				
	- Load	T1	5.00	Minute	Test results
	- Stir	T2	4.00	Minute	Test results
	- Pouring	T3	5.00	Minute	Test results
	- Wait, etc.	T4	5.00	Minute	Test results
		Ct1	19.00	Minute	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct1}$	Q1	1.184	m3/Hour	
	Equipment Coefficient / m3 = 1 / Q1		0.8444	Hour	
b.	Water Tank Truck with Pump 5000 liter	E86			
	Water Tank Volume	Vw	5.00	m3	Moderate
	The need for water/m3 of concrete	Wr	0.18	m3	machine :
	Equipment Efficiency Factor *	Ef	0.75	-	Moderate
	Charging Tang/Hour	n2	1.00	Time	
	Production Capacity/hour = $\frac{Vw \times Ef \times n2}{Wr}$	Q2	20.33	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.0492	Hour	
c.	Concrete Vibrator	E24			
	The needs of the concrete vibrator is proportional to the production capacity of Concrete Mixer;				
	Production Capacity/Hour =				
	Production Capacity/Hour of Concrete Mixer.	Q3	1.184	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.8444	Hour	
d.	Concrete Pump	E25			
	Equipment Capacity	V	8.00	m3	Moderate
	Equipment Efficiency Factor *	Ef	0.83	-	Maintenance of machine :
	Prod. Cap. /hr = Prod. Cap./hr of Con. Mixer	Q2	1.184	m3	Moderate
	Equipment Coefficient / m3 = 1 / Q2		0.8444	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
e.	Tools Required : - Shovel = 2 pieces - Hoe = 2 pieces - Spoon Cement = 3 pieces - Buckets = 8 pieces				
3.	LABOR Concrete Production in 1 day = Ew x Q1 Labor Requirement - Foreman - Skilled Labor - Workers Coefficient of Labor / m3: - Foreman = (Ew x FO) / Qt - Skilled Labor = (Ew x SL) / Qt - Workers = (Ew x UL) / Qt	Qt FO SL UL L4 L2 L1	8.29 1.00 4.00 12.00 0.8444 3.3778 10.1333	m3 Person Person Person Hour Hour Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Concrete Class K-350 (Structural Concrete Class "A" - 30 Mpa)
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Foreman	Hour	10.1333	0.63	6.38
	Skilled Labor	Hour	3.3778	1.00	3.38
	Worker	Hour	0.8444	1.50	1.27
	Sum of the Labour Cost				11.03
B.	MATERIAL				
	Cement	kg	410.000	0.16	65.60
	Sand	m3	0.4556	20.00	9.11
	Course Aggregat	m3	0.6833	45.00	30.75
	Wood Scaffolding / Formwork	m3	0.2300	350.00	80.50
	Nail	kg	1.9000	2.00	3.80
	Sum of the Materials Cost				189.76
C.	EQUIPMENT				
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.8444	10.53	8.89
	Water Tank Truck with Pump 5000 liter	Hour	0.0492	25.00	1.23
	Concrete Vibrator	Hour	0.8444	5.00	4.22
	Concrete Pump	Hour	0.8444	29.83	25.19
	Tools	Ls	1.0000	1.00	1.00
	Sum of the Equipment Cost				40.53
D.	Work Unit Price (A+B+C)				241.32

Note :

- The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- The unit cost for equipment including fuel, used material and the operator's Cost.
- Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Concrete Class K-300

PAYMENT ITEM NO. :
TYPES OF WORK : Concrete, Class K-300
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using tools (mechanically)				
2	Location of work: all the way				
3	Basic materials (stone, sand and cement) accepted entirely on the location of the job				
4	The average distance to the work site Base camp	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Minimum levels Cement (Specifications)	Ks	350	kg/m3	
7	The ratio of water / cement maximum (Spec.)	Ag	19	mm	
		Wcr	0.45	-	
8	The mixing ratio 1.00 : Cement	Sm	16.0	%	Based on JMF & fit
	2.25 : Sand	Ps	36.0	%	with Specifications
	3.00 : Coarse Aggregate	Kr	48.0	%	
9	Material Volume Weight :				
	- Concrete	Vd1	2.25	Ton/m3	
	- Cement	Vd2	1.44	Ton/m3	
	- Sand	Vd3	1.80	Ton/m3	
	- Course Aggregates	Vd4	1.80	Ton/m3	
II.	SEQUENCE OF WORK				
1	Cement, sand, gravel and water are mixed and stirred				
	into concrete using Concrete Mixer				
2	Concrete casted into the formwork prepared				
3	Completing and tidying up after installation				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Cement (PC) = {Sm x Vd1 x 1000} x 1.025	M27	369.000	kg	
b.	Concrete sand = {(Ps x Vd1) / Vd3} x 1.025	M2	0.4613	m3	
c.	Course aggregate {(Kr x Vd1) / Vd4} x 1.025	M7	0.6150	m3	
d.	Scaffolding wood and / or Formwork	M40	0.1000	m3	
e.	Nail	M34	1.0000	kg	
2.	EQUIPMENT				
a.	Concrete Mixer 0.3 - 0.6 m3	E15			
	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	The cycle time, Ct (T1 + T2 + T3 + T4)	Ct			
	- Load	T1	3.00	Minute	Test Result
	- Stir	T2	2.00	Minute	Test Result
	- Pouring	T3	3.00	Minute	Test Result
	- Wait, etc.	T4	3.00	Minute	Test Result
		Ct	11.00	Minute	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct}$	Q1	2.045	m3/Hour	
	Equipment Coefficient / m3 = 1 / Q1		0.4889	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
b.	Water Tank Truck with Pump 5000 liter Water Tank Volume The need for water/m3 of concrete Equipment Efficiency Factor * Charging Tang/Hour $\text{Production Capacity/hour} = \frac{Vt \times Ef \times n2}{Wr}$	E86 Vw Wr Ef n2 Q2	 5.00 0.17 0.75 1.00 22.58	 m3 m3 - Kali m3	Moderate machine : Moderate
	Equipment Coefficient / m3 = 1 / Q2		0.0443	Hour	
c.	Concrete Vibrator The needs of the concrete vibrator is proportional to the production capacity of Concrete Mixer; Production Capacity/Hour = Production Capacity/Hour of Concrete Mixer.	E24 Q3	 2.045	 m3	
	Equipment Coefficient / m3 = 1 / Q3		0.4889	Hour	
d.	Concrete Pump Equipment Capacity Equipment Efficiency Factor * Prod. Cap. /hr = Prod. Cap./hr of Con. Mixer Equipment Coefficient / m3 = 1 / Q2	E25 V Ef Q2	 8.00 0.83 2.045 0.4889	 m3 - m3 Hour	Moderate Maintenance of machine : Moderate
e.	Tools Required : - Shovel = 2 pieces - Hoe = 2 pieces - Spoon Cement = 3 pieces - Buckets = 8 pieces				
3.	LABOR Concrete Production in 1 day = Ew x Q1 Labor Requirement - Foreman - Skilled Labor - Workers Coefficient of Labor / m3: - Foreman = (Ew x FO) / Qt - Skilled Labor = (Ew x SL) / Qt - Workers = (Ew x UL) / Qt	Qt FO SL UL L4 L2 L1	 14.32 1.00 4.00 12.00 0.4889 1.9556 5.8667	 m3 Person Person Person Hour Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Concrete, Class K-300
PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	5.8667	0.63	3.70
	Skilled Labor	Hour	1.9556	1.00	1.96
	Foreman	Hour	0.4889	1.50	0.73
	Sum of the Labour Cost				6.38
B.	MATERIAL				
	Cement	kg	369.000	0.16	59.04
	Sand	m3	0.4613	20.00	9.23
	Course Aggregat	m3	0.6150	45.00	27.68
	Wood Scaffolding / Formwork	m3	0.1000	350.00	35.00
	Nail	kg	1.0000	2.00	2.00
	Sum of the Materials Cost				132.94
C.	Peralatan				
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.4889	10.53	5.15
	Water Tank Truck with Pump 5000 liter	Hour	0.0443	25.00	1.11
	Concrete Vibrator	Hour	0.4889	5.00	2.44
	Concrete Pump	Hour	0.4889	29.83	14.58
	Tools	Ls	1.0000	1.00	1.00
	Sum of the Equipment Cost				24.28
D.	Work Unit Price (A+B+C))				163.61

Note :

1

The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2

The unit cost for equipment including fuel, used material and the operator's Cost.

3

Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Concrete Class K-250

PAYMENT ITEM NO. :
TYPES OF WORK : Concrete, Class K-250
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using tools (mechanically)				
2	Location of work: all the way				
3	Basic materials (stone, sand and cement) accepted entirely on the location of the job				
4	The average distance to the work site Base camp	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Minimum levels Cement (Specifications)	Ks	340	kg/m3	
7	The ratio of water / cement maximum (Spec.)	Ag	19	mm	
		Wcr	0.50	-	
8	The mixing ratio 1.00 : Cement	Sm	15.4	%	Based on JMF & fit with Specifications
	2.25 : Sand	Ps	34.6	%	
	3.25 : Course Aggregate	Kr	50.0	%	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
9	Material Volume Weight : - Concrete - Cement - Sand - Course Aggregates	Vd1 Vd2 Vd3 Vd4	2.25 1.44 1.80 1.80	Ton/m3 Ton/m3 Ton/m3 Ton/m3	
II.	SEQUENCE OF WORK				
1	Cement, sand, gravel and water are mixed and stirred into concrete using Concrete Mixer				
2	Concrete casted into the formwork prepared				
3	Completing and tidying up after installation				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Cement (PC) = {Sm x Vd1 x 1000} x 1.025	M27	354.808	kg	
b.	Concrete sand = {(Ps x Vd1) / Vd3} x 1.025	M2	0.4435	m3	
c.	Course aggregate {(Kr x Vd1) / Vd4} x 1.025	M7	0.6406	m3	
d.	Scaffolding wood and / or Formwork	M40	0.1500	m3	
e.	Nail	M34	1.0000	kg	
2.	EQUIPMENT				
a.	Concrete Mixer 0.3 - 0.6 m3	E15			
	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	The cycle time, Ct (T1 + T2 + T3 + T4)	Ct			
	- Load	T1	3.00	Minute	Test result
	- Stir	T2	2.00	Minute	Test result
	- Pouring	T3	3.00	Minute	Test result
	- Wait, etc.	T4	3.00	Minute	Test result
		Ct	11.00	Minute	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct}$	Q1	2.045	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.4889	Hour	
b.	Water Tank Truck with Pump 5000 liter	E86			
	Water Tank Volume	Vw	5.00	m3	Moderate
	The need for water/m3 of concrete	Wr	0.18	m3	machine :
	Equipment Efficiency Factor *	Ef	0.75	-	Moderate
	Charging Tang/Hour	n2	1.00	Time	
	Production Capacity/hour = $\frac{Vw \times Ef \times n2}{Wr}$	Q2	21.14	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.0473	Hour	
c.	Concrete Vibrator	E24			
	The needs of the concrete vibrator is proportional to the production capacity of Concrete Mixer;				
	Production Capacity/Hour =				
	Production Capacity/Hour of Concrete Mixer.	Q3	2.045	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.4889	Hour	
e.	Tools				
	Required :				
	- Shovel = 2 pieces				
	- Hoe = 2 pieces				
	- Spoon Cement = 2 pieces				
	- Buckets = 4 pieces				
	- Cart push = 1 pieces				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	LABOR Concrete Production in 1 day = Ew x Q1 Labor Requirement:- Foreman - Skilled Labor - Workers Coefficient of Labor / m3: - Foreman = (Ew x FO) / Qt - Skilled Labor = (Ew x SL) / Qt - Workers = (Ew x UL) / Qt	Qt FO SL UL L4 L2 L1	14.32 1.00 4.00 12.00 0.4889 1.9556 5.8667	m3 Person Person Person Hour Hour Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Concrete, Class K-250
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	5.8667	0.63	3.70
	Skilled Labor	Hour	1.9556	1.00	1.96
	Foreman	Hour	0.4889	1.50	0.73
	Sum of the Labour Cost				6.38
B.	MATERIAL				
	Cement	kg	354.808	0.16	56.77
	Sand	m3	0.4435	20.00	8.87
	Course Aggregat	m3	0.6406	45.00	28.83
	Wood Scaffolding / Formwork	m3	0.1500	350.00	52.50
	Nail	kg	1.0000	2.00	2.00
	Sum of the Materials Cost				148.97
C.	EQUIPMENT				
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.4889	10.53	5.15
	Water Tank Truck with Pump 5000 liter	Hour	0.0473	25.00	1.18
	Concrete Vibrator	Hour	0.4889	5.00	2.44
	Tools	Ls	1.0000	1.00	1.00
	Sum of the Equipment Cost				9.78
D.	Work Unit Price (A+B+C)				165.13

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Concrete Class K-175

PAYMENT ITEM NO. :
TYPES OF WORK : Concrete, Class K-175
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using tools (mechanically)				
2	Location of work: all the way				
3	Basic materials (stone, sand and cement) accepted entirely on the location of the job				
4	The average distance to the work site Base camp	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Minimum levels Cement (Specifications)	Ks	300	kg/m3	
7	The ratio of water / cement maximum (Spec.)	Wcr	0.57	-	
8	The mixing ratio	Sm	13.8	%	Based on JMF & fit with Specifications
	1.00 Cement	Ps	31.0	%	
	2.25 Sand	Kr	55.2	%	
	4.00 Coarse Aggregate				
9	Material Volume Weight :				
	- Concrete	Vd1	2.25	Ton/m3	
	- Cement	Vd2	1.44	Ton/m3	
	- Sand	Vd3	1.80	Ton/m3	
	- Course Aggregates	Vd4	1.80	Ton/m3	
II.	SEQUENCE OF WORK				
1	Cement, sand, gravel and water are mixed and stirred				
	into concrete using Concrete Mixer				
2	Concrete casted into the formwork prepared				
3	Completing and tidying up after installation				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Cement (PC) = {Sm x Vd1 x 1000} x 1.05	M27	318.103	kg	
b.	Concrete sand = {(Ps x Vd1) : Vd3} x 1.05	M2	0.3976	m3	
c.	Course aggregate {(Kr x Vd1) : Vd4} x 1.35	M7	0.7069	m3	
d.	Scaffolding wood and / or Formwork	M40	0.0750	m3	
e.	Nail	M34	0.5000	kg	
2.	EQUIPMENT				
a.	Concrete Mixer 0.3 - 0.6 m3	E15			
	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	The cycle time, Ct (T1 + T2 + T3 + T4)				
	- Load	T1	3.00	Minute	Test result
	- Stir	T2	2.00	Minute	Test result
	- Pouring	T3	3.00	Minute	Test result
	- Wait, etc.	T4	3.00	Minute	Test result
		Ct1	11.00	Minute	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct1}$	Q1	2.045	m3/Hour	
	Equipment Coefficient / m3 = 1 / Q1		0.4889	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
b.	Water Tank Truck with Pump 5000 liter Water Tank Volume The need for water/m3 of concrete Equipment Efficiency Factor * Charging Tang/Hour $\text{Production Capacity/hour} = \frac{Vw \times Ef \times n2}{Wr}$	E86 Vw Wr Ef n2 Q2	 5.00 0.18 0.75 1.00 20.68	 m3 m3 - Kali m3	Moderate machine : Moderate
	Equipment Coefficient / m3 = 1 / Q2		0.0484	Hour	
c.	Concrete Vibrator The needs of the concrete vibrator is proportional to the production capacity of Concrete Mixer; Production Capacity/Hour = Production Capacity/Hour of Concrete Mixer.	E24 Q3	 2.045	 m3	
	Equipment Coefficient / m3 = 1 / Q3		0.4889	Hour	
d.	Concrete Pump Equipment Capacity Equipment Efficiency Factor * Prod. Cap. /hr = Prod. Cap./hr of Con. Mixer Equipment Coefficient / m3 = 1 / Q4	E25 V Rf Q4	 8.00 0.83 2.045 0.4889	 m3 - m3 Hour	Moderate Maintenance of machine : Moderate
e.	Tools Required : - Shovel = 2 pieces - Hoe = 2 pieces - Spoon Cement = 2 pieces - Buckets = 4 pieces				
3.	LABOR Concrete Production in 1 day = Ew x Q1 Labor Requirement - Foreman - Skilled Labor - Workers Coefficient of Labor / m3: - Foreman = (Ew x FO) / Qt - Skilled Labor = (Ew x SL) / Qt - Workers = (Ew x UL) / Qt	Qt FO SL UL L4 L2 L1	 14.32 1.00 4.00 12.00 0.4889 1.9556 5.8667	 m3 Person Person Person Hour Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Concrete, Class K-175
PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	5.8667	0.63	3.70
	Skilled Labor	Hour	1.9556	1.00	1.96
	Foreman	Hour	0.4889	1.50	0.73
	Sum of the Labour Cost				6.38
B.	MATERIAL				
	Cement	kg	318.103	0.16	50.90
	Sand	m3	0.3976	20.00	7.95
	Course Aggregat	m3	0.7069	45.00	31.81
	Wood Scaffolding / Formwork	m3	0.0750	350.00	26.25
	Nail	kg	0.5000	2.00	1.00
	Sum of the Materials Cost				117.91
C.	Peralatan				
	Concrete Mixer 0.3 – 0.6 m3	Hour	0.4889	10.53	5.15
	Water Tank Truck with Pump 5000 liter	Hour	0.0484	25.00	1.21
	Concrete Vibrator	Hour	2.0455	5.00	10.23
	Concrete Pump	Hour	0.4889	29.83	14.58
	Tools	Ls	1.0000	1.00	1.00
Sum of the Equipment Cost				32.17	
D.	Work Unit Price (A+B+C))				156.46

Note :

1

The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2

The unit cost for equipment including fuel, used material and the operator's Cost.

3

Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Cyclop Concrete Class K-175

PAYMENT ITEM NO. :
TYPES OF WORK : Cyclop concrete K-175
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using equipment (mechanically)				
2	Location of work: all the way				
3	Basic materials (stone, sand and cement) accepted entirely on the location of the job				
4	The average distance to the work site Base camp	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Minimum levels Cement (Specifications)	Ks	300	kg/m3	K-175
7	The ratio of water / cement maximum (Spec.)	Wcr	0.57	-	
8	The mixing ratio 1.00 - Cement	Sm	13.8	%	Based on JMF & fit with Specifications
	2.25 - Sand	Ps	31.0	%	
	4.00 - Course Aggregates	Kr	55.2	%	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
9	Material Volume Weight : - Concrete - Cement - Sand - Course Aggregates	Vd1 Vd2 Vd3 Vd4	2.25 1.44 1.80 1.80	Ton/m3 Ton/m3 Ton/m3 Ton/m3	
II.	SEQUENCE OF WORK				
1	Cement, sand, gravel and water are mixed and stirred into concrete using Concrete Mixer				
2	Concrete casted into the formwork prepared				
3	Completing and tidying up after installation				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Cement (PC) = $\{Sm \times Vd1 \times 1000\} \times 1.025$	M27	318.103	kg	
b.	Concrete sand = $\{(Ps \times Vd1) / Vd3\} \times 1.025$	M2	0.3976	m3	
c.	Course aggregate = $\{(Kr \times Vd1) / Vd1\} \times 0.70 \times 1.025$	M7	0.8907	m3	
d.	Stone ϕ 10 - 15 = $\{(Kr \times Vd1) / Vd4\} \times 0.30 \times 1.025$	M15a	21.2069	m3	
e.	Scaffolding wood and / or Formwork	M40	0.0500	m3	
f.	Nail	M34	0.4000	kg	
2.	EQUIPMENT				
a.	Concrete Mixer 0.3 - 0.6 m3	E15			
	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	The cycle time, Ct (T1 + T2 + T3 + T4)				
	- Load	T1	3.00	Minute	Test results
	- Stir	T2	2.00	Minute	Test results
	- Pouring	T3	3.00	Minute	Test results
	- Wait, etc.	T4	3.00	Minute	Test results
		Ct1	11.00	Minute	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct}$	Q1	2.045	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.4889	Hour	
b.	Water Tank Truck with Pump 5000 liter	E86			Moderate
	Water Tank Volume	Vw	5.00	m3	Maintenance of machine :
	The need for water/m3 of concrete	Wr	0.01	m3	Moderate
	Equipment Efficiency Factor *	Ef	0.75	-	
	Charging Tang/Hour	n2	1.00	Kali	
	Production Capacity/hour = $\frac{Vw \times Ef \times n2}{Wr}$	Q2	683.74	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.0015	Hour	
c.	Concrete Vibrator	E24			
	The needs of the concrete vibrator is proportional to the production capacity of Concrete Mixer;				
	Production Capacity/Hour =				
	Production Capacity/Hour of Concrete Mixer.	Q3	2.045	m3	
	Equipment Coefficient / m3 = 1 / Q3		0.4889	Hour	
e.	Tools				
	Required :				
	- Shovel = 2 pieces				
	- Hoe = 2 pieces				
	- Spoon Cement = 2 pieces				
	- Buckets = 4 pieces				
	- Cart push = 2 pieces				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
3.	LABOR Concrete Production in 1 day = Ew x Q1 Labor Requirement- Foreman - Skilled Labor - Workers Coefficient of Labor / m3: - Foreman = (Ew x FO) / Qt - Skilled Labor = (Ew x SL) / Qt - Workers = (Ew x UL) / Qt	Qt FO SL UL L4 L2 L1	14.32 1.00 4.00 12.00 0.4889 1.9556 5.8667	m3 Person Person Person Hour Hour Hour	

**STANDARD FORM
ANALYSIS OF EACH UNIT PRICE**

PAYMENT ITEM NO. :
 TYPES OF WORK : Cyclop concrete K-175
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	5.8667	0.63	3.70
	Skilled Labor	Hour	1.9556	1.00	1.96
	Foreman	Hour	0.4889	1.50	0.73
	Sum of the Labour Cost				6.38
B.	MATERIAL				
	Cement	kg	318.103	0.16	50.90
	Sand	m3	0.3976	20.00	7.95
	Course Aggregat	m3	0.8907	45.00	40.08
	Stone ϕ 10 - 15 cm	m3	21.2069	18.00	381.72
	Wood Scaffolding / Formwork	m3	0.0500	350.00	17.50
	Nail	kg	0.4000	2.00	0.80
	Sum of the Materials Cost				498.95
C.	Peralatan				
	Concrete Mixer 0.3 – 0.6 m3	Hour	11.0000	10.53	115.83
	Water Tank Truck with Pump 5000 liter	Hour	0.0015	25.00	0.04
	Concrete Vibrator	Hour	2.0455	5.00	10.23
	Tools	Ls	1.0000	1.00	1.00
	Sum of the Equipment Cost				127.09
D.	Work Unit Price (A+B+C)				632.43

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Concrete Class K-125

PAYMENT ITEM NO. :
TYPES OF WORK : Concrete Class K - 125
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using tools (mechanically)				
2	Location of work: all the way				
3	Basic materials (stone, sand and cement) accepted entirely on the location of the job				
4	The average distance to the work site Base camp	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Minimum levels Cement (Specifications)	Ks	250	kg/m3	
7	The ratio of water / cement maximum (Spec.)	Wcr	0.60	-	
8	The mixing ratio 1.00 - Cement	Sm	11.111	%	Based on JMF & fit with Specifications
	3.00 - Sand	Ps	33.333	%	
	5.00 - Course Aggregates	Kr	55.556	%	
9	Material Volume Weight :				
	- Concrete	Vd1	2.25	Ton/m3	
	- Cement	Vd2	1.44	Ton/m3	
	- Sand	Vd3	1.80	Ton/m3	
	- Course Aggregates	Vd4	1.80	Ton/m3	
II.	SEQUENCE OF WORK				
1	Cement, sand, gravel and water are mixed and stirred into concrete using Concrete Mixer				
2	Concrete casted into the formwork prepared				
3	Completing and tidying up after installation				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Cement (PC) = {Sm x Vd1 x 1000} x 1.025	M27	250.000	kg	Course aggregate
b.	Concrete sand = {(Ps x Vd1) : Vd3} x 1.025	M2	0.4167	m3	
c.	Course aggregate {(Kr x Vd1) / Vd4} x 1.025	M7	0.6944	m3	
d.	Scaffolding wood and / or Formwork	M40	0.0900	m3	
e.	Nail	M34	0.4000	kg	
2.	EQUIPMENT				
a.	Concrete Mixer 0.3 - 0.6 m3	E15			
	Equipment Capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	The cycle time, Ct (T1 + T2 + T3 + T4)				
	- Load	T1	3.00	Menit	
	- Stir	T2	2.00	Menit	
	- Pouring	T3	3.00	Menit	
	- Wait, etc.	T4	3.00	Menit	
		Ct1	11.00	Menit	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct1}$	Q1	2.045	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.4889	Hour	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
b.	Water Tank Truck with Pump 5000 liter Water Tank Volume The need for water/m3 of concrete Equipment Efficiency Factor * Charging Tang/Hour Production Capacity/hour = $\frac{Vw \times Ef \times n2}{Wr}$ Equipment Coefficient / m3 = 1 / Q2	E86 Vw Wr Ef n2 Q2	 5.00 0.0046 0.75 1.00 810.00	 m3 m3 - Kali m3 Hour	Moderate Maintenance of machine : Moderate
c.	Concrete Vibrator The needs of the concrete vibrator is proportional to the production capacity of Concrete Mixer; Production Capacity/Hour = Production Capacity/Hour of Concrete Mixer. Equipment Coefficient / m3 = 1 / Q3	E24 Q3	 2.045 0.4889	 m3 Hour	
e.	Tools Required : - Shovel = 2 pieces - Hoe = 2 pieces - Spoon Cement = 2 pieces - Buckets = 4 pieces - Cart push = 1 pieces				
3.	LABOR Concrete Production in 1 day = Ew x Q1 Labor Requirem- Foreman - Skilled Labor - Workers Coefficient of Labor / m3: - Foreman = (Ew x FO) / Qt - Skilled Labor = (Ew x SL) / Qt - Workers = (Ew x UL) / Qt	Qt FO SL UL L4 L2 L1	14.32 1.00 4.00 12.00 0.4889 1.9556 5.8667	m3 Person Person Person Hour Hour Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
 TYPES OF WORK : Concrete Class K - 125
 PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Worker	Hour	5.8667	0.63	3.70
	Skilled Labor	Hour	1.9556	1.00	1.96
	Foreman	Hour	0.4889	1.50	0.73
	Sum of the Labour Cost				6.38
B.	MATERIAL				
	Cement	kg	250.000	0.16	40.00
	Sand	m3	0.4167	20.00	8.33
	Course Aggregat	m3	0.6944	45.00	31.25
	Wood Scaffolding / Formwork	m3	0.0900	350.00	31.50
	Nail	kg	0.4000	2.00	0.80
	Sum of the Materials Cost				111.88

C.	Peralatan				
	Concrete Mixer 1 bagger	Hour	0.4889	5.00	2.44
	Water Tank Truck with Pump 5000 liter	Hour	0.0012	25.00	0.03
	Concrete Vibrator	Hour	0.4889	5.00	2.44
	Tools	Ls	1.0000	1.00	1.00
Sum of the Equipment Cost					5.92
D.	Work Unit Price (A+B+C))				124.19

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Unit Price Analysis of Excavation work for Placement Gabion

PAYMENT ITEM NO. :
TYPES OF WORK : Excavation work for placement Gabion
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1.	Road condition : bad				
2.	Using heavy equipment (mechanically)				
3.	Location : along the road				
4.	Type of soil : sand / gravel				
5.	Effective working hours per day	Ew	7.00	Hour	
6.	Material development factor	Lf	1.40	-	
7.	Weight volume of soil (loose)	Vd	1.90	Ton/m3	
8.	Distance to the disposal site	L	1.00	km	
II.	SEQUENCE OF WORK				
1.	Land that is cut o the side / river bank;				
2.	Excavation done using Excavator;				
3.	Excavator loading materials that are dug into the Dump Truck;				
4.	Dump Truck dispose of excavated material to a disposal area as far as L;				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	EQUIPMENT				
a.	Hydraulic Excavator 0.90 cu.m.	E54			Moderate
	Bucket Capacity	Vb	0.90	m3	
	Bucket Factor	Bf	0.80	-	
	Equipment Efficiency Factor*	Ef	0.75	-	
	Excavation	Cf	1.60	-	Maksimum 6.37 m
	and somewhat has difficult dumping condition				
	Cycle Time, Ct :				
	-buckling, lifting, loading	T1	0.40	Minute	Test Result
	-Others (delayed time, etc)	T2	0.20	Minute	Test Result
	Sum	Ct1	0.60	Minute	
	Production Capacity/hour = $\frac{Vb \times Bf \times}{Ct1 \times Cf}$	Q1	24.11	m3	

Example : Analysis of Unit Price Gabion

PAYMENT ITEM NO. : ...
 TYPES OF WORK : Gabion
 PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	The work is done manually				
2	Location of the work : along the river that will be strengthened;				
3	Basic material (iron woven wire and stone) are accepted entirely at the work site;				
4	Effective working hours per day	Ew	7.00	Hour	
5	Material loss factor.	Lf	1.10	-	
II.	SEQUENCE OF WORK				
1	Gabion wire basket is stretched and placed in accordance with the constructio design;				
2	Stone placed one after the other so that the cavity as small as possible;				
3	Woven wire closed and fastened.				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Wire gabion finished/manufactured size (1 x 1 x 2) m3;		0.5000	Unit	
b.	Gabion Wire tise;		2.0000	kg	
b.	Stone		1.2000	m3	
2.	EQUIPMENT				
a.	Tools				
	Required :				
	- Pliers = 2 pieces				
	- Wire cutters = 2 pieces				
	-Rock breaker hammer. = 2 pieces				
3.	LABOR				
	Productio jobs per day	Qt	8.00	m3	
	Labor required : - Foreman	FO	1.00	Person	
	- Skilled Labor	SL	3.00	Person	
	- Workers	UL	6.00	Person	
	Labor coefficient / m3 :				
	- Foreman = (FO x Ew) / Qt	L4	0.8750	Hour	
	- Skilled Labor = (SL x Ew) / Qt	L2	2.6250	Hour	
	- Workers = (UL x Ew) / Qt	L1	5.2500	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
TYPES OF WORK : Gabion
PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Foreman	Hour	0.8750	1.50	1.31
	Skilled Labor	Hour	2.6250	1	2.63
	Worker	Hour	5.2500	0.63	3.31
	Sum of the Labour Cost				7.25
B.	Bahan	-	-	-	-
	Gabion Boxes (1m x 1m x 2m)	Unit	0.5	39.00	19.50
	Gabion Wire	kg	2	2.50	5.00
	Boulder Stone	m3	1.2	10.00	12.00
	Sum of the Materials Cost				36.50
C.	Peralatan				
	Tools	LS	1.0000	0.50	0.50
	Sum of the Equipment Cost				0.50
D.	Work Unit Price (A+B+C)				44.25

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Analisis of Unit Price Skilled Laborry 1 : 4

PAYMENT ITEM NO. :
TYPES OF WORK : Skilled Laborry 1 : 4
PAYMENT UNIT : m3

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using heavy equipment (mechanically)				
2	Location : Bridge abutment				
3	Basic materials accepted entirely at site;				
4	Effective working hours per day	Ew	7.00	Hour	
5	Sand-cement R _c : - Volume of cement	Sm	20	%	Spec.
	: - Volume of sand	Ps	80	%	Spec.
6	Stone - mortar Ratio :				
	- Stone	Bt	65	%	
	- Mortar (mix of cement & sand)	Mr	35	%	
7	Weight volume of material :				
	- Pasangan Batu Dengan Mortar	Vd1	2.40	Ton/m3	
	- Stone	Vd2	1.60	Ton/m3	
	- Mortar	Vd3	1.80	Ton/m3	
	- Sand	Vd4	1.67	Ton/m3	
	- Portland cement	Vd5	1.44	Ton/m3	

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
II.	SEQUENCE OF WORK				
1	Cement, sand and water are mixed and stirred into a mortar using Concrete Mixer;				
2	Stone clean and wet the entire surface before being installed;				
3	Completion and tidying up after installation;				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				
1.	MATERIAL				
a.	Stone $\{(Bt \times Vd1 \times 1 \text{ m}^3) : Vd2\} \times 1.20$	M14	1.1700	m3	Loose
b.	Cement $:Sm \times \{(Mr \times Vd1 \times 1 \text{ m}^3) : Vd3\} \times 1.05$ $\times \{Vd5 \times (1000)\}$	M27	0.0980	m3	
c.	Sand $= Ps \times \{(Mr \times Vd1 \times 1 \text{ m}^3) : Vd4\} \times 1.05$	M1	141.00	kg	
			0.4225	m3	
2.	EQUIPMENT				
a.	Concrete Mixer	E18			
	Equipment capacity	V	500.00	Liter	
	Equipment Efficiency Factor	Ef	0.75	-	
	Cycle Time : $(T1 + T2 + T3 + T4)$	Ct			
	- Loading	T1	6.00	Minute	
	- Stirring	T2	4.00	Minute	
	- Pouring	T3	2.00	Minute	
	- Wait, etc.	T4	5.00	Minute	
		Ct	17.00	Minute	
	Production Capacity/hour = $\frac{V \times Ef \times 60}{1000 \times Ct}$	Q1	1.324	m3	
	Equipment Coefficient / m3 = 1 / Q1		0.7556	Hour	
b.	Water Tank Truck with Pump 5000 liter	E86			
	Water tank volume	Vw	5.00	m3	
	Water demand / m3 Skilled Laborry;	Wr	2.256	m3	
	Equipment Efficiency Factor;	Ef	0.75	-	
	Filling the tank / hour;	n2	2.00	Time	
	Production Capacity/hour = $\frac{Vw \times Ef \times n2}{Wr}$	Q2	3.32	m3	
	Equipment Coefficient / m3 = 1 / Q2		0.3008	Hour	
c.	Tools				
	Required :				
	- Shovel = 2 pieces				
	- Hoe = 2 pieces				
	- Spoon Cement = 2 pieces				
	- Buckets = 4 pieces				
	- Cart push = 1 pieces				
3.	LABOR				
	Production decesive : Concrete Mixer production	Q1	3.324	m3/Hour	
	Production Skilled Laborry with mortar / day				
	= $Ew \times Q1$	Qt	23.27	m3	
	Labor required : Worker	FO	1.00	Person	
	Skilled Labor	SL	2.00	Person	
	Foreman	UL	8.00	Person	
	Labor coefficient / m3 :				
	- Foreman = $(Ew \times FO) : Qt$	L4	0.3008	Hour	
	- Skilled Labor = $(Ew \times SL) : Qt$	L2	0.6016	Hour	
	- Workers = $(Ew \times UL) : Qt$	L1	2.4064	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :

TYPES OF WORK : Stone Assembly 1 : 4 (Concrete-Mixer)

PAYMENT UNIT : m3

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Foreman	Hour	0.3008	1.50	0.45
	Skilled Labor	Hour	0.6016	1	0.60
	Worker	Hour	2.4064	0.63	1.52
	Sum of the Labour Cost				2.57
B.	MATERIAL				
	Batu	m3	1.1700	25.00	29.25
	Semen (PC)	kg	141.00	0.18	25.38
	Pasir	m3	0.4225	20.00	8.45
	Sum of the Materials Cost				63.08
C.	EQUIPMENT				
	Concrete Mixer	Hour	0.76	0.76	0.57
	Water Tank Truck with Pump 5000 liter	Hour	0.30	0.30	0.09
	Alat Bantu	LS	1.0000	1.00	1.00
	Sum of the Equipment Cost				1.66
D.	Work Unit Price (A+B+C))				67.31

Note :

1

The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2

The unit cost for equipment including fuel, used material and the operator's Cost.

3

Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Analysis of unit price of concrete bored pile

PAYMENT ITEM NO. :

TYPES OF WORK : Concrete pile diameter of 800 mm

PAYMENT UNIT : m

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Using heavy equipment (mechanically)				
2	Concrete is based on the analysis of the relevant work item;				
3	Reinforcing steel is based on the analysis of the relevant work item;				
4	Average distance Base Camp to work location;	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	Long of pole	p	12.00	m	
7	Diameter bored pile of concrete;	φ	0.80	m	
8	Reinforcing steel needs.	Sb	150	kg/m3	
II.	SEQUENCE OF WORK				
1	Drilling is using Tower Bor Pile machine				
2	once the drilling is done the earth is dumped load chasing				
3	Reinforcement is assembled with the help of Labor				
4	casting is using Concrete Pump				

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL MATERIAL				
1.					
a.	Concrete K-250 = $\{1/4 \text{ Phi} \times (\text{Uk})^2\} \times 1\text{m}$		0.5027	m3	
b.	Reinforcing stee = $\{\text{EI-716} \times \text{Mb}\}$		75.3982	kg	
c.	Casing = $\text{Phi} \times \text{Uk}$		2.5133	m2	
2.	EQUIPMENT				
a.	Bore Pile Machine	E14			
	Capacity	V1	2,000.00	m	
	Equipment efficiency factor	Ef	0.80	-	
	Cycle time :				
	- Time shift and drill point adjustment;	T1	15.00	Minute	
	- Excavation and disposal of drilling time;	T2	60.00	Minute	
	- Installation time chasing;	T3	25.00	Minute	
	- Reinforcement installation time;	T4	35.00	Minute	
	- Casting time;	T5	55.00	Minute	
	- Other time.	T6	15.00	Minute	
		Ct1	205.00	Minute	
	Production Capacity/hour = $\frac{V1 \times Ef \times 60}{Ct1}$	Q1	468.29	m/Hour	
	Equipment Coefficient / m = 1 / Q1		0.0021	Hour	
b.	Concrete Pump	E25			
	Capacity	V2	8.00	m3	
	Equipment efficiency factor	Ef	0.80	-	
	Cycle time				
	- Casting time	T1	55.00	Minute	
	- Other time	T2	15.00	Minute	
		Ct2	70.00	Minute	
	Production Capacity/hour = $\frac{V2 \times Ef \times 60}{Ct2}$	Q2	5.49	m3/Hour	
		Q2	10.91	m/Hour	
	Equipment Coefficient / m = 1 / Q2		0.1823	Hour	
c.	Tools				
	Requirement of helping tools :				
	- Measuring instruments, etc.				Lumpsum
3.	LABOR				
	Production pole at 1 point of the drill	Qt	468.29	m	
	Additional manpower at site :				
	- Foreman	FO	1.00	Person	
	- Skilled Labor	SL	3.00	Person	
	- Workers	UL	7.00	Person	
	Labor coefficient / m3 :				
	- Foreman = FO / Qt	L4	0.0021	Hour	
	- Skilled Labo = SL / Qt	L2	0.0064	Hour	
	- Workers = UL / Qt	L1	0.0149	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :
 TYPES OF WORK : Concrete pile diameter of 800 mm
 PAYMENT UNIT : m

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Foreman	Hour	0.0021	1.50	0.0032
	Skilled Labor	Hour	0.0064	1.00	0.0064
	Worker	Hour	0.0149	0.63	0.0094
	Sum of the Labour Cost				0.0190
B.	MATERIAL				
	Concrete K-250	m3	0.5027	354	177.9398
	Reinforcing steel	kg	75.3982	3.96	298.5770
	Casing	m2	2.5133	43.47	109.2520
	Sum of the Materials Cost				585.7688
C.	EQUIPMENT				
	Bore Pile	Hour	0.0021	54.00	0.1153
	Concrete Pump	Hour	0.1823	30.00	5.4688
	Tools	Hour	1.0000	5.00	5.0000
	Sum of the Equipment Cost				10.5841
D.	Work Unit Price (A+B+C))				596.37

Note :

1

The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight

2

The unit cost for equipment including fuel, used material and the operator's Cost.

3

Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs

Example : Analysis of Unit Price of Reinforcing Steel, threaded D32

PAYMENT ITEM NO. :
 TYPES OF WORK : Reinforcing steel, threaded D32
 PAYMENT UNIT : kg

NO.	DESCRIPTION	CODE	COEFF.	UNIT	REMARKS
I.	ASSUMPTIONS				
1	Work is done manually				
2	Location : along the road				
3	Basic materials accepted entirely at site;				
4	Average distance Base Camp to work location;	L	4.0	km	
5	Effective working hours per day	Ew	7.00	Hour	
6	The loss factor steel reinforcement	Wf	1.10	-	
II.	SEQUENCE OF WORK				
1	Cut and bent steel reinforcement as required				
2	Reinforcement rods installed with the drawings and the implementation of its cross tied wire.				
III.	USE OF MATERIALS, EQUIPMENT AND PERSONNEL				

1.	MATERIAL				
	a. Reinforcing steel (screw) D32		1.1000	kg	
	b. Wire concrete		0.0200	kg	
	EQUIPMENT				
	a. Tools			Ls	
	Required :				
	- Steel cutting scissors = 2 pieces				
	- Bending keys = 2 pieces				
	- Other tool				
	LABOR				
3.	Production work one day	Qt	200.00	kg	
	Labor requirement - Foreman	FO	1.00	Person	
	- Skilled Labor	SL	1.00	Person	
	- Workers	UL	3.00	Person	
	Labor coefficient / kg :				
	- Foreman = (FO x Ew) / Qt	L4	0.0350	Hour	
	- Skilled Labor = (SL x Ew) / Qt	L2	0.0350	Hour	
	- Workers = (UL x Ew) / Qt	L1	0.1050	Hour	

STANDARD FORM
ANALYSIS OF EACH UNIT PRICE

PAYMENT ITEM NO. :

TYPES OF WORK : Reinforcing steel, threaded D32

PAYMENT UNIT : kg

NO.	COMPONENT	UNIT	COEFF.	UNIT PRICE (\$)	PRICE SUMMATION (\$)
A.	LABOR				
	Foreman	Hour	0.0350	1.50	0.0525
	Skilled Labor	Hour	0.0350	1.00	0.0350
	Worker	Hour	0.1050	0.63	0.0662
	Sum of the Labour Cost				0.1537
B.	MATERIAL				
	Reinforcing steel (screw) D32	kg	1.1000	1.42	1.5620
	Wire concrete	kg	0.0200	2.25	0.0450
	Sum of the Materials Cost				1.6070
C.	Peralatan				
	Tools	Hour	1.0000	0.50	0.5000
	Sum of the Equipment Cost				0.5000
D.	Work Unit Price (A+B+C)				2.26

Note :

- 1 The unit for labor and equipment are based on Operation hours while for materials is based on volume and/or weight
- 2 The unit cost for equipment including fuel, used material and the operator's Cost.
- 3 Unit costs include expenses for all tax related (but not including tax paid from the contract) and other costs



**STANDARD COST OF BUILDING COMPONENT
&
STANDARD COST OF
CONSULTANT FEE**

TABEL A1

PERCENTAGE COST OF BUILDING COMPONENT SIMPLE GOVERNMENT BUILDING
(Use supervision consultant)

Total construction cost (\$1000)													
Construction Component	<= 600	600 - 1,200	1,200 - 2,400	2,400 - 5,000	5,000 - 7,500	7,500 - 10,000	10,000 - 12,500	12,500 - 25,000	25,000 - 50,000	50,000 - 125,000	125,000 - 250,000	250,000 - 500,000	
	1	2	3	4	5	6	7	8	9	10	11	12	13
1. PHYSICAL CONSTRUCTION (%)	87,70	87,70	87,70 up to 89,29	89,29 up to 90,92	90,92 up to 93,18	93,18 up to 93,79	93,79 up to 94,39	94,39 up to 94,72	94,72 up to 94,97	94,97 up to 95,65	95,65 up to 96,22	96,22 up to 96,83	96,83 up to 97,19
2. DESIGN (%)	7,00	7,00	7,00 up to 5,80	5,80 up to 4,70	4,70 up to 3,75	3,75 up to 3,50	3,50 up to 3,25	3,25 up to 3,07	3,07 up to 2,94	2,94 up to 2,57	2,57 up to 2,25	2,25 up to 1,89	1,89 up to 1,66
3. SUPERVISION (%)	4,00	4,00	4,00 up to 3,70	3,70 up to 3,50	3,50 up to 2,50	2,50 up to 2,24	2,24 up to 2,00	2,00 up to 1,88	1,88 up to 1,78	1,78 up to 1,53	1,53 up to 1,33	1,33 up to 1,14	1,14 up to 1,03
4. PROJECT MANAGEMENT (%)	1,30	1,30	1,30 up to 1,21	1,21 up to 0,88	0,88 up to 0,57	0,57 up to 0,47	0,47 up to 0,36	0,36 up to 0,33	0,33 up to 0,31	0,32 up to 0,25	0,25 up to 0,20	0,20 up to 0,14	0,14 up to 0,12
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100

SIMPLE GOVERNMENT BUILDING :

- * Elementary schools
- * Traditional market
- * Polyclinic
- * Office in District

TABEL A2

PERCENTAGE COST OF BUILDING COMPONENT SIMPLE GOVERNMENT BUILDING
(Use construction management consultant)

Total Construction Cost (\$1000)	Construction Component	<= 600	600 - 1,200	1,200 - 2,400	2,400 - 5,000	5,000 - 7,500	7,500 - 10,000	10,000 - 12,500	12,500 - 25,000	25,000 - 50,000	50,000 - 125,000	125,000 - 250,000	250,000 - 500,000
1	1	2	3	4	5	6	7	8	9	10	11	12	13
1. PHYSICAL CONSTRUCTION (%)		86,70	86,70 up to 88,36	88,36 up to 90,04	90,04 up to 92,55	92,55 up to 93,23	93,23 up to 93,89	93,89 up to 94,25	94,25 up to 94,52	94,52 up to 95,26	95,26 up to 95,88	95,88 up to 96,54	96,54 up to 96,93
2. DESIGN (%)		7,00	7,00 up to 5,80	5,80 up to 4,70	4,70 up to 3,75	3,75 up to 3,50	3,50 up to 3,25	3,25 up to 3,07	3,07 up to 2,94	2,94 up to 2,57	2,57 up to 2,25	2,25 up to 1,89	1,89 up to 1,66
3. SUPERVISION (%)		5,00	5,00 up to 4,63	4,63 up to 4,38	4,38 up to 3,13	3,13 up to 2,80	2,80 up to 2,50	2,50 up to 2,35	2,35 up to 2,23	2,23 up to 1,92	1,92 up to 1,67	1,67 up to 1,43	1,43 up to 1,29
4. PROJECT MANAGEMENT (%)		1,30	1,30 up to 1,21	1,21 up to 0,88	0,88 up to 0,57	0,57 up to 0,47	0,47 up to 0,36	0,36 up to 0,33	0,33 up to 0,31	0,32 up to 0,25	0,25 up to 0,20	0,20 up to 0,14	0,14 up to 0,12
TOTAL		100	100	100	100	100	100	100	100	100	100	100	100

SIMPLE GOVERNMENT BUILDING :

- * Elementary schools
- * Traditional market
- * Polyclinic
- * Office in District

TABEL B1

PERCENTAGE COST OF BUILDING COMPONENT NOT SIMPLE GOVERNMENT BUILDING

(Use SUPERVISION CONSULTANT)

Total Construction Cost (\$1000) Construction Component)	<= 600	600 - 1,200	1,200 - 2,400	2,400 - 5,000	5,000 - 7,500	7,500 - 10,000	10,000 - 12,500	12,500 - 25,000	25,000 - 50,000	50,000 - 125,000	125,000 - 250,000	250,000 - 500,000
1	2	3	4	5	6	7	8	9	10	11	12	13
1. PHYSICAL CONSTRUCTION (%)	86,70	86,70 up to 88,29	88,29 up to 89,92	89,92 up to 92,18	92,18 up to 92,79	92,79 up to 93,39	93,39 up to 93,72	93,72 up to 93,97	93,97 up to 94,65	94,65 up to 95,22	95,22 up to 95,81	95,81 up to 96,19
2. DESIGN (%)	7,00	7,50 up to 6,30	6,30 up to 5,20	5,20 up to 4,25	4,25 up to 4,00	4,00 up to 3,75	3,75 up to 3,57	3,57 up to 3,44	3,44 up to 3,07	3,07 up to 2,75	2,75 up to 2,39	2,39 up to 2,16
3. SUPERVISION (%)	5,40	4,50 up to 4,20	4,20 up to 4,00	4,00 up to 3,00	3,00 up to 2,74	2,74 up to 2,50	2,50 up to 2,38	2,38 up to 2,28	2,28 up to 2,03	2,03 up to 1,83	1,83 up to 1,64	1,64 up to 1,53
4. PROJECT MANAGEMENT (%)	1,30	1,30 up to 1,21	1,21 up to 0,88	0,88 up to 0,57	0,57 up to 0,47	0,47 up to 0,36	0,36 up to 0,33	0,33 up to 0,31	0,32 up to 0,25	0,25 up to 0,20	0,20 up to 0,16	0,16 up to 0,12
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100

NOT SIMPLE GOVERNMENT BUILDING :

* Ministry Office, Agency office, which have special installation such as escalator, IT, building automation, central hospital, church

TABEL B2

PERCENTAGE COST OF BUILDING COMPONENT NOT SIMPLE GOVERNMENT BUILDING
(Use Construction Management consultant)

Total Construction Cost (\$1000) Construction Component	1	2	3	4	5	6	7	8	9	10	11	12	13
600 - 1,200	1,200 - 2,400	2,400 - 5,000	5,000 - 7,500	7,500 - 10,000	10,000 - 12,500	12,500 - 25,000	25,000 - 50,000	50,000 - 125,000	125,000 - 250,000	250,000 - 500,000	500,000 - 1,000,000	1,000,000 - 2,500,000	2,500,000 - 5,000,000
1. PHYSICAL CONSTRUCTION (%)	85,58	85,58 up to 87,24	88,92 up to 91,43	91,43 up to 92,77	92,77 up to 93,13	93,13 up to 93,40	93,40 up to 94,14	94,14 up to 94,76	94,76 up to 95,40	95,40 up to 95,81	95,81 up to 96,45	96,45 up to 97,09	97,09 up to 97,73
2. DESIGN (%)	7,00	7,50 up to 6,30	5,20 up to 4,25	4,25 up to 4,00	4,00 up to 3,75	3,75 up to 3,57	3,57 up to 3,44	3,44 up to 3,31	3,31 up to 3,18	3,18 up to 3,05	3,05 up to 2,92	2,92 up to 2,79	2,79 up to 2,66
3. SUPERVISION (%)	5,62	5,62 up to 5,25	5,00 up to 3,75	3,75 up to 3,42	3,42 up to 3,12	3,12 up to 2,97	2,97 up to 2,85	2,85 up to 2,73	2,73 up to 2,61	2,61 up to 2,49	2,49 up to 2,37	2,37 up to 2,25	2,25 up to 2,13
4. PROJECT MANAGEMENT (%)	1,30	1,30 up to 1,21	0,88 up to 0,57	0,57 up to 0,47	0,47 up to 0,36	0,36 up to 0,33	0,33 up to 0,31	0,31 up to 0,29	0,29 up to 0,27	0,27 up to 0,25	0,25 up to 0,23	0,23 up to 0,21	0,21 up to 0,19
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100

NOT SIMPLE GOVERNMENT BUILDING :

* Ministry Office, Agency office, which have special installation such as escalator, IT, building automation, central hospital, church

TABEL C

PERCENTAGE COST OF BUILDING COMPONENT SPECIAL GOVERNMENT BUILDING
(Use Construction Management consultant)

Cost (\$1000)	Total Construction	<= 600	600 - 1,200	1,200 - 2,400	2,400 - 5,000	5,000 - 7,500	7,500 - 10,000	10,000 - 12,500	12,500 - 25,000	25,000 - 50,000	50,000 - 125,000	125,000 - 250,000	250,000 - 500,000
	1	2	3	4	5	6	7	8	9	10	11	12	13
1. PHYSICAL CONSTRUCTION (%)	84,70	84,70 up to 86,39	86,39 up to 88,09	88,09 up to 90,68	90,68 up to 91,39	91,39 up to 92,06	92,06 up to 92,43	92,43 up to 93,47	93,47 up to 94,11	94,11 up to 94,76	94,76 up to 95,18	95,18 up to 95,76	95,76 up to 96,18
2. DESIGN (%)	8,00	8,00 up to 8,60	8,60 up to 9,20	9,20 up to 9,80	9,80 up to 10,40	10,40 up to 11,00	11,00 up to 11,60	11,60 up to 12,20	12,20 up to 12,80	12,80 up to 13,40	13,40 up to 14,00	14,00 up to 14,60	14,60 up to 15,20
3. SUPERVISION (%)	6,00	6,00 up to 6,60	6,60 up to 7,20	7,20 up to 7,80	7,80 up to 8,40	8,40 up to 9,00	9,00 up to 9,60	9,60 up to 10,20	10,20 up to 10,80	10,80 up to 11,40	11,40 up to 12,00	12,00 up to 12,60	12,60 up to 13,20
4. PROJECT MANAGEMENT (%)	1,30	1,30 up to 1,60	1,60 up to 1,90	1,90 up to 2,20	2,20 up to 2,50	2,50 up to 2,80	2,80 up to 3,10	3,10 up to 3,40	3,40 up to 3,70	3,70 up to 4,00	4,00 up to 4,30	4,30 up to 4,60	4,60 up to 4,90
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100

SPECIAL GOVERNMENT BUILDING :

- * Monumental buildings,
- security & safety building,
- nuclear/reactor building,
- international port and harbor

TABLE- D

PERCENTAGE COST BUILDING COMPONENTGOVERNMENT BUILDING WITH PROTOTYPE DESIGN FOR **SIMPLE GOVERNMENT BUILDING**

(such as for housing complex, municipal office, schools, small hospital/clinic, small market, etc which the total BUDGET not more than UUP TO. 600,000. (AS AN EXAMPLE ONLY).

BUILDING COMPONENT	PERCENTAGE COST OF BUILDING COMPONENT				
	IF DONE BY CONSULTANT		IF DONE BY PUBLIC WORKS		
1	2	3	4	5	
1. PHYSICAL CONSTRUCTION		91.20%			94.20%
2. DESIGN MODIFICATION	50%X7%	3.50%	60%X50%X7%		2.10%
3. SUPERVISION		4%	60%X4%		2.40%
4. PROJECT MANAGEMENT		1.30%			1.30%
TOTAL		100.00%			100.00%

NOTES :

- Design modification such as : cut and fill, outside work (parking, landscape, drainage), foundation if there is no modification at all, the cost only for photo copy the documents/drawing
- If the total budget and the type of building are different with this example, please see the table A1, A2, B1, B2, and C for the percentage of design and supervision fee accordingly

TABEL E

PERCENTAGE COST OF BUILDING COMPONENT FOR ROAD , BRIDGE, AND IRRIGATION

(Use Construction Management consultant)

Total Construction Cost (\$1000) Construction Component)	1	2	3	4	5	6	7	8	9	10	11	12	13
		<= 600	600 - 1,200	1,200 - 2,400	2,400 - 5,000	5,000 - 7,500	7,500 - 10,000	10,000 - 12,500	12,500 - 25,000	25,000 - 50,000	50,000 - 125,000	125,000 - 250,000	250,000 - 500,000
1. PHYSICAL CONSTRUCTION (%)	84,70	84,70	84,70 up to 86,39	86,39 up to 88,09	88,09 up to 90,68	90,68 up to 91,39	91,38 up to 92,06	92,06 up to 92,43	92,43 up to 92,71	92,71 up to 93,47	93,47 up to 94,11	94,11 up to 94,76	94,76 up to 95,18
2. DESIGN (%)	8,00	8,00	8,00 up to 6,80	6,80 up to 5,70	5,70 up to 4,75	4,75 up to 4,50	4,50 up to 4,25	4,25 up to 4,07	4,07 up to 3,94	3,94 up to 3,57	3,57 up to 3,25	3,25 up to 2,89	2,89 up to 2,66
3. SUPERVISION (%)	6,00	6,00	6,00 up to 5,60	5,60 up to 5,33	5,33 up to 4,00	4,00 up to 3,65	3,65 up to 3,33	3,33 up to 3,17	3,17 up to 3, 04	3,04 up to 2,71	2,71 up to 2,44	2,44 up to 2,19	2,19 up to 2,04
4. PROJECT MANAGEMENT (%)	1,30	1,30	1,30 up to 1,21	1,21 up to 0,88	0,88 up to 0,57	0,57 up to 0,47	0,47 up to 0,36	0,36 up to 0,33	0,33 up to 0,31	0,32 up to 0,25	0,25 up to 0,20	0,20 up to 0,16	0,16 up to 0,12
TOTAL		100	100	100	100	100	100	100	100	100	100	100	100

AGÊNCIA DESENVOLVIMENTO NACIONAL

CLOSING





CLOSING

We thank the SMM Team whose names appear below, for their tireless effort which has resulted in the completion of this TIMOR LESTE STANDARD METHOD OF MEASUREMENT, we hope that our work does not only end here but continues to improve alongside the rapid development in science and technology as well as with the experience of all of the stakeholders. We also thank the relevant stakeholders such as Line Ministries, Contractors, and Consultants in Timor-Leste who have given valuable and useful feedback in preparing this document.

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Members of the Team:

General Coordinator:

Esron ST. Henuk

Secretary:

Tomas Magno do Carmo
Estelio Manuel Dos Santos

Team Member:

HerningWidayati	JohanesHornay
Muhasyim	Francisco Xavier de Deus Jeronimo
Melania Da Costa Baros	João P. Amaral
Aleixo A. do Carmo	Arlindo Sarmento Monteiro
Januario M. Guterres	Joaquim P.da Pinto
Demistocles G.F.X. Cabral	Celvio J. Alves
F.X. Totok Prastowo	Oscar M. Gomes
Cesaltina da Costa Morreira	Martino da Costa Graciano
Rogério Marcal Pires	
Abdul Afif	Aniceto da Costa
Soemartono	Pedro de L. Alves
Haruno	Vidal Guterres
Dadan Sudarwan	Amorin S. Menezes
Rahadi Sukirman	Romualdo Guterres
Agus Widianto	Miguel M. de Jesus
Warsoadi Dh.	Susana S.D.R. Amaral
Maximos Dos Santos	Emerenciana da Costa Maia
David da Silva	

We hope that what has been started by our colleagues will be continued by the next generation of ADN in the future for the development of Timor-Leste.

We welcome any comments and inputs to further improve the document in its next publication.

Dili, April 2016

Agência de Desenvolvimento Nacional

A handwritten signature in blue ink, consisting of a large, stylized 'S' followed by a series of loops and a long, sweeping horizontal stroke that extends to the right.

Samuel Marçal
Director General

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