Cost Estimation Manual for Performance Based Road Maintenance Contract

Volume 1: Manual for Cost Estimation Administrators

Edition 1.1

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JAPAN INTERNATIONAL COOPERATION AGENCY

Strengthening of Capacity on Road Maintenance Management through Contracting (Phase 2)

COST ESTIMATION MANUAL
FOR PERFORMANCE BASED
ROAD MAINTENANCE CONTRACT

Volume I — Manual for Cost Estimation Administrators

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Contents

Foreword

The concept of performance based contracting in road maintenance and management has been adopted in Kenya and was commenced in 2010 on a pilot basis. However, the method of estimating cost of works under performance based contracts was not clear as it was based on traditional method of road maintenance. It was therefore noted that a more scientific and accurate way of cost estimation of PBC road maintenance contracts need to be formulated since these types of contracts differ from the traditional maintenance contracts. To this end, JICA under the Project for strengthening of capacity on road maintenance and management through contracting (phase 2), embarked on the noble task of developing this manual.

The manual has been prepared based on surveys conducted on the ongoing performance based contracts and wide stakeholder consultations. The manual does not only provides scientific method of estimating the cost of PBC road maintenance works but also provides survey techniques for collection of data necessary for regular updating of the manuals. The manual consist of three volumes. Volume 1 is tailored to be used by the Road Administrator (KRB) who provide estimation parameters and will be in charge of updating of the database. Volume 2 will be used by the road authorities for estimation of Project Cost i.e. determining the ceiling price for purposes of budget allocation, planning and tendering. Volume 3 has been prepared specifically for contractors who will be interested in tendering for PBC works. In volume 3, a deliberate move was taken to exclude information on unit prices and percentages of indirect cost, overheads/profits which the contractors are required to provide during the tendering processes. A computer program known as COSTES for PBC 2015 was also developed with data collected from surveys on the ongoing PBC contracts. The computer program will be used with the manual to ease rigorous computation processes. Explanations on how to operate the program have been appended in the manual.

It is hoped that this manual will be very useful in implementation of this new concept of road maintenance and will be beneficial to both the clients and the contractors.

I urge all stakeholders to make proper use of the manual in costing of PBC road maintenance works to arrive at more accurate cost of PBC contracts, thus guaranteeing value for money and best return to the taxpayer.

Finally, I recognize and acknowledge with appreciation the National Working Group and Sub-Working Group members who provided their valuable advice through a series of meetings during the period of formulating this manual. I am particularly grateful to the JICA team for their technical assistance in achieving this milestone and for their overall assistance in capacity building for road maintenance and management. Special gratitude goes to all road authorities and other government agencies which include KRB, KeNHA, KURA, KeRRA, KWS, KIHBT, NCA and PPOA for their valuable support in the development of this manual.

Eng. Patrick Mwinzi
Chief Engineer (Roads)
Ministry of Transport and Infrastructure

Abbreviations and Acronyms

IMP	—	Initial Mobilization Period
P/R	—	Productivity Rate
RA	—	Road Authority
RMP	—	Routine Maintenance Period
SRUQ	—	Standard Resource Usage per (Unit) Quantity

Glossary of Terms

Actual Quantity	Refers to the actual quantity of work and service for each service criteria executed by the contractor to achieve the specified service level.
Simple Quantity	Refers to the targeted quantity of work and services for each service criteria to be executed by the contractor as per the contract drawings.
General Maintenance	Refers to all works and services (mainly off-carriageway) required to be performed by the contractor under the performance based contract.
Initial Mobilization Period	This is the period during the initial stages of the contract when the contractor makes interventions to bring the road to maintainable conditions.
Routine Maintenance Period	This is the period after the expiry of the initial mobilization period when the contractor undertakes routine maintenance activities.. The activities are performed to maintain the performance standards of the road and to achieve specified service levels.

1. Introduction

1.1 Background and Objectives

Performance Based Contract (PBC) is a new type of contract, which was introduced in Kenya recently but is increasingly becoming very common as a contract method for road maintenance. The main payment method in PBC projects is based on a km-lump sum utilizing set service levels to be achieved by contractors. PBC is a term contract which covers both the wet seasons when frequent works are required, and the dry seasons when lesser works may just be sufficient. In spite of the widespread use of PBC's in road maintenance, no standard cost estimation method has been developed. This creates a situation that no scientifically based judgment can be made when the Engineer's cost estimate is very different from the actual tender price.

Therefore, the need for development of such standard cost estimation method is vital for sustainable application of PBC. Utilizing the standard cost estimation method is one of the basic fundamentals of project management of PBC's and will enable staff in various road authorities to have proper understanding of the tender price..

This Cost Estimation Manual for Road Maintenance under Performance Based Contract (hereinafter referred to as "the Manual ") aims to develop a scientific cost estimation method for PBC road maintenance using cost breakdown sheets and standardized estimation procedures.

The Manual includes not only how to estimate costs but also provide information on survey methods required for revisions and updates of various parameters such as the Standard Resource Usage per (Unit) Quantity (SRUQ) and important cost items such as unit rates.

The Manual is in line with COST Estimation System for PBC 2015 (hereinafter referred to as "COSTES for PBC 2015"), the computer tool used for actual cost estimation exercises.

The Manual and COSTES for PBC 2015 are intended for use by engineers and managers who are responsible for road maintenance in each road authority in Kenya, and who require scientifically based judgment when planning and implementing PBC road maintenance projects.

1.2. Structure of Cost Estimation Manual

Three (3) Cost Estimation Manuals are prepared according to the purpose and user shown in **Table 1-1**.

Table 1-1 Structure of Cost Estimation Manuals

Vol	Name of Manual	User	Objectives
1	Manual for Cost Estimation Administrators	KRB	Cost and Affiliated Surveys Provision of Estimation Parameters Update and Maintenance of Database and Manual How to Revise Vol. 2 and 3
2	Manual for Government Cost Estimators	Road Authorities and KWS	Estimation of Project Cost for Budget Allocation Estimation of Project Cost for Tender
3	Manual for Contractors' Reference & Use	Contractors	Estimation of Project Cost

1.3. PBC Works and Instructed Works

All current PBC projects in Kenya are composed of works and services related to Maintenance Services (hereafter referred to as the PBC Works) and Instructed Works. Contractors have full responsibilities for works and services required to bring up the road condition to the specified service levels. Contractors need to assess the existing road condition and quantify the volume of the works and services required to achieve specified service levels.

The PBC Works mainly consists of:

1) Labour-based works and services such as repair and maintenance of drainage, vegetation, road cleanliness, and provision of a Self Control Unit for self management of road maintenance; and,
2) Other works and services such as repair and maintenance of the carriageway and shoulders, repair of structures, repair on road furniture, profile, width and embankment and slopes.

Table 1-2 PBC Works and Instructed Works

Work Type	PBC Works	Instructed Works
Payment Method	Based on Km-Monthly Lump Sum	Based on Bill of Quantities
Initiator	Contractor	Client

Based on the nature of various requirements, Instructed Works are a combination of the following works and services as indicated in **Table 1-3**.

Table 1-3 Details of Instructed Works

Instructed Works	Bill of Quantities	Payment
Rehabilitation Works • To bring the road up to the pre-defined standards at the start of the PBC project. E.g. filling potholes, laying gravel wearing course, repairing carriageway edges, reinstating road camber, road furniture maintenance and repair, and repairing culverts as may be required.	Prepared by the client	Unit rate payment determined by the contractor
Improvement Works • To add new characteristics to the road in response to new traffic, safety or other conditions	Prepared by the client	Unit rate payment determined by the contractor
Emergency Works • To reinstate the road after damage has occurred as a result of natural occurrences with unexpected consequences under the condition defined in the contract	Prepared by the client	Unit rate payment determined by the contractor

This Manual has been prepared principally to estimate the cost of PBC Works for which no standard procedure for cost estimation was addressed in the previously issued "*Cost Estimation Manual for Road Maintenance Works 2011*", popularly referred to as the COSTES Manual 2011.

This Manual is a new edition and focuses exclusively on the PBC Works. It tries to correctly estimate labour-based works and services based on surveys conducted on on-going PBC projects. The Manual therefore reflects the result of the surveys and recommends methods of standard estimation procedures using the results obtained

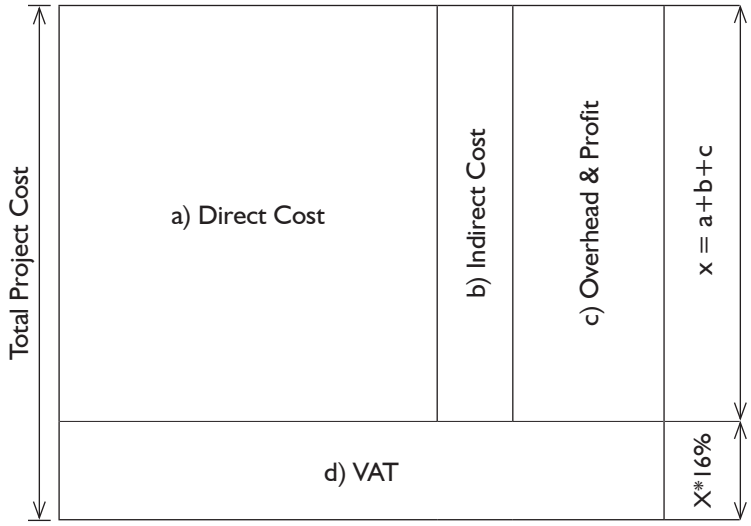
from PBC projects undertaken in 2014 and 2015.

It is important to appreciate that some future projects may be different from those projects surveyed for the purpose of determining various values incorporated into this Manual. For example, in projects surveyed, there were no physical repairs of scour checks and headwalls, and no physical maintenance and repair of structures and road furniture.

In such cases, the COSTES Manual 2011 should be used to correctly modify the cost estimation by incorporating the additional costs for such physical repairs. Similarly, if a road authority is required to estimate the cost of Instructed Works in addition to the PBC Works, the COSTES Manual 2011 should be used after correctly assessing quantities of the Instructed Works required. In order that the Manual is useful for such cases, an attempt has been made to allow adding such costs as deemed necessary from past experience/data, and collection of estimates for such works, based on prudent judgment of the cost estimator. Default values set out in COSTES for PBC 2015 may also be used.

1.4. Cost Structure for Estimation

The cost structure for estimation is shown in **Figure 1-1** and the contents of each cost estimation element are shown in **Table 1-4**. The Total Project Cost consists of four (4) cost components namely; a) Direct Cost, b) Indirect Cost, c) Overhead & Profit and d) VAT. The total estimated cost is computed as the summation of all four cost components. The project cost is the summation of three cost components excluding VAT.



Note: Using the Framework of the COSTES Manual 2011

Figure 1-1 Principal Structure of PBC Cost Estimation

Table 1-4 Contents of Cost Estimation Components

Components	Cost Estimation Elements	
Direct Cost	Off Carriageway Maintenance Costs (6 Major Labour Based Works and Self Control Unit)	Maintenance costs which are required for the PBC Works such as repair and maintenance of drainage, vegetation, road cleanliness and provision of Self Control Unit for self-management of road maintenance.
	Other PBC Works	Maintenance costs for the PBC Works such as repair of carriageway and shoulders, repair of structures, repair of road furniture, repair of road profile and width, and repair of embankment and slopes.
	Miscellaneous Costs and Others	Miscellaneous expenses and other costs which are required for proper on-site control and provision of safety gears and devices for workers and necessary haulage cost for transporting labour, materials and equipment from/to the site.
Indirect Cost	• Site Management Cost • Site Staff Allowances • Site Staff Social Charges • General Safety Measures • Human Resource Management Cost	Cost computation for these items is taken as a percentage of the Direct Cost
Overhead & Profit	• Head Office Management Cost • Head Office Staff Salaries and Allowances • Cooperate Social Charges • Research and Development • Advertisement and Publicity • Depreciation Costs for Fixed Asset • Profit Margin	Cost computation for these items is taken as a percentage of the sum of Direct Cost and Indirect Cost

The structure of a typical project is shown in **Figure 1-2** for cost estimation purpose under COSTES for PBC 2015. The Direct Cost in this case consists of PBC Works, Instructed Works and Haulage Cost.

Item	Cost
Total Project Cost (VAT(16%) Inclusive)	12=10+11
Project Cost	10=7+8+9
Direct Cost	7=4+5+6
PBC Works	4=1+2+3
Patrol and Self Inspection under Road Safety	1
Major 6 Labor Based Work under Road Durability	2
Other PBC Works	3
Instructed Works	5
Haulage Cost of Major 6 Labor Based Work	6
Indirect Cost	8
Overhead & Profit	9
VAT(16%)	11

Figure 1-2 Cost Estimation Structure under COSTES for PBC 2015

1.5. Definition of SRUQ and P/R

Standard Resource Usage per (Unit) Quantity (SRUQ) is the ratio of the number of person-days divided by the volume of work completed. On the other hand, Productivity Rate (P/R) is an inverse of SRUQ.

An example of SRUQ and Productivity Rate is illustrated in **Figure 1-3**.

Example:

Grass cutting of 10,000m^2 is completed in 5 man-days. That is 5 persons each completing 2,000m^2 on a given day.

SRUQ = 5 man-days/ 10,000 m^2 = 0.0005 man-day/m^2

Productivity Rate (P/R) = 2,000m^2 / man-day

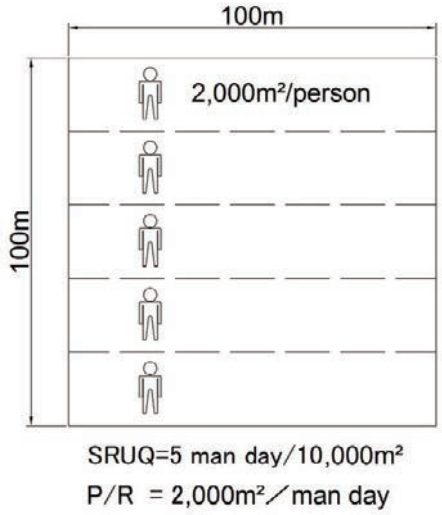


Figure 1-3 SRUQ and P/R

2. Role of Cost Estimation Administrator

The roles of a cost estimation administrator are as follows:

1 Conducting surveys on costs, establishing standard costs and updating of costs annually;

2 Conducting surveys on productivity, establishing productivity indices and updating of productivity indices; and,

3 Management and updating of the Cost Estimation Manual

Table 2-1 gives the Plan, Do, Check, Action (PDCA) cycle for cost estimation related activities

Table 2-1 PDCA Cycle for Cost Estimation Related Activities

Item		Contents			Frequency	Road Authorities
Manual Revision	C (Check)	Cost Survey	Unit Rates Survey Indirect Cost and Overhead & Profit Surveys	(Coordination and referral with KNBS[1] index, etc)	Every Year	KRB
			Productivity Survey	SRUQ(by work item) SRUQ(by Road Authority)	Every Year	
	A (Action)	Manual Update (See 2.2)			Every Year	
Manual Utilization	P (Plan)	Planning the budget for next year projects			Every Year	KeNHA, KURA, KeRRA, KWS
	D (Do)	Cost Estimation for the project			Every Year	

Note) SRUQ : Standard Resource Usage per (Unit) Quantity

3. PDCA Cycle for Cost Estimation

Scientific cost estimation is based on utilizing data collected from actual road maintenance sites. The Manual should therefore be revised periodically so that data used are always current. Hence, the PDCA (Plan-Do-Check-Action) cycle is introduced to express this periodic updating process. This process is to improve the quality of the Manual by accumulation of basic data.

Figure 3-1 shows the Cost Estimation PDCA Cycle Schedule.

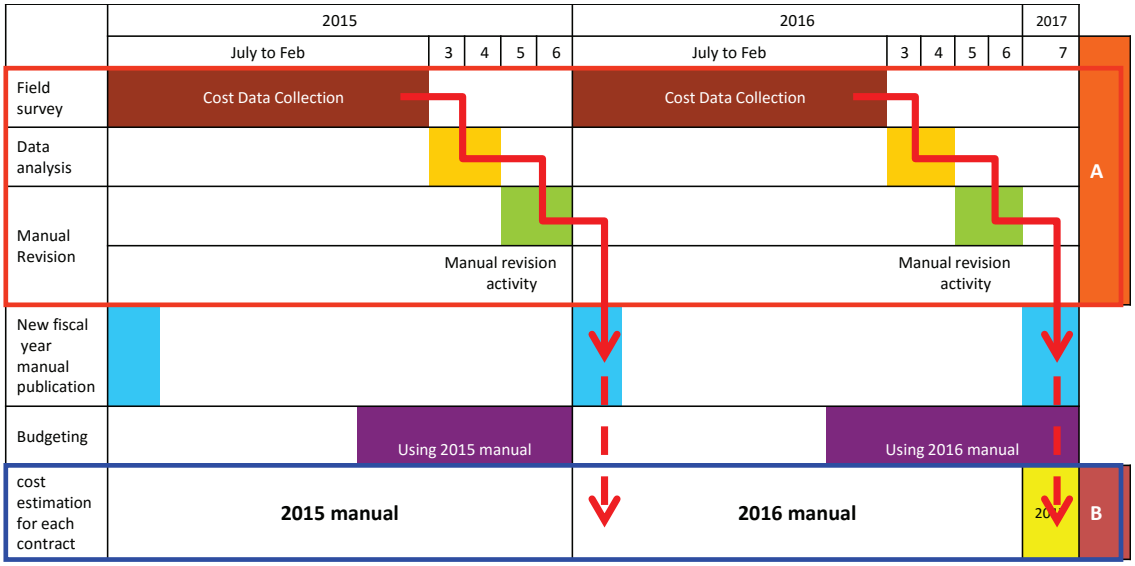


Figure 3-1 Cost Estimation PDCA Cycle Schedule

4. Cost Estimation Methods of PBC Works

Cost estimation is performed in two stages.The first stage involves cost estimation of the PBC Works. The contents of the PBC Works maybe split into three (3) categories as indicated in **Table 4-1** based on cost elements involved. The details of the Six (6) Major Labour-Based Works are indicated in **Table 4-2**.

Compatibility of such three categories in respect to the specific service scope are indicated in **Table 4-3**.

The second stage requires estimating the cost of the Indirect Cost and the Overhead & Profit

Table 4-1 PBC Works

No	Categories	Description	Cost Element
1	6 Major Labour-Based Works	Essentially the work is labour-based and off-carriageway activity.	Labour cost only. Vehicle and fuel costs are included in Haulage Cost.
2	Patrol and Self-Inspection (Self Control Unit)	For patrolling under Road Usability and for self-inspection.	Labour, vehicles and fuel costs.
3	Other PBC Works	Works involving the carriageway and others.	Labour, materials, machineries and equipment. Vehicle and fuel costs are included in Haulage Cost.

Table 4-2 6 Major Labour-Based Work

No	Item
1	Grass Cutting
2	Cross Culvert De-silting
3	Catch Basin De-silting
4	Lined Side Ditch De-silting
5	Unlined Side Ditch De-silting
6	Carriage Way Cleaning

Table 4-3 Compatibility of the PBC Works and Service Scope

Category	Service Scope	6 Major Labour Based Works	Patrol and Self Inspection	Other PBC Works
Road Usability	A) Road Usability		O	
Road User Comfort	B) Pavement, Shoulders and ROW for Paved Roads (P-B-1) & Unpaved Roads (UP-B-2)	O (Cleanliness)	Δ	O (repairing items)
Road Durability	C) Drainage	O	Δ	
	D) Vegetation	O	Δ	
	E) Structures		Δ	O
	F) Road Furniture		Δ	O
	G) Profile and Road width		Δ	O
	H) Embankment and slopes		Δ	O

5. Cost and Other Affiliated Surveys

This section covers cost surveys and other affiliated surveys, such as the productivity survey and the road facilities survey which are required for updating the Manual by the cost estimation administrator.

1) Unit Rates
2) 6 Major Labour Based Works (Productivity)
3) Self Control Unit
4) Other Works
5) Percentages Based Indirect Cost, and the Overhead & Profit
6) Road Facilities (Survey for Assessing Associated Facilities Required for Maintenance)

Table 5-1 List of Cost Surveys

No	Cost Surveys	Purposes
1	Unit Rates	For determining standard unit rates
2	6 Major Labour Based Work	For determining productivity parameters. P/Rs
3	Patrol and Self Inspection (Self Control Unit)	For determining productivity parameters
4	Other PBC Works	For determining standard work information For determining standard work quantities For determining productivity parameters
5	Indirect Cost, Overhead & Profit Percentages	For determining standard indirect cost percentages For determining standard overhead & profit percentages
6	Road Facilities (Survey for Assessing Associated Facilities Required for Maintenance)	For assessing quantities of associated facilities required for maintenance

5.1. Unit Rates

The unit rates survey is conducted by the cost estimation administrator so that each road authority may use standard unit rates for the cost estimation purpose.

Unit rates for material, labour and machineries used for cost estimation by road authorities are basically derived from official price information provided by several government offices. They are open to public and are based on nation-wide market surveys. Hence they can be assumed to be the average rates in Kenya. They include:

- Material Rates: Material Price List from Kenya National Bureau of Statistics (KNBS)
- Fuel Rates: Pump Price List from Energy Regulatory Commission, the Ministry of Energy.
- Labour Rates: The Regulation of Wages (General) (Amendment)Order, The Labour Institution Act, the Ministry of Labour
- Machinery Rates: Equipment Hire Rate List from Mechanical and Transport Department, the Ministry of Transport and Infrastructure

All labour, material and machinery rates should be surveyed by regions; big cities (example: Nairobi, Mombasa and Kisumu) and all others.

Rates may be updated in an ad-hoc basis when substantial change takes place during the fiscal year (e.g. in case of high inflation or embargo).

When some of material and machinery rates are not covered in official documents, average market rates acquired

from surveys by the cost estimation administrator or provisional rates by referring to similar items may be used. However, those rates should be revised immediately the official rates become available.

For cost estimation using the Manual, collection of the unit rates indicated in **Table 5-2** is required. These unit rates apply for 6 Major Labour Based Works and Self Control Unit (Patrol and self-inspection), but these are not applicable to the Other PBC Works.

Table 5-2 Unit Rates for Cost Estimation

No	Category	Item	Unit	Remarks
1	Labour Cost	Labourers	KSH/day	
		Foreman	KSH/month	
		Supervisors	KSH/month	
		SCU Leader	KSH/month	
		SCU Inspector	KSH/month	
		Driver	KSH/month	
		Patrol Crew	KSH/month	
2	Vehicle Cost	Truck	KSH/month	
		Pick up	KSH/month	
		Diesel, Gasoline	KSH/litre	
3	Fuel Cost	Diesel	Km/litre	
		Gasoline	Km/litre	

5.1.1 Labour Cost

The unit rate for labourers will be determined based on the current regulation issued by the Ministry of Labour on minimum wages. The minimum wage will be used. The unit rates for Labour Costs (excluding Labourers) indicated in **Table 5-1** will be determined by conducting Workers' Wage Survey to check prevailing rates for each position. Adequate data will be collected and the average value will be used as the unit rates for each worker category. In case drastic regional disparity exists, adjustment will be made to compensate for such disparity in certain regions.

5.1.2. Vehicle Cost

The unit rate (dry hire rate) for vehicles will be determined based on availability in the market. Adequate data will be collected and the average value used as the unit rate. This survey may be supplemented by conducting a survey on firms who own a fleet of vehicles on purchase basis and who apply a yearly depreciation cost as the vehicle cost. In this case also, adequate data will be collected and the average value used as the unit rate.

5.1.3. Fuel Cost

The unit rate for fuel will be determined based on use of the latest Pump Price List issued by the Energy Regulatory Commission.

5.1.4. Material Cost

Six (6) Major Labour Based Works do not have material costs. However, the Other PBC Works require unit rates survey to determine various materials required for works.

Owing to variation in rates according to the location of the project, the result of the material cost survey must be compiled according to regions. Adequate data will be collected and the average value used as the unit rate.

5.2. Survey on 6 Major Labour Based Works

The survey on 6 Major Labour Based Works is conducted by the cost estimation administrator so that each road authority may use productivity parameters for the cost estimation purpose.

These are the Productivity Survey (SRUQ Survey and the Work Frequency Survey).

5.2.1. Productivity Survey

The Productivity Survey is conducted and the result is compiled for each road authority by the cost estimation administrator.

5.2.1.1 Survey Procedure

In order to obtain precise cost estimation, it is important to understand the precise volume of work inputs such as labour, materials and equipment resources for a volume of work output necessary to achieve the specific service level. It is also important to understand the work frequency so that a volume of work output is computed for achieving the specific service level.

For such, a productivity rate termed 'Standard Resource Usage per (unit) Quantity (SRUQ)' is computed for each work by obtaining the actual productivity rate (P/R) on site.by collecting multiple samples and performing a statistical analysis on the entire samples. The P/R is the inverse of the SRUQ.

- **Productivity Survey for P/Rs**

This is the survey to understand how much of work output is produced and completed for a given manpower.

Examples:

Work Output:	Grass Cutting	P/R: xx m^2/ man day
	Cross Culvert De-silting	P/R: yy m/man day
	Carriageway Cleaning	P/R: zz m^2/man day.

The procedure for conducting the survey is as follows;

1. The plan and cross-section of the road being maintained will be drawn. All pertinent features including access drives, drainages, carriageways, vegetation zones and so on will be included.
2. The start point of each activity is marked with spray paint and recorded on the drawing with the start time recorded.
3. Two types of forms are used; One for sketching the road plan and cross-section and the other for survey recording. Both samples of completed forms are attached as Forms 1 and 2 in **Figure 5-1** whereas completed filled in forms are shown in Chapter 5.2.1.4.
4. Measurement is done on completed sections for each activity at an interval of 1 hour. Dimensions to be measured are the lengths, widths and depths. Measurement is conducted using a tape measure (preferably 50m long). The end point for each completed activity in one hour is marked after the measurement.
5. The number of workers assigned for each work output is recorded at the beginning of the survey. Also the number of workers who have been re-assigned to work on a different work output should be recorded.
6. Difficulty of work produced is classified into "Heavy", "Normal" and "Light" based on the visual inspection performed by surveyors and will be recorded in "Remarks". These remarks will be referred to when calculating three different levels of SRUQs. For details of each site work condition to Work

Difficulty Levels, please refer to **Table 5-3.**

Table 5-3 Work Difficulty Levels

Work Difficulty Level	Site Work Condition	Remarks
Heavy (productivity: low)	Very heavy work normally observed in the initial mobilization period.	Used for initial mobilization period
Normal (productivity: normal)	Moderate work volume mainly observed in the wet season	Used for the wet season
Light (productivity: high)	Light work volume mainly observed in the dry season	Used for the dry season

7. Safety will be observed throughout the survey. Surveyors will always wear reflective safety jackets and helmets to enhance safety. Surveyors are also required to be cautious of the traffic to avoid accidents.
8. Pictures are taken for each activity and grouped into respective roads. Pictures will be taken before, during and after completion of every activity. Pictures are also taken to show how the survey was carried out. Please refer to Chapter 5.2.1.3.

- **Work Frequency**

This is the survey to understand the number of frequencies required to maintain the work output to achieve the prescribed service levels.

Examples:

Work Frequency: xx times /month, or yy times/day

This survey is performed based on interviews with contractors and also by continual monitoring of SRUQ survey above.

Date:	Start Time:	End Time:
Location:	Weather:	

Form 1: Site Layout Sheet Produce 1)Typical Cross sections 2) Work Team Info 3) Work Items 4) Work Progress per Hour and 5) Others by hand during the survey on site.

Date	Weather
Location	Contractor's Name

Work Item	Number of Workers	Start time	End time	Working Hrs	Work Measurement

Form 2: Work Survey Form Produce 1)Start Time 2)End Time 3)Working Hours 4) Work Output 5) Remarks by hand during the survey on site.

Form 3: Productivity Survey Summary Form: (For compiling survey data to calculate labour productivity- Yellow sections are to be filled with appropriate survey data.)

Location		Client		Site		Weather		Initial Mobilization Period / Routine Maintenance				
Width of Road Reserve (Wr)		Width of Carriage Way (Wc)		Left Lined Ditch (LL)		Right Lined Ditch (RL)		Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	0.00 m	Total Length		Number of Labors		Men

Worked Items		Asset Quantity							Labour Input						SRUQ		Remarks (Equipment)
		Simple Quantity			Actual Quantity		Work Difficulty		Foreman	Supervisor	Labors				(4) Simple SRUQ (man day/ Qty)	(5) Actual SRUQ (man day/ Qty)	
		Q'ty	Unit	Remarks	Q'ty (Vol)	Unit	-Heavy -Normal -Light	Remark	nos	nos	nos	working hours					
		a			b				c	d	e	f	j=e×f	Man day			
1)	Grass Cutting(1) / Left		m2			m2	GW x L										
	Grass Cutting(2) / Right		m2			m2	GW x L										
2)	Cross Culvert(1)		Pcs			Pcs											
			m				m										
	Cross Culvert(2)					Pcs											
							m										
3)	Catch Basin / Cover(1)					Pcs											
	Catch Basin / Cover(2)					Pcs											
	Catch Basin / No cover(1)					Pcs											
	Catch Basin / No cover(2)					Pcs											
4)	Lined Side Ditch(1)					m	L										
	Lined Side Ditch(2)					m	L										
5)	Unlined Side ditch(1)					m	L										
	Unlined Side ditch(2)					m	L										
6)	Carriage De-sliting(1)					m2	Lx1.0(m)										
	Carriage De-sliting(2)					m2	Lx1.0(m)										
	Total										0	0					
													0.0				
													Man day	1 day = 7 working hours			

Note) To use one sheet per day

To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.
To specify structures to be maintained
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

Figure 5-1 Standard Survey Forms for SRUQ survey (Forms 1, 2 and 3)

5.2.1.2. Data Transfer

Calculations to obtain the areas, volumes, total number of workers and hours worked are performed at the site during the survey using Forms 1 and 2 above. The results are then transferred to Form 3 (Productivity Survey Summary Form) from which the SRUQs will be computed. Please refer to Chapter 5.2.1.4 for completed/filled in forms.

Such transfer of data and analytical services are explained in Chapter 6.

5.2.1.3. Photos of Productivity Survey

Processional way; Slashing of grass

Measurement of slashing of grass

De-silting of drainage

Measurement on De-silted drain

De-siltation of carriageway

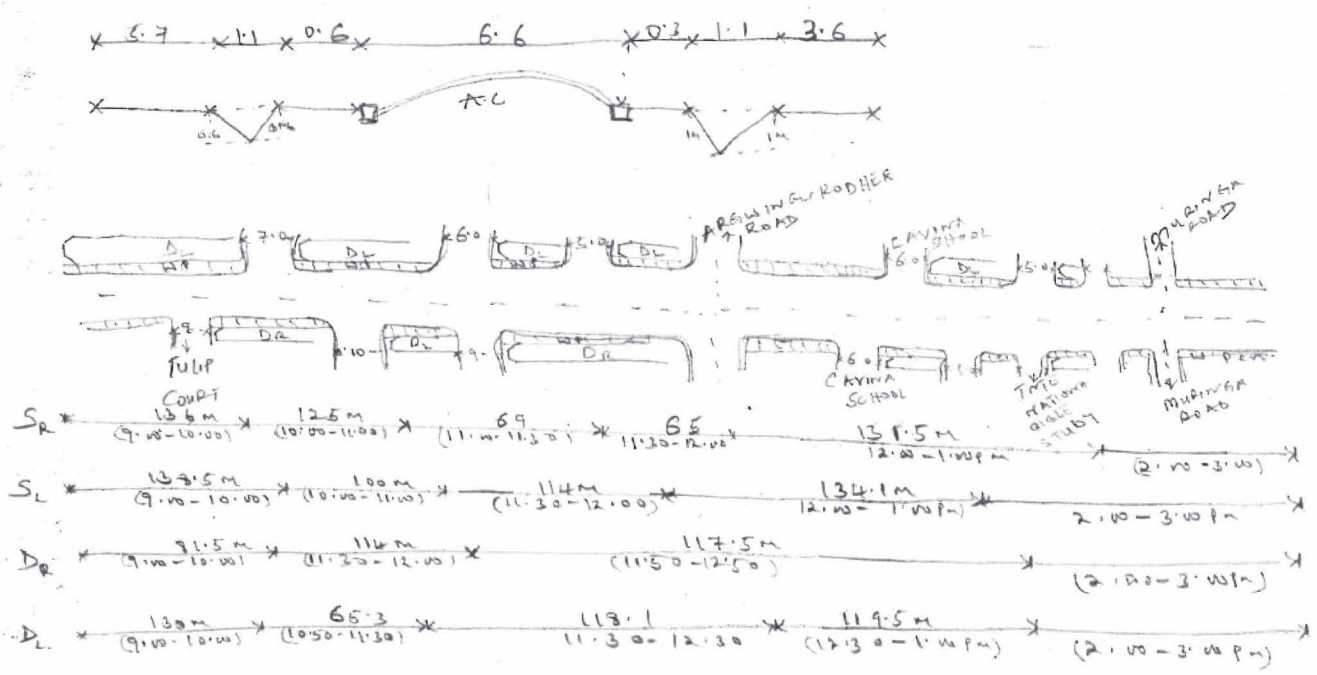
Measurement on de-silted carriageway.

De-siltation of drainage and cleaning of carriageway

Measurement of completed section

5.2.1.4. Sample Forms

Date: 13/03/2015	Start Time: 9.00 am	End Time: 3.00 pm
Location: ELGEYO MARAKWET ROAD	Weather: Cloudy/Sunny	



PBC Contract Work Producutivity Survey Form

Date 13/03/2015 Weather Cloudy/Sunny Inspected by Robert
Location ELGEYO MARAKWET ROAD Contractors Name HAVAT CONSTRUCTION COMPANY

Work Item	Number of workers	Start time	End time	workin hours	Work measurement	Work volume	Unit	Remark
SILTATION (R)	1	9:00	10:00 am	1hr.	L= 136, W= 0.3	39	m^2	very little silt on
		10:00	11:00 am	1hr.	L= 125 W= 0.3	37.5	m^2	Siltation part
		11:00	11:30am	30min	L= 69 W=0.3	20.7	m^2	work on Both side
		11:30	12:00 Pm	30min	L= 65 W=0.3	19.5	m^2	drainage and Siltation
		12:00 Pm	1:00 Pm	1hr.	L= 131.5 W= 0.3	39.45	m^2	~~347m²/hr. 1P~~ 184.56.
		1:00 Pm	2:00 Pm	1hr.	~~L= 94.7 W=0.3~~	~~156.5m²~~		lunch hour. 41.01m²/hr. 1P
	621.2m	2:00 Pm	2:30 Pm	30min 4hrs	L= 94.7 W= 0.3	~~621.2m~~ 284	m^2	138.04m²/hr. 1P
SILTATION (R)	1	9:00 am	10:00 am	1hr.	L= 138.5, W=0.3	41.55	m^2	very little left part
		10:00 am	11:00 am	1hr.	L= 100, W= 0.3	30	m^2	on Siltation side
		11:30am	12:00 Pm	30min	L= 114 W=0.3	34.2	m^2	Both workers work on
		12:00 Pm	1:00 Pm	1hr.	L= 134.1 W=0.3	40.23	m^2	Drainage and on
		1:00 Pm	2:00 Pm	1hr.		- lunch		Siltation side
		2:00 Pm	3:30 Pm	30Mins	L= 107.1 W= 0.3	32.13	m^2	148.43m/hr. 1P
				4hrs	593.7M	178.11m^2		44.53m²/hr. 1P
DRAINAGE (R)	1	9:00 am	10:00 am	1hr	L= 81.5, W=0.3, D=0.01	0.2445	m^3	Very little left part
		10:50 am	11:50 am	1hr.	L= 60.5 W=0.3, D=0.01	0.1815	m^3	on drainage side.
		11:50 am	12:50 Pm	1hr.	L= 117.5 W= 0.3, D=0.01	0.3525	m^3	One worker work on
		1:00 Pm	2:00 Pm	1hr.		lunch break.		both drainage and
		2:00 Pm	3:00 Pm	1hr.	L= 90.7 W=0.3 D=0.01	0.2721	m^3	Siltation part
				4hrs	350.2m	1.0506m^3		
					87.55m/hr. 1P	0.26m^3/hr. 1P		

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	Nairobi	Client	KURA	Site	Elgeyo Marakwet Road	Weather	Sunny	Initial Mobilization Period / Routine Maintenance				**No. 37**
Width of Road Reserve (Wr)	19.0 m	Width of Carriage Way (Wc)	6.6 m	Left Lined Ditch (LL)	0 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	12.40 m	Total Length	621 m	Number of Labors	4 men	3/13/2015

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	working hours			SRUQ (4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f	Man day	ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left		m2	GW x L		m2	Normal						0	0			
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0			
2)	Cross Culvert(1)		Pcs			Pcs							0	0			
			m			m	Light						0	0			
	Cross Culvert(2)		Pcs			Pcs							0	0			
			m			m							0	0			
3)	Catch Basin / Cover(1)		Pcs			Pcs							0	0			
	Catch Basin / Cover(2)		Pcs			Pcs							0	0			
	Catch Basin / No cover(1)		Pcs			Pcs							0	0			
	Catch Basin / No cover(2)		Pcs			Pcs							0	0			
4)	Lined Side Ditch(1)	621.2	m	L	350.2	m	Light				1	4	4	0.571428571	0.0009	0.0016	
	Lined Side Ditch(2)	621.2	m	L	522.9	m	Light				1	4.167	4.167	0.595285714	0.0010	0.0011	
5)	Unlined Side ditch(1)		m	L		m	Normal						0	0			
	Unlined Side ditch(2)		m	L		m							0	0			
6)	Carriage De-sliting(1)	621.2	m2	Lx1.0(m)	184.6	m2	Normal				1	4.5	4.5	0.642857143	0.0010	0.0035	
	Carriage De-sliting(2)	621.2	m2	Lx1.0(m)	178.1	m2					1	4	4	0.571428571	0.0009	0.0032	
	Total										4	16.667	16.667				
													2.4	1day = 7 working hours			
													Man Day				

Note) To use one sheet per day

To fill only the number of workers who are engaged in PBC works

Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.

To specify structures to be maintained

To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

5.2.2. Miscellaneous Cost Survey

Miscellaneous cost is a cost required to: 1) obtain necessary tools and equipment for carrying out the work; 2) acquire safety equipment and gears; and 3) acquire tools and equipment for inspection. An example is indicated in **Table 5-4** below.

The Manual recommends the value of 5% on top of the total labour cost. However, this can be improved by conducting the Miscellaneous Cost Survey to determine the standard percentage based on each road authority, region and contract.

Table 5-4 Example of Miscellaneous Cost

Item	Unit	Quantity	Rate	Amount	Remarks
Safety Jacket	Pcs	100	300	30,000	100pcs/year
Helmet	Pcs	100	1,000	100,000	100pcs/year
Safety Boots	Pcs	100	2,500	250,000	100pcs/year
Safety Cones	Pcs	20	250	5,000	60pcs/3years45
Grass Slasher	Pcs	200	700	140,000	200pcs/year
Wheel barrow	Pcs	40	3,000	120,000	40pcs/year
Shovel	Pcs	20	500	10,000	20pcs/year
Hoe	Pcs	20	800	16,000	20pcs/year
Fork foe	Pcs	10	1,000	10,000	20pcs/2years
Pick-axe	Pcs	2	800	1,600	6pcs/3yeas
Rake	Pcs	20	300	6,000	20pcs/year
Broom	Pcs	600	150	90,000	50pcs/month
Machete	Pcs	5	600	3,000	5pcs/year
Tape Measure	Pcs	2	200	400	2pcs/year
Total				782,000	(a)
%				5.0%	(a)/(b)%
Foreman	Man days	30,000	450	13,500,000	100*25days*12mths
Supervisor	Man months	40	40,000	1,600,000	3.33*12mths
Foreman	Man months	13.3	50,000	665,000	1.11*12mths
Workers Total				15,765,000	(b)

5.3. Patrol and Self-Inspection (Self-Control Unit) Survey

In order to obtain precise cost estimation, it is important to understand the precise volume of work inputs such as labour, materials and equipment resources for a given volume of work output under Self-Control Unit. It is also important to understand the work frequency so that a given volume of work output is performed to achieve the prescribed service level.

A survey is required to determine how the Self Control Unit is utilized in on-going projects. The scope of such a survey is indicated in **Table 5-5**.

The team formation illustrated in the PBC Guideline is indicated in **Figure 5-2**. Similarly in

Table 5-6, the required set up for patrolling and self-inspection is indicated.

The additional survey is required to either maintain or modify such team, vehicles and equipment formations for more precise cost estimation as standard formation of the Self-Control Unit may be different for projects under KeNHA, KURA, KeRRA and KWS.

Table 5-5 Patrol and Self-Inspection (Self Control Unit) Survey

Activities	Survey Items	Remarks
Patrol	Team Formation, Vehicles and Equipment Frequency	According to road authorities and types of roads
Self-Inspection	Team formation, Vehicles and Equipment Frequency	Same as above
Documentation	Details of Work Inputs Required	In case of a project with extraordinary inputs required, an extra cost may be required other than the cost included under the Indirect Cost

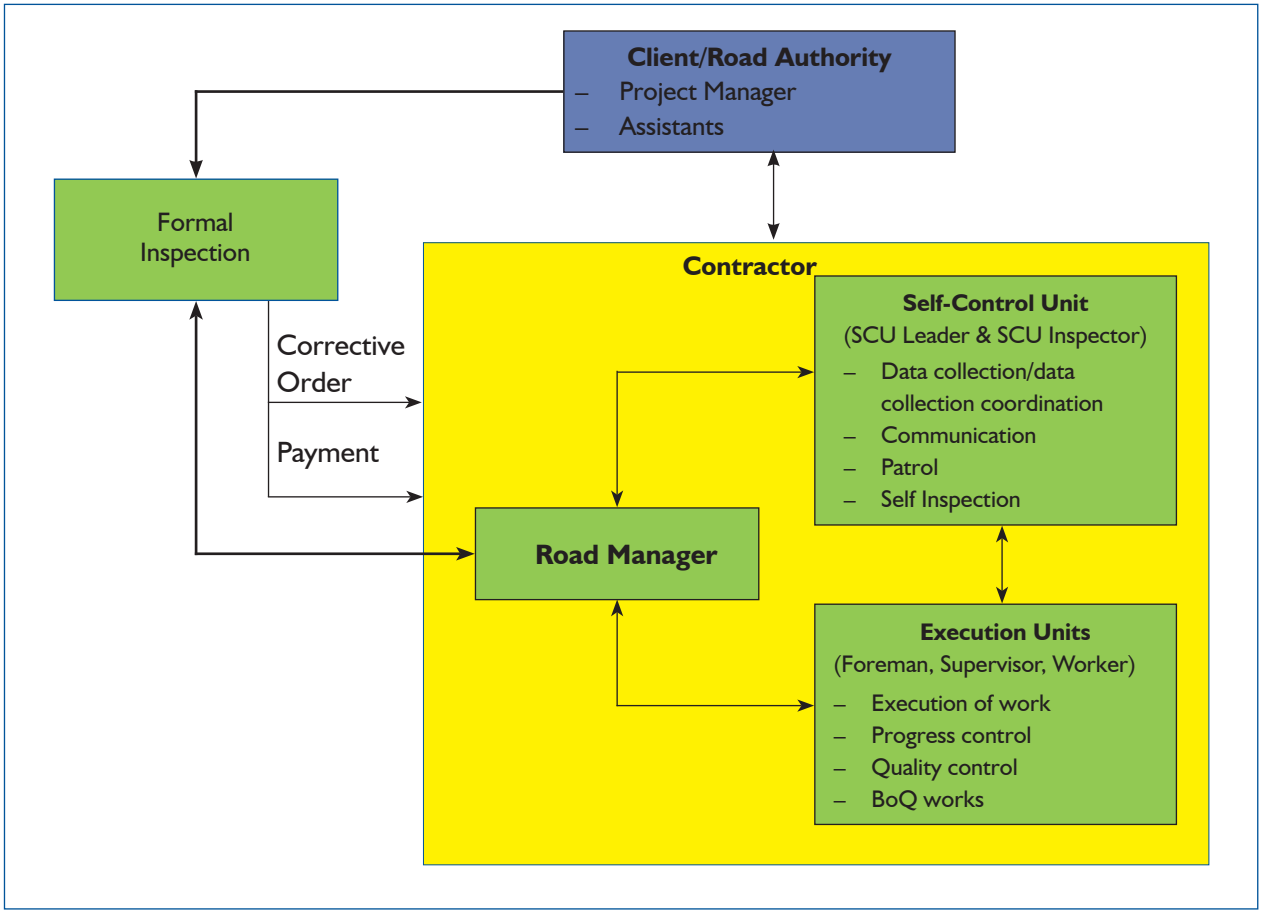


Figure 5-2 Example of Self Control Unit Structure

Table 5-6 Staffing Structure of Self-Control Unit

Position		Task	Requirements	Number of staff (Depends on the road type and complexity)		
				Up to 10km*1	Up to 50km*2	Over 50km*3
1	SCU leader	Coordination of data collection, Report, communication	Trained in PBC, Experience more than 5 years in road construction and maintenance	1	1	1
2	SCU Inspector	Data collection Patrol	Experience more than 3 years in road construction and maintenance	0	1	2

*1 Up to 10km: SCU leader conducts both patrol and self-inspection (1 vehicle required)
*2 Up to 50km (standard) : SCU leader conducts patrol and self-inspection with one inspector (1 vehicle required)
*3 Over 50km: SCU leader and an assistant conduct patrol and self-inspection. An inspector conducts patrol in other roads under contract at same time (2 vehicles required).

5.4. Survey on Other PBC Works

This section covers the survey on the "Other PBC Works" which are also required to be undertaken under a PBC project. They are non-labour based and SRUQs for 6 Major Labour Based Works do not apply. Components of the Other Major PBC Works are indicated in **Table 5-7** with information required for cost estimation.

Table 5-7 Components of Other PBC Works

Items	Check Items for Cost Estimation
Repair of Carriageway	Simple Quantity, Period of Maintenance, Age of Road, Number of Lanes, Thickness of Asphalt Pavement, Damage Inventory, Probable Quantity
Repair of Shoulder	Simple Quantity, Period of Maintenance, Age of Road, Thickness of Asphalt Pavement, Damage Inventory, Probable Quantity
Repair of Structures	Simple Quantity, Period of Maintenance, Damage Inventory, Probable Quantity
Repair of Road Furniture	Simple Quantity, Period of Maintenance, Damage Inventory, Probable Quantity
Repair of Profile and Road Width	Simple Quantity, Period of Maintenance, Damage Inventory, Probable Quantity
Repair of Embankment and Slopes.	Simple Quantity, Period of Maintenance, Damage Inventory, Probable Quantity

The Manual proposes three ways of cost estimation for Other PBC Works and surveys to obtain data/information to enable such cost estimation must be conducted. It is important to understand the precise volume of work inputs such as labour, materials and equipment resources for a volume of work output to achieve the specific service levels as well as the volume of work output itself are important. However, we must acknowledge that it is understandably difficult to determine the volume of the work output for each work on its own. Therefore, collection of damage inventory and computation of damage probabilities through this survey becomes important as well.

5.4.1. Damage Inventory Survey

By understanding the past maintenance record of damages and compiling them into the damage inventory, the probability of each repair such as pothole repair, rutting repair, shoulder repair and road furniture repair can be placed in a database to be provided by the cost estimation administrator.

This probability of each repair is termed as the damage probability and the probable quantity may be computed by multiplying the simple quantity and the damage probability of repairs necessary under Other PBC Works by the cost estimator from information in the database.

For compiling the damage inventory, the following survey needs to be established completely from scratch as no information is available in Kenya at this moment. The damage inventory survey is conducted in the following order:

1. Selection of Roads for Obtaining Damage Inventory
   The selected road should possess typical features of roads in Kenya which is being maintained under PBC. The road authority in charge and the cost estimation administrator will need to agree that the selected road will be used for the damage inventory throughout the duration of the PBC project.
2. Cooperation with PBC Contractor
   The PBC contractor responsible for maintaining the road will be informed that the selected road will be used as a model project for collection of the damage inventory for Other PBC Works, The contractor will be informed of usefulness which the study will serve for the road authority.
3. Damage Inventory Survey
   Based on the progress on site, the contractor will inform the representative of the road authority on the volume of Other PBC Works which the contractor periodically carries out. The representative

will then pass the information to the cost estimation administrator. Inventories of repairs carried out on damages will be recorded by the cost estimation administrator in a standardized form indicating the magnitude of damage and ensuing details of repair recorded with the anticipated cost incurred by the contractor. This is the input required for the damage inventory.

4. Compilation of Database
   Upon completion of the PBC project, all information collected in the damage inventory under the project can be compiled into a database by computing the number of damages recorded per project, per year and per km/year. Computing the amounts required for repair recorded per project, per year and per km/year for each work under Other PBC Works will also be made. This database will become the damage probability database. In case, the model project is in multiple numbers, the database will be more useful in future.

5.4.2. Percentage Survey

The percentage survey is a survey following the result of Damage Inventory Survey.

This is the survey using the database established under Damage Inventory Survey to quantify the cost required for repair of damages as a percentage of the direct cost of the PBC project.

This survey may be carried out without using the result of Damage Inventory Survey by collection of data through interviewing contractors undertaking PBC projects for which the Other PBC Works are a part of the scope.

5.4.3. How Survey is Used in Cost Estimation

For the Six (6) Major Labour Based Works and Self- Control Unit, quantification of work outputs are comparatively simple as such works are of repetitive nature and one can be able to adopt standard work frequencies to obtain work outputs.

For quantifying work outputs for "Other PBC Works", a concept of probable quantities is introduced instead of computing work outputs using work frequencies.

The probable quantity for Other PBC Works can be computed using the following formula:

Probable Quantity = Simple Quantity x Damage Probability

This is based on the understanding that various work outputs under Other PBC Works are of random occurrence and the impact of damage is also inconsistent.

In case, the damage probability is set higher than the reality, cost estimation will be higher; and in case, that the damage probability is set lower than the reality, cost estimation falls short of what is actually required. In order to minimize occurrence of such, it should be high priority to collect vital information as quick as possible.

The Manual recommends that works utilizing such probable quantities should not be treated as Other PBC Works, but as a part of Instructed Works so that the risk is borne by the road authority at this stage. This measure should be taken until such a time that a stable database of Other PBC Works is available.

Example:

Pothole repair:	Simple Quantity (Paved Area) 1,000m^2 × Damage Probability 5% = Probable Quantity 50m^2
Km Post repair:	Simple Quantity (Km Posts) 100 nos. x Damage Probability 3% = Probable Quantity 3 nos,

Difference of cost computation method is indicated in **Table 5-8**.

Table 5-8 Cost Estimation Methods

No	Categories	Description	Computation Method
1	6 Major Labour Based Works (Table 4-2)	Essentially the work is off carriageway and labour based.	Quantity *×Productivity×Unit Rate×Work Frequency (*length of drains, area of grass cutting etc.)
2	Patrol and Self-Inspection (Self Control Unit)	For patrolling under Road Usability and for self-inspection.	Quantity *×Productivity×Unit Rate×Work Frequency (* Road Length)
3	Other PBC Works	Works involving non-labour based work.	Probable Quantity = Simple Quantity x Damage Probability

5.5. Survey on Percentage Add-ons on Indirect Cost and Overhead & Profit

This section covers the survey required to determine the percentage add-ons to determine the costs of Indirect Cost and Overhead & Profit.

Indirect Cost and Overhead & Profit are the costs to cover items indicated in **Table 1-4** and are generally computed as percentages of: the Direct Cost for the Indirect Cost; and the sum of the Direct Cost and the Indirect Cost for the Overhead & Profit. The percentages are generally smaller when the contract amount is large and it is larger when the amount is small.

Indirect Cost	◆ Site Management Cost ◆ Site Staff Allowances ◆ Site Staff Social Charges ◆ General Safety Measures ◆ Human Resource Management Cost	*Cost computation of these items are a percentage of the Direct Cost*
Overhead & Profit	◆ Head Office Management Cost ◆ Head Office Staff Salaries and Allowances ◆ Cooperate Social Charges ◆ Research and Development ◆ Advertisement and Publicity ◆ Depreciation Costs for Fixed Asset Cost and Indirect Cost ◆ Profit Margin	*Cost computation of these items are a percentage of the sum of Direct*

The survey to understand what desirable percentages to apply must be conducted by the cost estimation administrator. For deriving such percentages, the cost estimation administrator requires to conduct interviews with PBC contractors to determine the amount the contractors actually incur as Indirect Costs and Overhead & Profit in relation to the actual amount the contractor incurs on the Direct Cost. The survey needs to be established completely from first principles as no information is available in Kenya at this moment.

In case the above survey is not possible, the percentage add-on can be established by collecting tendered prices on recent road construction projects in Kenya as the benchmark. There are sums indicated in Bill No. 1 General and Preliminaries which covers the cost of the indirect work. Normally, overhead & profit are spread all over the bill of quantities. Since PBC projects do not require major site establishment costs, the percentage for road construction project should be computed by deducting such site establishment costs from Bill No.1.

5.6. Survey on Standardized Quantities-for 6 Major Labour Based Works

In order to obtain precise cost estimation, understanding the volume of work outputs for road facility maintenance is vital. However, this involves elaborate time consuming tasks. Sometimes the purpose of cost estimation may not require such preciseness and a simpler way of obtaining work outputs will be required. In such a case, the Manual recommends adoption of standardized quantities of work outputs for the six (6) Major Labour Based

Works on a Kilometre (KM) format. Such KM Standardized quantities are computed in simple quantity for each road authority in this survey. Similarly, the percentage ratios of such simple and actual quantities for various road facilities have been also computed by Productivity Survey so that the cost estimation method using only a project length as an acquired parameter can be used. The details of cost estimation methods using KM Standardized Quantities are explained in Vol. 2 for Government Cost Estimators together with other two methods.

This section covers the survey method for obtaining a list of standardized quantities for road facilities for each road authority.

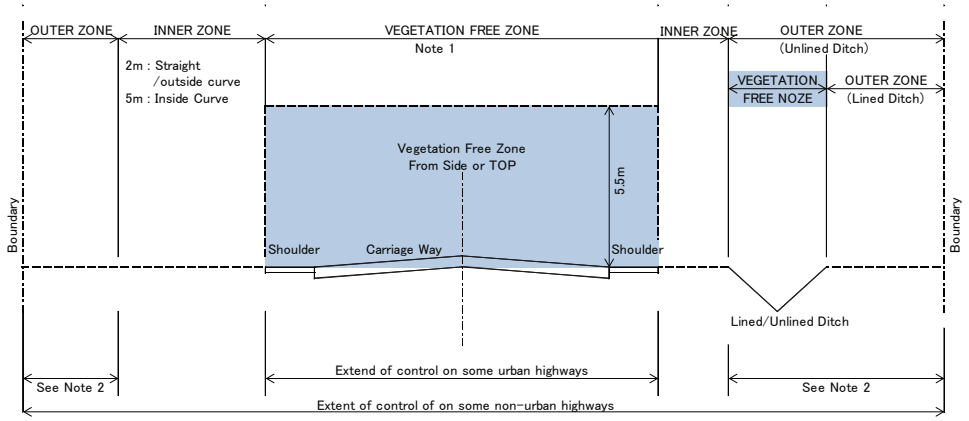
The survey for road facilities is conducted in the following order:

1. *Selection of Roads for Obtaining Standardized Quantities*
   The selected road should possess typical features of roads in Kenya.
   The selected road should be simple in its own nature and PBC is either being implemented or to be implemented. Selected roads thus become the Standardized Road.

2. *Selection of Survey Section*
   Survey sections will be selected taking into consideration that the section is simple in its own nature. Either a section or sections maybe selected. However, each section should be at least 1km in length and the total section should be between 3km to 5km in length.

   These sections thus become the Standardized Road Section.

3. *Computation of Simple Quantities for Each Road Facility*
   The Standardized Road Section will also be surveyed for simple quantities for each road facility, based on the following computation methods
   i. *Grass Cutting:* The length of the Standardized Road Section × (The road reserve – Carriage Way – Side Walk – Lined ditch) See Figure 5-3.
   ii. *Cross Culvert:* The total metre length of cross culverts regardless of whether maintenance is required or not in the Standardized Road Section.
   iii. *Catch Basin:* The total number of catch basins regardless of whether maintenance is required or not in the Standardized Road Section.
   iv. *Lined Ditch:* The total length of Lined Ditches regardless of whether maintenance is required or not in the Standard Road Section.
   v. *Unlined Ditch:* The total length of Unlined Ditches regardless of whether maintenance is required or not in the Standard Road Section.
   vi. *Carriageway:* The paved length of the Standardized Road Section ×1.0m × 2 × No of lanes. (1.0m for de-silting purpose)



Note 1 Vegetation free zone must be maintained free of all vegetaiton
Note 2 These area must be maintained accrding to the local requirements

Figure 5-3 Typical Section for Grass Cutting Maintenance Work

5. *Introduction of the Percentage of Actual Quantity/Simple Quantity*

Based on Productivity Survey, the percentage ratios of such actual and simple quantities for various road facilities can be computed. The result will be summarized in a format indicated in **Table 5-9**, which was the result of the Productivity Survey performed in 2015.

By conducting the survey periodically, together with the Productivity Survey on the 6 Major Labour Based Works, simpler and rough cost estimation can be completed in addition to more precise cost estimation methods.

Table 5-9 Percentages of Actual Quantities/Simple Quantities

KeNHA

Item	Unit	(1) Simple Quantity/1km	(2) Actual Quantity/1km	(3) Actual/Simple %
1) Grass Cutting	m^2	6055	2,018.3	33%
2) Cross Culvert Desilting	M	100	64.5	64%
3) Catch Basin Desilting	Pcs	10	3.3	33%
4) Lined Ditch Desilting	M	200	99.5	50%
5) Unlined Ditch Desilting	M	1400	496.5	35%
6) Carriageway Cleaning	m^2	2000	639.0	32%

KM Standardized Quantities for each road authority are indicated in **Table 5-10**. The KM Standardized Quantities in a simple quantity format and the percentage of actual quantity/simple Quantity have been derived from the survey. In addition, KM Standardized Quantities in an actual quantity have been computed.

In case some information is lacking from the survey due to unavailability of suitable projects in hand, a certain common sense judgment must be provided during the survey analysis as outlined in Chapter 6.

Table 5-10 KM Standardized Quantities in a Simple Quantity for Each Road Authority (2015)

KeNHA

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	6055	33%	2,018.3
Cross Culvert	m	100	64%	64.4
Catch Basin	Pcs	10	33%	3.3
Lined Ditch	m	200	50%	99.3
Unlined Ditch	m	1400	35%	496.2
Carriageway	m^2	2000	32%	638.7

Note: Figures are from survey on the Paved Road.

KeNHA (2×2Lanes)

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	12110	33%	4,036.7
Cross Culvert	m	200	64%	129.0
Catch Basin	Pcs	20	33%	6.7
Lined Ditch	m	400	50%	199.0
Unlined Ditch	m	2800	35%	992.9
Carriageway	m^2	4000	32%	1,278.0

Note: Figures are from survey on the Paved Road.

KURA

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	6819	33%	2,273.0
Cross Culvert	m	100	64%	64.5
Catch Basin	Pcs	50	33%	16.7
Lined Ditch	m	1400	50%	696.5
Unlined Ditch	m	200	35%	70.9
Carriageway	m^2	2000	32%	639.0

Note: Figures are from survey on the Paved Road.

KeRRA

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	2310	33%	777.0
Cross Culvert	m	10	64%	6.5
Catch Basin	Pcs	10	33%	3.3
Lined Ditch	m	0		-
Unlined Ditch	m	1800	35%	638.3
Carriageway	m^2	0		-

Note: Figures are from survey on the Unpaved Road.

KWS

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m2	2310	33%	770.0
Cross Culvert	m	10	64%	6.5
Catch Basin	pcs	10	33%	3.3
Lined Ditch	m	0		-
Unlined Ditch	m	1800	35%	638.3
Carriageway	m^2	0		-

Note: Figures are from survey on the Unpaved Road.

6. Analytical Results Based on Surveys Conducted

This section covers analytical results required to be obtained by the cost estimation administrator using the data/ information obtained from Cost and Affiliated Surveys as explained in Chapter 4. These results are of paramount importance for proper cost estimation by road authorities.

For traditional road maintenance, cost estimation involves identifying and quantifying work inputs required for performance outputs, identifying applicable unit rates for work inputs and arriving at mathematical summation of costs of all required work inputs using estimated quantities and unit rates.

For PBC road maintenance, cost estimation requires additional considerations to convert and break down service levels into applicable outputs then down to work inputs. Suitable work frequencies for each output needs to be identified so that specific service levels are maintained throughout the duration of the project.

The cost estimation administrator is required to determine and provide the following data for cost estimation to be carried out by each road authority on a yearly basis, or as indicated otherwise in applicable sections.

i. Unit Rates applicable for the year of cost estimation
ii. Standard SRUQs for 6 Major Labour Based Works
iii. Data on KM Standardized Quantities and the percentage ratios of such actual and simple quantities for various road facilities for 6 Major Labour Based Works
iv. Data on Self-Control Unit
v. Data on Other PBC Works
vi. Data on Percentage Add-ons on Indirect Cost and Overhead & Profit

6.1. Unit Rates

No specific analysis is required. Data obtained from the units rate survey will be used, Every year, the cost estimation administrator must determine applicable unit rates and provide the data in a summarized format to all road authorities. Please refer to Appendix 3 for the data applicable in FY 2015.

6.2. SRUQs for 6 Major Labour Based Works

Based on an agreed frequency, the cost estimation administrator must provide the data on the standard SRUQs and P/Rs to all road authorities by conducting desk reviews.

From the Productivity Survey, field data must be compiled into an Excel sheet and analysis will be conducted taking into consideration the various parameters affecting work productivity.

Under the 1st step, the result of the Productivity Survey is summarized into **Table 6-1**. Information on Simple Quantity、Actual Quantity and labour work input required for 6 Major Labour Based Works and other project information are then added. The level of Work Difficulty are added in three levels: Heavy, Normal, and Light based on the survey. Whether the project is under the initial mobilization period or not, seasonal conditions will be checked and recorded using this table.

At least two projects from each road authority will be selected. Each project will have several locations surveyed.

Summary of Survey Result

Table 6-1 Result of Productivity Survey

	Name of Project	RA	Length Main-tained	Grass Cutting 1				Grass Cutting 2				Cross Culvert(1)				Catch Basin / No Cover(1)				Catch Basin / No cover(2)				Lined Side Ditch(1) /de-silted volume				Lined Side Ditch(2) /de-silted volume				Unlined Side ditch(1) / de-silted volume				Unlined Side ditch(2) / de-silted volume				Carriage De-silting(1) / de-silted area				Carriage De-silting(2) / de-silting area			
				m^2				m^2				pcs				pcs				pcs				m				m				m				m				m^2				m^2			
				Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour	
						Person day				Person day				Person day				Person day				Person day				Person day				Person day				Person day				Person day				Person day			
1	Kirichwa(1)	KURA	200.0	2,800.0	337.9	1.00	Normal																	200.0	12.9	1.71	Normal	200.0	7.5	0.90	Normal									200.0	97.2	1.71	Normal	200.0	85.0	1.71	Normal
2	Kirichwa(2)	KURA	370.5	4,075.5	664.9	3.57	Normal									1.0	1.0	1.14	Heavy					370.5	28.0	4.29	Normal													370.5	70.5	3.75	Normal	370.5	70.5	3.75	Normal
3	Kirichwa(3)	KURA	303.0	3,333.0	168.8	0.29	Normal	3,333.0	178.2	0.14	Normal																					303.0	189.0	2.57	Normal	303.0	110.0	1.71	Normal	303.0	90.0	0.86	Normal	303.0	43.4	0.57	Normal
4	Excel Industries	KURA	331.0																													331.0	39.0	0.86	Normal	331.0	29.0	0.86	Normal	331.0	50.0	0.48	Light	331.0	119.7	0.14	Light
5	Likoni Rd	KURA	112.8	282.0	268.4	1.14	Normal	564.0	456.8	1.14	Normal																																						
6	Dennis Prit Rd	KURA	210.0	2,079.0	91.0	0.74	Normal																	192.4	109.0	1.24	Normal													210.0	31.5	0.66	Normal	210.0	31.5	0.66	Normal
7	Dorobo Rd	KURA	304.0	1,124.8	447.7	1.47	Normal	1,124.8	478.8	0.67	Normal																															304.0	91.2	0.86	Normal	486.4	347.4	0.57	Normal
8	Jabavu Lane	KURA	236.0	967.6	484.2	0.43	Normal	967.6	94.0	0.33	Normal													236.0	125.6	0.86	Normal	236.0	73.7	1.05	Normal									236.0	71.0	0.43	Normal	236.0	40.5	0.64	Normal
9	Theta Lane	KURA	65.0	84.5	52.0	0.29	Normal	84.5	49.2	0.86	Normal																																						
10	Processional Way 1st day	KURA	483.4	5,680.0	873.5	1.14	Light	5,680.0	948.7	1.14	Light													483.4	483.4	0.29	Light													483.4	115.6	0.29	Light	483.4	119.7	0.57	Light
11	Processional Way 2nd day	KURA	126.3	1,484.0	647.9	0.86	Normal	1,484.0	948.7	0.64	Normal																																						
12	Ralph Bunche Rd	KURA	352.6	4,513.3	350.3	0.29	Light	4,513.3	398.7	0.36	Light													352.6	64.0	0.29	Normal													352.6	211.6	1.00	Normal	352.6	154.7	0.71	Normal
13	Access to Excel undust1	KURA	435.5																					435.5	88.3	0.52	Normal	435.5	266.6	0.29	Light									435.5	265.7	0.93	Light	435.5	44.1	0.14	Light
14	Access to Excel undust2	KURA	111.1																					111.1	96.1	0.43	Light																				
15	Eastern Bypass service lane	KURA	245.5																					245.5	245.5	0.57	Light	245.5	54.0	0.29	Light																
16	Excel Indust20150303(1).	KURA	225.6	2,639.5	1,266.6	0.64	Normal																	225.6	67.6	0.81	Normal													225.6	67.7	0.59	Normal	225.6	30.6	0.29	Normal
17	Excel Indust20150303(2).	KURA	166.3																					166.3	166.3	0.33	Light																				
18	eastern service lane	KURA	169.0																					169.0	169.0	0.86	Normal																				
19	Eastern Bypass (SL1)	KURA	316.0																																					316.0	163.1	3.57	Normal				
20	Eastern Bypass (SL2)	KURA	230.0																																					598.0	598.0	2.14	Normal				
21	Link rd off airport n/s	KURA	3.0																					3.0	3.0	1.14	Heavy																				
22	Service lane near cabanas	KURA	294.3	3,796.5	51.9	0.29	Normal																																	294.3	90.1	1.14	Light				
23	Service Lane	KURA	210.7																																					210.7	22.7	1.14	Light				
24	Link rd off airport n/s	KURA	5.4																					5.4	5.4	1.71	Heavy																				
25	Eastern Bypass SL	KURA	77.6																																	77.6	46.9	1.79	Normal								
26	Mombasa Rd-Eastern Bypass	KURA	200.7																					200.7	150.7	3.36	Normal																				
27	4th Ngong Avenue	KURA	374.6																					52.0	52.0	0.14	Light	70.2	70.2	0.14	Light											374.6	112.4	0.74	Normal				
28	5th Ngong Avenue	KURA	384.6																																							384.6	14.6	0.04	light	384.6	65.3	0.29	Normal
29	3rd Ngong Avenue	KURA	158.7																					53.1	53.1	0.05	Light																	158.7	15.9	0.14	Normal	158.7	31.7	0.29	Normal
30	Jabavu Road	KURA	667.5	1,802.3	25.0	0.02	Light																	122.0	122.0	0.19	Light																	667.5	209.9	0.71	Light	667.5	251.5	0.71	Light
31	1st Ngong Avenue	KURA	320.0																																							320.0	84.9	0.25	Light	320.0	31.8	0.11	Light
32	3rd Ngong Avenue	KURA	165.0																																							145.0	72.0	0.29	Light	165.0	82.5	0.14	Light
33	Muringa road	KURA	272.7	886.3	40.0	0.07	Light	886.3	24.0	0.12	Light													272.7	159.4	0.36	Light	272.7	127.0	0.40	Light											272.7	72.7	0.29	Light	272.7	136.4	0.14	Light
34	Ndemi Road	KURA	640.0																					640.0	341.3	0.33	Light	640.0	205.8	0.33	Light											640.0	184.8	0.29	Light	640.0	188.7	0.29	Light
35	Statehouse Road	KURA	1,499.2																					1,499.2	456.7	0.57	Light	1,499.2	552.5	0.43	Light											1,499.2	449.8	1.14	Light	1,499.0	434.2	1.14	Light
36	Turbo Road	KURA	435.6																					53.9	53.9	1.57	Heavy	435.6	139.8	1.19	Normal																
37	Elgeyo Marakwet Rd	KURA	621.2																					621.2	350.2	0.57	Light	621.2	522.9	0.60	Light											621.2	184.6	0.64	Light	621.2	178.1	0.57	Light
38	Makindi Rd	KURA	498.6																																							498.6	96.8	0.36	Light	498.6	68.1	0.31	Light
39	Elgeyo Marakwet Rd	KURA	79.8																					79.8	69.4	0.10	Light																				
40	Gacharage-DB Thika	KeRRA	39.7																																	39.7	39.7	1.05	Heavy								
41	Kangema - Kiriaini Rd	KeRRA	259.7																																	259.7	102.7	3.04	Heavy								
42	Gacharage-DB Thika	KeRRA	732.4	1,062.0	732.4	0.67	Light	1,062.0	664.7	0.52	Light																									732.4	271.0	3.86	Heavy	732.4	195.5	3.86	Heavy				
43	Kangema - Kiriaini Rd	KeRRA	153.4																																	153.4	153.4	3.38	Heavy								
44	Gacharage-DB Thika	KeRRA	220.4																																	220.4	220.4	1.38	Heavy								
45	Kangema - Kiriaini Rd	KeRRA	901.8																																	901.8	161.8	2.71	Heavy								
46	Gacharage-DB Thika	KeRRA	134.0																																	134.0	134.0	1.33	Heavy								
47	Kangema - Kiriaini Rd	KeRRA	438.2													1.0	1.0	0.01	Light																	438.3	158.7	2.23	Heavy								
48	Gacharage-DB Thika	KeRRA	150.1													1.0	1.0	0.09	Light																	150.1	150.1	1.71	Heavy								
49	Kangema - Kiriaini Rd	KeRRA	56.9																																	56.9	56.9	2.38	Heavy								
50	Kisii-kilgoris(boroko)	KeNHA	16.6									1.0	1.0	0.12	Heavy																					16.6	16.6	4.70	Heavy								
51	Kisii-kilgoris(Magena)	KeNHA	4.3																					4.3	4.3	7.28	Heavy																				
52	Kisii-kilgoris(Magena)	KeNHA	5.8																					3.3	3.3	4.57	Heavy	5.8	5.8	2.14	Heavy																
53	Kisii-kilgoris(Ogembo)	KeNHA	439.0	3,029.1	746.3	0.36	Light	3,029.1	867.1	0.36	Light																																						
54	Kisii-kilgoris(Nyangusu)	KeNHA	6.4									1.0	1.0	0.05	Heavy																					6.4	6.4	3.39	Heavy								
55	Kisii-kilgoris(Menyinkwa)	KeNHA	516.7									12.0	1.0	0.02	Normal																					516.7	21.7	4.70	Heavy								
56	Kisii-kilgoris(near kisii town)	KeNHA	131.1									6.9	6.9	0.12	Normal									131.1	100.7	4.33	Normal																				
57	Kisii-kilgoris(near kisii town)	KeNHA	213.0	2,023.5	638.6	0.40	Light	2,023.5	231.9	0.40	Light													213.0	54.4	3.07	Normal	213.0	19.5	0.86	Normal																
58	Kisii-kilgoris(Menyinkwa)	KeNHA	376.9																																	376.9	8.9	0.36	Normal								
59	Kisii-kilgoris(kisii town)	KeNHA	130.7													1.0	1.0	0.14	Light					65.4	36.2	0.74	Normal	65.4	13.0	0.64	Normal																
60	Kisii-kilgoris(kisii town)	KeNHA	140.4																					70.2	58.8	1.33	Heavy	70.2	65.4	1.33	Heavy																
61	Lanet njoro (pipeline)	KeNHA	74.5																																	74.5	20.3	0.40	Normal								
62	Lanet njoro (near pipeline)	KeNHA	87.6													1.0	1.0	0.05	Light					85.7	85.7	0.19	Light																	87.6	26.3	0.19	Light				
63	Lanet njoro (Nakuru twn)	KeNHA	215.2									4.5	4.5	0.21	Heavy	4.0	4.0	0.11	Light					107.6	96.9	2.50	Heavy	107.6	118.3	1.01	Light																
64	Lanet njoro (pipeline)	KeNHA	32.7																																	19.9	19.9	1.81	Heavy	12.8	12.8	0.81	Heavy				
65	Lanet njoro (Nakuru twn)	KeNHA	129.0													1.0	1.0	0.02	Light					61.7	61.7	2.71	Heavy	67.3	67.3	0.86	Normal																
66(A)	Lanet njoro (pipeline)(A)	KeNHA	42.8																																	21.4	20.5	0.56	Normal	21.4	12.0	0.63	Normal				
66(B)	Lanet njoro (pipeline)(B)	KeNHA	42.8																																	21.4	7.7	0.77	Normal	21.4	6.5	0.14	Normal				
66(C)	Lanet njoro (pipeline)(C).	KeNHA	21.8																																	21.4	13.9	0.85	Normal								
67	Lanet njoro (pipeline)	KeNHA	20.0																																	10.0	6.1	0.49	Normal	10.0	6.9	0.46	Normal				
68	Lanet njoro (Nakuru twn)	KeNHA	74.3									5.5	5.5	1.24	Heavy	2.0	2.0	0.05	Light					17.8	17.8	0.38	Heavy	56.5	56.5	0.62	Heavy																

Heavy			0	0	0.00		0	0	0.00		12	12	0.00		1	1	1.14		0	0	0.00		327	305	23.20		133	128	4.10		3,646	1,513	37.68		745	208	4.67		74	52	0.19		0	0	0.00	
Normal			22,666	4,481	10.72		7,602	2,228	3.93		27	16	0.36		0	0	0.00		0	0	0.00		2,556	881	21.21		1,217	321	5.50		1,253	368	8.69		687	164	3.81		3,649	1,620	16.45		2,054	702	3.44	
Light			18,997	1,905	2.96		16,132	2,470	2.38		0	0	0.00		11	11	0.48		0	0	0.00		4,432	2,681	4.12		3,892	1,917	3.49		0	0	0.00		0	0	0.00		6,891	1,940	8.17		5,934	1,655	4.27	
counts	Heavy		0	0	0.00		0	0	0.00		4	4	4.00		1	1	1.00		0	0	0.00		9	9	9.00		3	3	3.00		14	14	14.00		2	2	2.00		0	0	0.00		0	0	0.00	
	Normal		11	11	11.00		6	6	6.00		2	2	2.00		0	0	0.00		0	0	0.00		11	11	11.00		6	6	6.00		9	9	9.00		5	5	5.00		12	12	12.00		7	7	7.00	
	Light		7	7	7.00		5	5	5.00		0	0	0.00		7	7	7.00		0	0	0.00		13	13	13.00		8	8	8.00		0	0	0.00		0	0	0.00		15	15	15.00		11	11	11.00	

Using information as summarized in **Table 6-1**, **Table 6-2** is prepared by arranging data according to work category, labour inputs (in man-days) and Work Difficulty Levels. By summation of data into various categories and then dividing them by Simple Quantity and Actual Quantity and P/Rs are obtained. From P/Rs, SRUQS are obtained through computation.

Based on difference of Work Difficulty Levels, applicable SRUQs and P/Rs are used for cost estimation.

Initial Mobilization Period: SRUQs and P/Rs under Heavy

Wet Season: SRUQs and P/Rs under Normal

Dry Season: SRUQs and P/Rs under Light

Using information derived in **Table 6-2**, **Table 6-3** is produced for use by cost estimators.

Table 6-2 Compilation of SRUQs, P/Rs, Percentage Ratio of Simple Quantity/Actual Quantity ((Simple/Actual) %)

The top section computes the field data to applicable field SRUQs for both simple and actual quantities together with the field percentage ratio of simple quantity/actual quantity.

The bottom section illustrates correction exercises necessary to obtain all applicable SRUQS and P/Rs for both simple and actual quantities together with the adjusted percentage ratio of simple quantity/actual quantity.

Correction exercises are required at this stage as sufficient data to cover the entire sphere of activities has not been obtained under the survey. Therefore, a certain common sense judgment must be provided to recover such deficiencies.

Summary of SRUQ

Work Item	Level	Simple	Actual	Person* day	P/R (Actual)	SRUQ (Actual)	SRUQ (Actual) *1000	Simple/ Actual	Actual/ Simple	P/R (Simple)	SRUQ (Simple)	SRUQ (Simple)*1000
Grass Cutting (m2)	Heavy	No Data										
	Normal	30,224	6,687	14.499	461.2	0.002168167	2.17			2,399.2	0.000416808	0.42
	Light	35,129	5,876	5.336	1,101.3	0.000907981	0.91			5,729.0	0.00017455	0.17
	Total(Ave.)	65,353	12,563	20	633.4	0.001578725	1.58	520%	19%	3,295.0	0.000303494	0.30
Cross Culvert (m)	Heavy	12	12	1.619	7.4	0.134916667	134.92			11.5	0.08688808	86.89
	Normal	19	8	0.142	55.5	0.018028933	18.03			86.1	0.011610866	11.61
	Light	No Data										
	Total(Ave.)	31	20	2	11.3	0.088513999	88.51	155%	64%	17.5	0.057004161	57.00
Catch Basin (pcs)	Heavy	1	1	1.143	0.9	1.142857143	1,142.86			0.9	1.142857143	1,142.86
	Normal	No Data										
	Light	11	11	0.475	23.2	0.043194805	43.19			23.2	0.043194805	43.19
	Total(Ave.)	12	12	2	7.4	0.134833333	134.83	100%	100%	7.4	0.134833333	134.83
Lined Side Ditch (m)	Heavy	460	433	27.299	15.9	0.063070622	63.07			31.9	0.031306995	31.31
	Normal	3,773	1,202	26.713	45.0	0.022230222	22.23			90.6	0.011034638	11.03
	Light	8,324	4,598	7.609	604.3	0.001654675	1.65			1,217.5	0.000821347	0.82
	Total(Ave.)	12,557	6,233	62	101.1	0.009886347	9.89	201%	50%	203.8	0.004907385	4.91
Unlined Side Ditch (m)	Heavy	4,391	1,722	42.350	40.7	0.02459982	24.60			114.7	0.008718194	8.72
	Normal	1,924	517	12.452	41.5	0.024101616	24.10			117.1	0.00854163	8.54
	Light	No Data										
	Total(Ave.)	6,315	2,238	55	40.8	0.024484818	24.48	282%	35%	115.2	0.008677437	8.68
Carrageway De-silting (m2)	Heavy	No Data										
	Normal	5,703	2,322	19.893	116.7	0.008568364	8.57			365.5	0.002736169	2.74
	Light	12,825	3,595	12.442	288.9	0.003460832	3.46			904.8	0.001105161	1.11
	Total(Ave.)	18,528	5,917	32	183.0	0.005464973	5.46	313%	32%	573.0	0.001745151	1.75

After Correction

Work Item	Level	P/R (Actual)	Remarks	SRUQ (Actual)	SRUQ (Actual) *1000	Simple/Actual	Actual/ Simple	P/R (Simple)	SRUQ (Simple)	SRUQ (Simple) *1000
Grass Cutting (m2)	Heavy	100	Assumption (From Normal and Little)	0.01	10.00			300.0	0.003333333	3.33
	Normal	461		0.002168167	2.17			1,383.7	0.000722722	0.72
	Light	1,101		0.000907981	0.91			3,304.0	0.00030266	0.30
	Total(Ave.)	633		0.001578725	1.58	300%	33%	1,900.3	0.000526242	0.53
Cross Culvert (m)	Heavy	7		0.134916667	134.92	(Assumption: 3:1)		11.5	0.08688808	86.89
	Normal	55		0.018028933	18.03			86.1	0.011610866	11.61
	Light	100	Assumption (From Heavy and Normal)	0.01	10.00			155.3	0.006440129	6.44
	Total(Ave.)	11		0.088513999	88.51	155%	64%	17.5	0.057004161	57.00
Catch Basin (pcs)	Heavy	1		1.142857143	1,142.86			2.6	0.380952381	380.95
	Normal	5	Assumption (From Heavy and Little)	0.2	200.00			15.0	0.066666667	66.67
	Light	23		0.043194805	43.19			69.5	0.014398268	14.40
	Total(Ave.)	7		0.134833333	134.83	300%	33%	22.2	0.044944444	44.94
Lined Side Ditch (m)	Heavy	16		0.063070622	63.07	(Assumption; 3:1)		31.9	0.031306995	31.31
	Normal	45		0.022230222	22.23			90.6	0.011034638	11.03
	Light	604		0.001654675	1.65			1,217.5	0.000821347	0.82
	Total(Ave.)	101		0.009886347	9.89	201%	50%	203.8	0.004907385	4.91
Unlined Side Ditch (m)	Heavy	41		0.02459982	24.60			114.7	0.008718194	8.72
	Normal	41		0.024101616	24.10			117.1	0.00854163	8.54
	Light	600	Assumption (From Lined Side Ditch Little)	0.001666667	1.67			1,693.0	0.000590668	0.59
	Total(Ave.)	41		0.024484818	24.48	282%	35%	115.2	0.008677437	8.68
Carrageway De-silting (m2)	Heavy	50	Assumption (From Normal and Little)	0.02	20.00			156.6	0.006386678	6.39
	Normal	117		0.008568364	8.57			365.5	0.002736169	2.74
	Light	289		0.003460832	3.46			904.8	0.001105161	1.11
	Total(Ave.)	183		0.005464973	5.46	313%	32%	573.0	0.001745151	1.75

Table 6-3 Final Results for Cost Estimators

Work item	Level	P/R (Simple)		SRUQ (Simple)	
			Unit		Unit
Grass Cutting (m2)	Heavy	300.0	m2/md	0.003333333	md/m2
	Normal	1,383.7		0.000722722	
	Light	3,304.0		0.00030266	
	Total(Ave.)	1,900.3		0.000526242	
Cross Culvert (m)	Heavy	11.5	m/md	0.08688808	md/m
	Normal	86.1		0.011610866	
	Light	155.3		0.006440129	
	Total(Ave.)	17.5		0.057004161	
Catch Basin (pcs)	Heavy	2.6	pcs/md	0.380952381	md/pcs
	Normal	15.0		0.066666667	
	Light	69.5		0.014398268	
	Total(Ave.)	22.2		0.044944444	
Lined Side Ditch (m)	Heavy	31.9	m/md	0.031306995	md/m
	Normal	90.6		0.011034638	
	Light	1,217.5		0.000821347	
	Total(Ave.)	203.8		0.004907385	
Unlined Side Ditch(m)	Heavy	114.7	m/md	0.008718194	md/m
	Normal	117.1		0.00854163	
	Light	1,693.0		0.000590668	
	Total(Ave.)	115.2		0.008677437	
Carrageway De-silting(m2)	Heavy	156.6	m2/md	0.006386678	md/m2
	Normal	365.5		0.002736169	
	Light	904.8		0.001105161	
	Total(Ave.)	573.0		0.001745151	

6.3 Data on Percentage Add-ons on Indirect Cost and Overhead & Profit

6.3.1 Indirect Cost

The cost estimation administrator is required to determine the percentage add-ons based on the survey carried out in accordance with Chapter 5. By collection of sufficient data and interviews with contractors who participated in past PBC projects, a percentage add-on can be determined.

The Manual recommends a percentage of Indirect Cost as **30%** over the Direct Cost (Refer to Appendix 9). This is the default value used in COSTES for PBC 2015. The percentage is based on other classical road contracts in Kenya.

In Japan, the standard values of the indirect cost percentage on public road infrastructure projects are indicated in **Table 6-4**.

Table 6-4 Percentage Add-ons on Indirect Cost and Overheads & Profits in Japan

Percentage of Indirect Cost/Direct Cost for Road Infrastructure Project in Japan			
Limit	Qty	Unit	Remarks
Upper Limit	32.73	%	For projects under US$ 58,000
Lower Limit	24.71	%	For projects over US$ US$ 8,300,000
Percentage of Overhead & Profit/(Direct Cost +Indirect Cost) for Road Infrastructure Project in Japan			
Limit	Qty	Unit	Remarks
Upper Limit	20.29	%	For projects under US$ 42,000
Lower Limit	7.41	%	For projects over US$ US$ 25,000,000

6.3.2 Overhead & Profit

The cost estimation administrator is required to determine the percentage add-ons based on the survey carried out in accordance with Chapter 5. By collection of sufficient data and interviews with contractors who participated in past PBC projects, a percentage add-on can be determined.

The Manual recommends a percentage of the Overhead/Profit as **10%** over the summation of the Direct Cost and the Indirect Cost (Refer to Appendix 9). This is the default value used in COSTES for PBC 2015. This percentage is also based on other classical road contracts in Kenya. It is to be noted that the profit margins and overheads include only those incurred by the Contractor but not the Client.

The default values of percentage for Indirect Cost and Overhead/Profit should be modified once comprehensive survey has been conducted.

6 Manual Revisions

This section describes the timing of revisions required so that the Manual is maintained and continues to serve its useful purpose.

Vol. 1 Administrators
- Revision is necessary whenever Cost Surveys are amended.
- Yearly revision of Cost Estimation Parameters 2015.

Vol. 2 Government Cost Estimators
- Revision is necessary whenever work/service items are added or excluded.
- Yearly revision of Cost Estimation Parameters 2015.

Vol. 3 Contractors
- Revision is necessary to synchronize with the revision made in Vol.2.
- Yearly revision of Cost Estimation Parameters 2015 for Use by Contractors.

Appendix

1. Basic flow of COSTES

1.1 COSTES Program flow and Data relationship

COSTES program refers to tables in the database (**jicadata**) as shown in the Figure below.

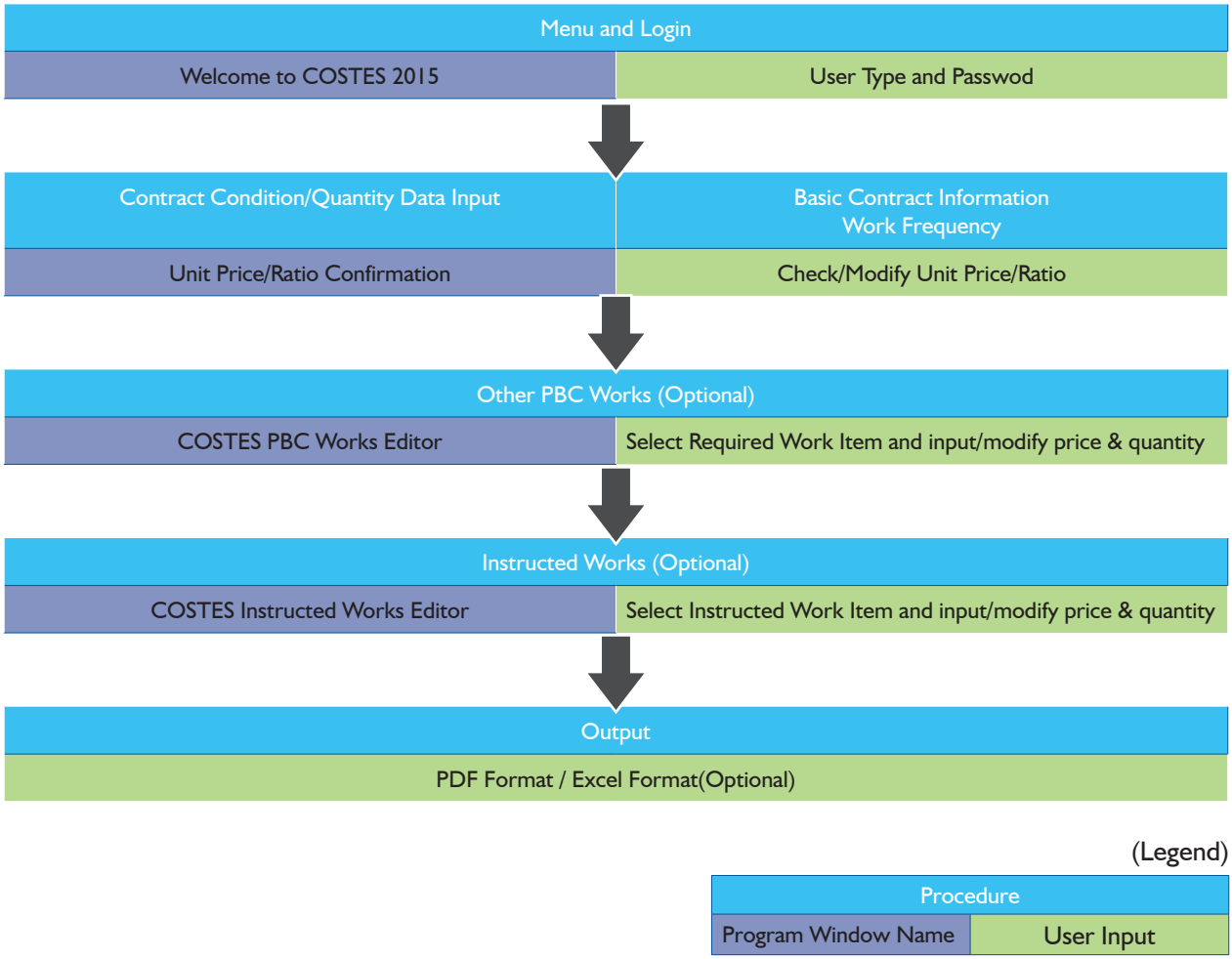
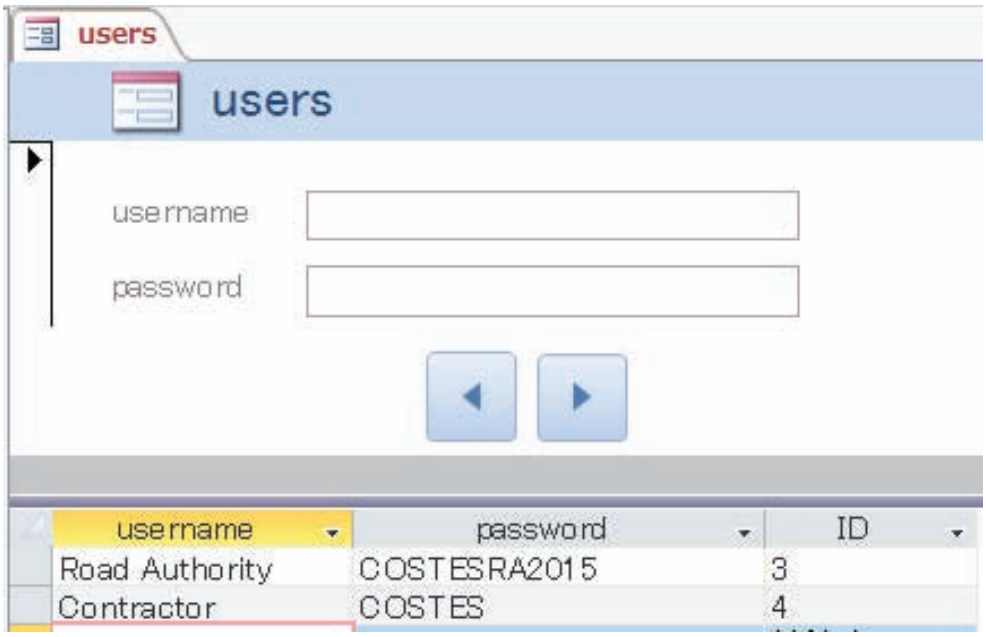


Figure 2.2 – Basic Data input and Program flow inside the COSTES2015

2. Users Information (Table: users)

User Information handles User Names and Passwords. On the Welcome screen, program users have to enter passwords in order to use COSTES.

COSTES accepts "Road Authority" and "Contractor" only



2.1 Contents of the table

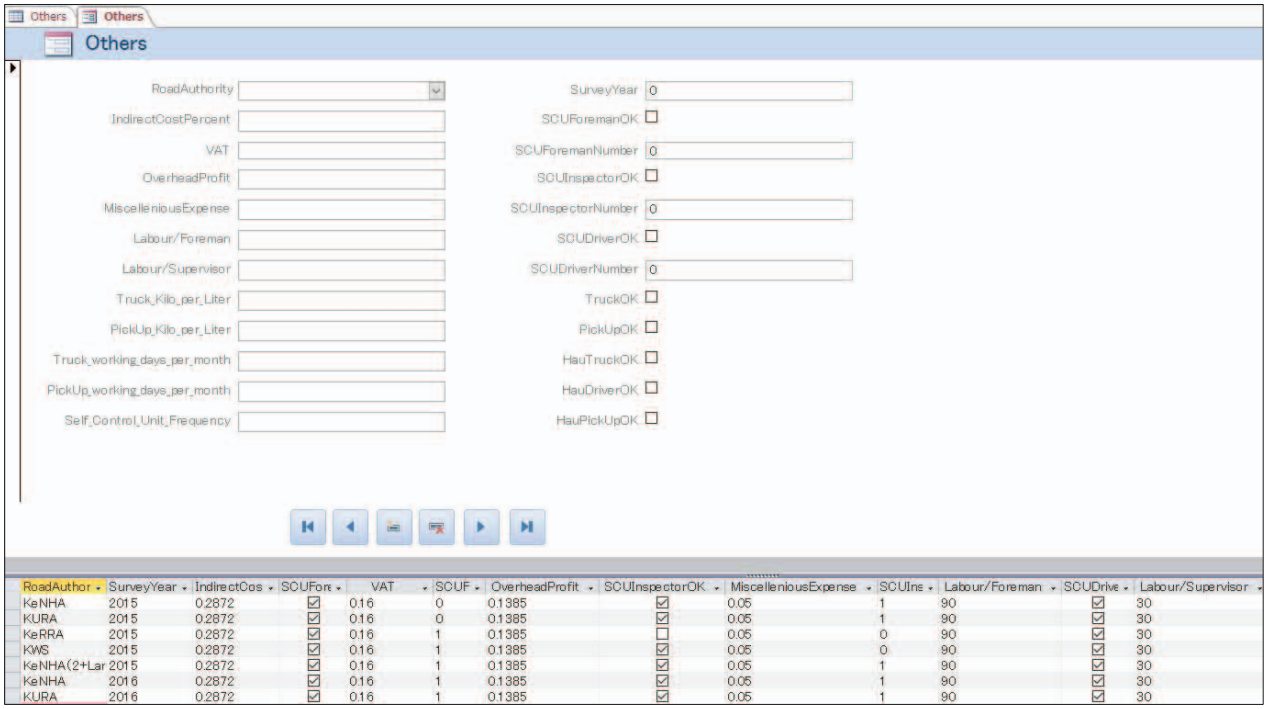
Item	Valid value range	Description
username	Selection from "Road Authority", "Contractor", "Administrator" only	Words are recognized directly
password	Letter String (any numbers of characters including number, alphabet, symbols)	Main menu recognizes password

2.2 Data Update

COSTES can identify "Road Authority", "Administrator" and "Contractors" only. Adding extra members is not allowed. It is advised that Passwords should be changed frequently.

3. Basic Parameters by Road Authority (Table: Others)

"Others" table handles basic condition for cost estimation. Parameters can be set by each road authority.



3.1 Contents of the table

Item	Value type/ value range/ condition	Description	Manual vol.I
Road Authority	Letter String/ up to 100 characters/ At least the name includes "KeNHA", "KURA", "KeRRA" or "KWS"	Defines the name of the road authorities. Alternatives include: "KeNHA", "KURA", "KeRRA", and "KWS". COSTES recognizes these names by exact word and character.	-
Indirect Cost	Decimal Number / 0.000 to 1.500 (3 decimal points)	Ratio of the indirect cost (see pp.33). COSTES calculates indirect cost by multiplying total direct cost (including PBC and Instructed work) by this ratio (see pp.33).	1.4/5.5/6.3.1
VAT	Decimal Number / 0.00 to 1.00 (2 decimal points)	Ratio of Value Added Tax	1.4
Overhead Profit	Decimal Number / 0.0000 to 1.5000 (4 decimal points)	Ratio of the overhead and profit. COSTES calculates overhead cost and profit by multiplying this ratio with the sum of direct and indirect cost.	1.4/5.5/6.3.2
Miscellaneous	Decimal Number/ 0.0000 to 1.5000 (4 decimal points)	Ratio of the miscellaneous cost (see pp.20 of the manual) . COSTES calculates miscellaneous cost by multiplying total labour cost by this ratio. This ratio is used on the detail cost sheets of 6 Major Labour Based Works in the "Detail Contents (B)" sheets.	5.2.2
Labour/ Foreman	No Decimal point / 0 to 300	Defines how many labours should be allocated to ONE Site agent. This value is used in the detail cost sheets of 6 Major Labour Based Works in the "Detail Contents (B)" sheets.	4.3.4.3*

Item	Value type/ value range/ condition	Description	Manual vol.I
Labour/ Supervisor	No Decimal point / 0 to 300	Defines how many labourers should be allocated to ONE Supervisor. This value is used on the detail cost sheets of 6 Major Labour Based Works6 Major Labour Based Works in the "Detail Contents (B)" sheets.	4.3.4.3*
Truck_Kilo_per_ Litre	No Decimal point / 0 to 30	Defines truck's diesel fuel consumption efficiency. The Unit is "Litres per km". This value is used for the Self inspection and Haulage expenses, and related to the truck distance travelled.	5.3/4.3.4.6*
Pick-Up_Kilo_ per_Litre	No Decimal point / 0 to 40	Defines Pick-up's petrol fuel consumption efficiency. The Unit is "Litres per km". This value is used for the Self inspection and Haulage expenses and related to the pickup distance travelled.	5.3/4.3.4.6*
Truck_working_ days_per_ month	No Decimal point / 0 to 30	Defines the number of days when the each maintenance work is carried out. It affects the calculation of the labour quantity per month in the "Detail Contents (B)". Default value is 25 days.	6.2.3
PickUp_ working_days_ per_month:	No Decimal point / 0 to 30	Defines the number of days when the each self-inspection work is carried out. It affects the calculation of the travel distance of the pickup per month in the "Detail Contents (B)" sheets. Default value is 30 days because Road Patrol is executed every day.	6.3
Password	Letter String / up to 100 characters	COSTES currently does not use this item	-
Self_Control_ Unit(patrol)_ Frequency	Decimal 2 decimal points/ 0.03 to 100.00	Specifies how many times the self-inspection crew patrols the road per day. This value can be changed in the "DataInput" form in COSTES.	5.3/4.3.5*
Survey Year	Numeric value / 2010 to 2030	Survey Year	5
SCU Foreman, SCU Inspector, SCU Driver, Truck, Truck for Haulage, Driver for Haulage, PickUp for Haulage	Checkbox / checked or non-checked	If checkbox is checked, SCU Table and Haulage Table in COSTES Contract Condition Editor will be checked. That is, checked items are regarded as the default member of SCU/Haulage Unit.	5.3/6.2.6.3
	Number / integer/ If non-checked, the number is zero	These values become default values in the SCU/Haulage Editor if checked.	5.3/6.2/6.3

* Refer to the Manual for Government Cost Estimators (vol.2)

3.2 Data Update

It is essential to modify parameters (2015 data), except for "Road Authority", for each authority otherwise COSTES cannot find any parameters if 2016 or later data have not been registered. One parameter set can be installed for each year by the road authority. It is important to note that two or more parameter sets cannot be registered in the same year.

If a new data set is obtained, please input them but the year should be unique. COSTES uses the data of the year which the user specifies on the "DataInput" form.

It is strongly recommended that both Road Authority and Contractor candidates use the data of the same year.

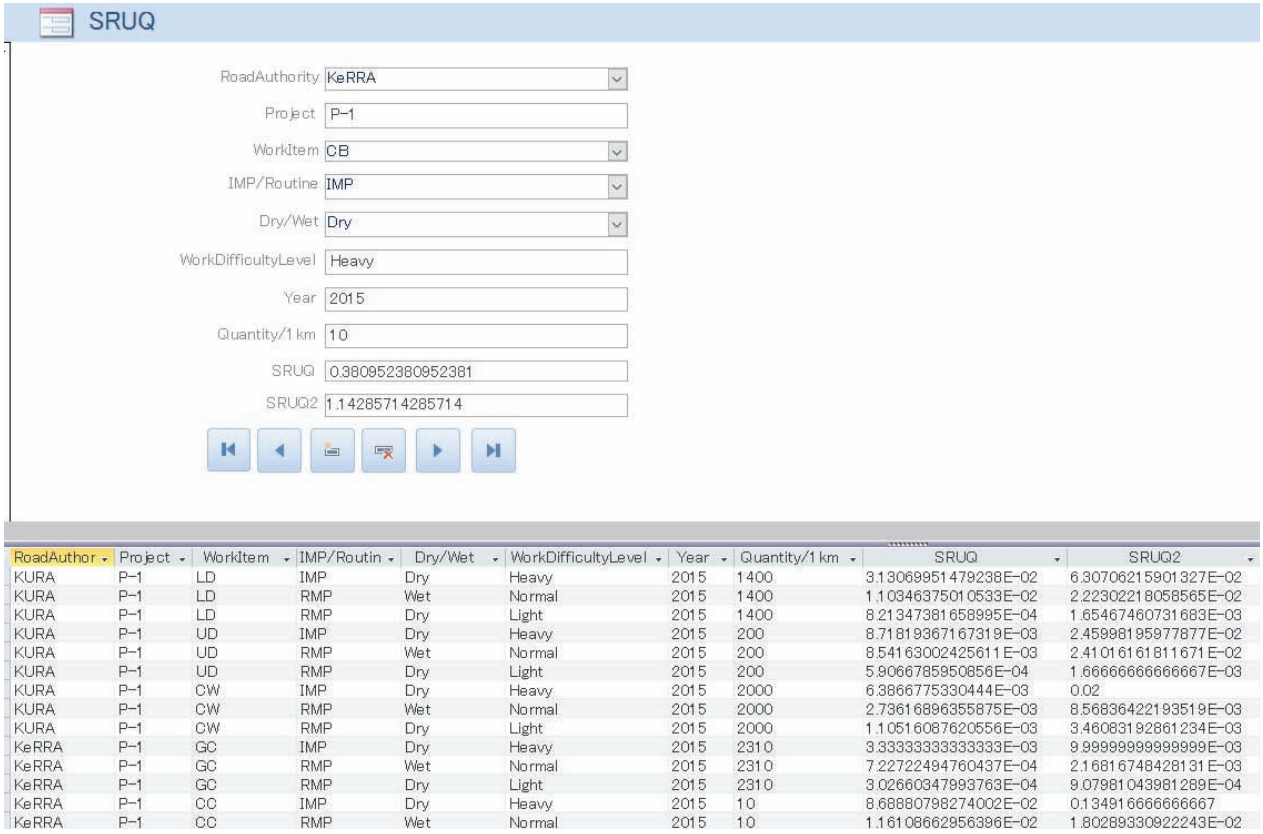
4. Standard Resource Usage per Quantity (SRUQs) by Road Authority (Table: SRUQ)

Standard Resource Usage per Quantity (SRUQ) Table defines:

1. The productivity rate (P/R):
2. Simple/Actual quantity ratio; and,
3. Standard quantity per km.

These parameters are defined for every 6 Major Labour Based Works and every type of contract period.

P/Rs have been surveyed, collected and classified into "Road authority", "Type of work", "IMP/RMP", and "Dry/Wet". The "Simple/Actual quantity ratio" and "standard quantity per km" are collected and classified into "Road Authority" and "Type of work". These parameters are used in the calculation of labour quantity in the "Detail Contents (B)" Sheets.



RoadAuthor	Project	WorkItem	IMP/Routin	Dry/Wet	WorkDifficultyLevel	Year	Quantity/1 km	SRUQ	SRUQ2
KURA	P-1	LD	IMP	Dry	Heavy	2015	1400	3.13069951479238E-02	6.30706215901327E-02
KURA	P-1	LD	RMP	Wet	Normal	2015	1400	1.10346375010533E-02	2.22302218058565E-02
KURA	P-1	LD	RMP	Dry	Light	2015	1400	8.21347381658995E-04	1.65467460731683E-03
KURA	P-1	UD	IMP	Dry	Heavy	2015	200	8.71819367167319E-03	2.45998195977877E-02
KURA	P-1	UD	RMP	Wet	Normal	2015	200	8.54163002425611E-03	2.41016161811671E-02
KURA	P-1	UD	RMP	Dry	Light	2015	200	5.9066785950856E-04	1.66666666666667E-03
KURA	P-1	CW	IMP	Dry	Heavy	2015	2000	6.3866775330444E-03	0.02
KURA	P-1	CW	RMP	Wet	Normal	2015	2000	2.73616896355875E-03	8.56836422193519E-03
KURA	P-1	CW	RMP	Dry	Light	2015	2000	1.10516087620556E-03	3.46083192861234E-03
KeRRA	P-1	GC	IMP	Dry	Heavy	2015	2310	3.33333333333333E-03	9.99999999999999E-03
KeRRA	P-1	GC	RMP	Wet	Normal	2015	2310	7.22722494760437E-04	2.16816748428131E-03
KeRRA	P-1	GC	RMP	Dry	Light	2015	2310	3.02660347993763E-04	9.07981043981289E-04
KeRRA	P-1	CC	IMP	Dry	Heavy	2015	10	8.68880798274002E-02	0.134916666666667
KeRRA	P-1	CC	RMP	Wet	Normal	2015	10	1.16108662956396E-02	1.80289330922243E-02

4.1 Contents of the table

Item	Value type/ value range/ condition	Description	Manual
Road Authority	Links to the list of "Road Authority" in "Others" Table	"Road Authority" in "Others" Table	-
Project	Letter String	Not used at present (future preparation)	-
SRUQ:	One of the list consists of "GC", "CC", "BC", "LD", "UD", "CW"	Specifies types of work. Values are for: "GC (Grass Cutting)", "CC (Cross Culvert", "BC (Catch Basin Cleaning)", "LD (Lined Ditch Cleaning", "UD (Unlined ditch Cleaning)", and "CW (Carriage Way Cleaning)".	1.5/5.2/6.2
IMP/Routine_ Maintenance_Period	Selection from "IMP" or "RMP"	Initial Mobilization Period (IMP) or Routine Maintenance Period (RMP)	
Dry/Wet	Selection from "Dry" or "Wet"	Selection of Dry or Wet season	
Work_Difficulty_Level	Automatically assigned Work_Difficulty_Level	See table below	
SRUQ	Decimal Number/ 0 to 100 (any number of decimal places)	Defined as how many labour-days are necessary for doing each task for pre-determined unit when carrying out maintenance to SIMPLE quantity.	
SRUQ2	Decimal Number/ 0 to 100 (any number of decimal places)	Defined as how many labour-days are necessary for doing each task for pre-determined unit when carrying out maintenance to ACTUAL quantity.	
Quantity/1km	Decimal Number/ 0 to 100 (any number of decimal places)	Defined as the quantity of subject maintenance work per km. This value is collected through survey.	5.6
Year	Numeric value / 2010 to 2030	The year when the Productivity Rate / SRUQ is surveyed	-

The Work_Difficulty_Level allocated to IMP and RMP, in accordance with the prevailing season, are as follows:

IMP/RMP	Dry/Wet	Work Difficulty Level
IMP	Dry or Rain (No concern)	Heavy
RMP	Wet	Normal
	Dry	Light

Users can calculate work quantities by choosing one of the following formulas in COSTES:

1: Quantity per km: SRUQ (Standard Resource Usage per Quantity)* (Simple quantity per km)* (Project Length)

2: Simple quantity input: SRUQ (Standard Resource Usage per Quantity) for SIMPLE Quantity *(Simple Quantity input)

3: Actual quantity input: SRUQ for ACTUAL Quantity input * (Actual Quantity input)

In the case of 2 and 3 above, users have to collect the information of total quantity of the project prior to the cost estimation.

Conversion between Productivity Rate and Standard Resource Usage per Quantity is described in Clause 1.5 of the Manual.

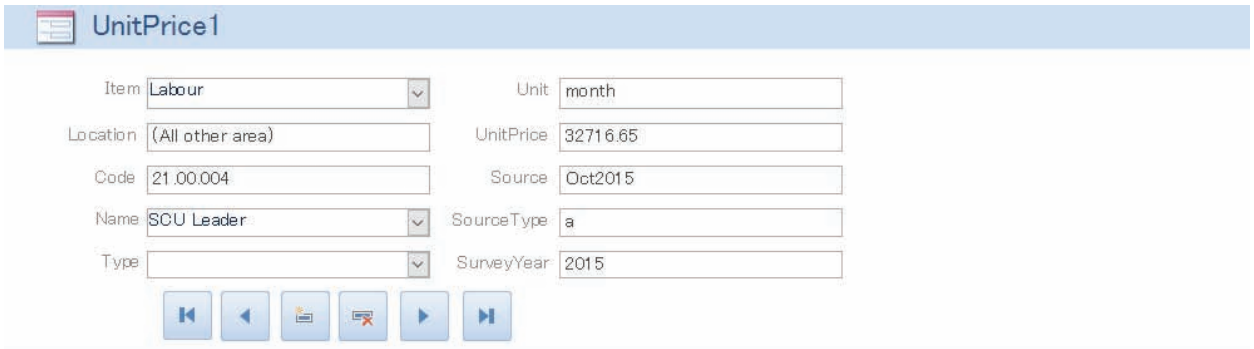
4.2 Data Update

The Year 2015 Value sets can be changed but should not be removed. The road authority name should not be changed. The Year 2015 Value sets are necessary for each Road Authority specified in the "Others" table. Data Update is possible per Work Item. In this regard, Year 2016 or later have to be chosen as "Survey Year" and COSTES will automatically search the latest data for each work item.

If the other conditions are identical, do not allocate the same year because COSTES cannot recognize which one is the correct one.

5. Unit Rates Information (Database Table: UnitPrice1)

Unit rate information is currently a set of 11 core unit rates. Rates information has to be excluded in the case of the COSTES distribution to the contractor candidates. "Haulage" table also includes the information related to vehicle operation. Detail of the unit rate survey is presented in Clause 5.1 and 6.2 of the Manual. In addition, Clause 5.3 of the manual refers to SCU Survey.



Item	Unit	Location	UnitPrice	Code	Source	Name	Sou	Type	SurveyYear
Labour	month	(All other area)	32716.65	21.00.004	Oct2015	SCU Leader	a		2015
Labour	month	(All other area)	32716.65	21.00.001	Oct2015	Foreman	a		2015
Labour	day	(All other area)	21811.1	21.00.003	Oct2015	Driver(Truck)	a	Operating Los	2015
Labour	month	(All other area)	25930.35	21.00.005	Oct2015	SCU Inspecto	a		2015
Labour	day	(All other area)	484.3	21.00.006	Oct2015	Labour	a		2015
Machinery	number	(All other area)	191800	21.00.010	Oct2015	Vehicle(2ton	a	Operating Los	2015
Machinery	number	(All other area)	88200	21.00.011	Oct2015	Vehicle(Pick u	a	Operating Los	2015
Labour	month	(All other area)	15239.1	21.00.003	Oct2015	Driver(Pickup)	a	Operating Los	2015
Material	month	(All other area)	102.65	21.00.013	Oct2015	Fuel	a	Gasoline	2015
Material	month	(All other area)	79.99	21.00.012	Oct2015	Fuel	a	Diesel	2016
Material	Lit	(All other area)	102.65	21.00.013	Oct2015	Vehicle(Pick u	a	Gasoline	2016
Material	Lit	(All other area)	79.99	21.00.012	Oct2015	Fuel	a	Diesel	2015
Labour	month	(All other area)	25930.35	21.00.002	Oct2015	Supervisor	a		2015
Labour	month	Nairobi, Mombasa, Kusumu	37079.25	21.00.002	Oct2015	Supervisor	a		2015
Labour	day	Nairobi, Mombasa, Kusumu	527.1	21.00.003	Oct2015	Labour	a		2015
Labour	month	Nairobi, Mombasa, Kusumu	37079.25	21.00.004	Oct2015	SCU Leader	a		2015
Labour	month	Nairobi, Mombasa, Kusumu	30126	21.00.005	Oct2015	SCU Inspecto	a		2015
Labour	month	Nairobi, Mombasa, Kusumu	18595.2	21.00.006	Oct2015	Driver(Piukup)	a		2015
Machinery	number	Nairobi, Mombasa, Kusumu	191800	21.00.010	Oct2015	Vehicle(2ton	a	Operating Los	2015
Machinery	number	Nairobi, Mombasa, Kusumu	88200	21.00.011	Oct2015	Vehicle(Pick u	a	Operating Los	2015
Material	Lit	Nairobi, Mombasa, Kusumu	102.65	21.00.013	Oct2015	Fuel	a	Gasoline	2015
Labour	month	Nairobi, Mombasa, Kusumu	37079.25	21.00.001	Oct2015	Foreman	a		2015
Labour	month	Nairobi, Mombasa, Kusumu	18595.2	21.00.006	Oct2015	Driver(Pickup)	a		2015
Material	Lit	Nairobi, Mombasa, Kusumu	102.65	21.00.013	Oct2015	Fuel	a	Gasoline	2016
Material	Lit	Nairobi, Mombasa, Kusumu	79.99	21.00.012	Oct2015	Fuel	a	Diesel	2016
Material	Lit	Nairobi, Mombasa, Kusumu	79.99	21.00.012	Oct2015	Fuel	a	Diesel	2015

5.1 Contents of the table

Item	Value type/ value range/ condition	Description	Manual
Item	Selection from "Labour", "Machinery", or "Material"	Classification of each item (Category) Labour, Machinery, or Material	5.1
Location	Letter String	Tables should complete 11 sets of unit price data for each area. At present "Nairobi, Mombasa, Kisumu" and (All other area) are listed as sample.	5.1
Code	Letter String	Sample data. Allocate unique code number (not used for the current COSTES).	5.1
Name	Selection from specified list	DO NOT Change the name for 11 price set. "Labours", "Supervisors"(Foreman)", "Fuel", "SCU Leader", "SCU Inspector", "Driver", "Vehicle (Pick up)", "Foreman", "Fuel", "Vehicle (2ton Truck)"	5.1
Type:	Selection from specified list	"Petrol" or "Diesel" for Fuel. "Operating Loss" for Vehicle. Blank for others	5.1
Unit	Automatic selection linked to the "Name"	Unit for each item. Current COSTES does not use it.	5.1
Unit Price	Numeric value / 0 to 1,000,000	Unit price **If the COSTES file set is distributed to contractor candidates, unit price should be zero for all items in the database.**	5.1
Source	Letter String	For reference purpose. Current COSTES does not use it.	5.1
Survey Year	Numeric value / 2010 to 2030	The year when the unit price was surveyed and collected. COSTES automatically selects the latest year's unit price if unit price was surveyed for several years.	5.1

5.2 Data Update

Unit price information is currently a set of 11 core unit prices. This set should be kept.

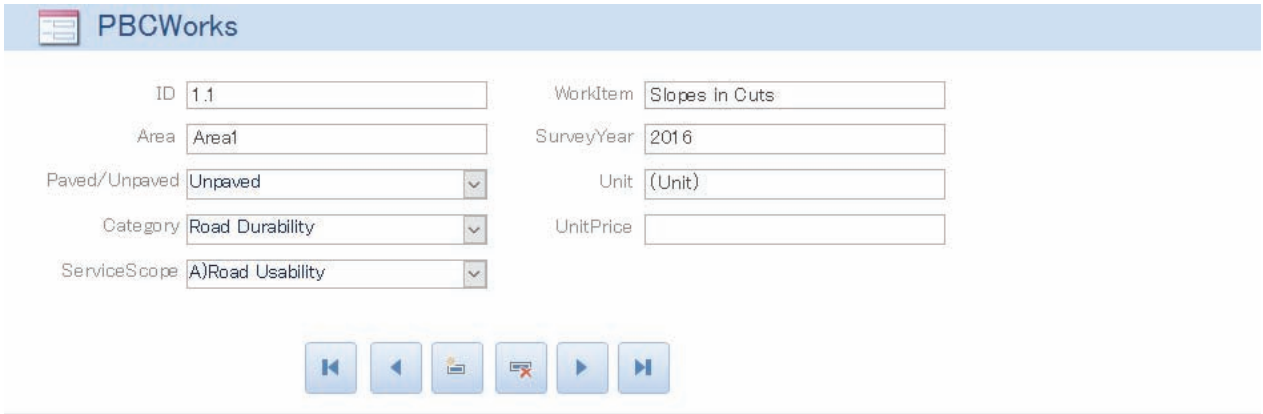
If a new set of unit prices is allocated for a new area, then all 11 costs should be surveyed as initial dataset.

Yearly update is possible per item. However, two or more unit prices cannot be allocated for the same year as COSTES will search for the latest year's price.

In the case of Haulage expense for instructed works, there is no classification by road authority nor location. (This option is future discussion)

6. Other PBC Works

Variables for the estimation of Other PBC Works consist of the following items. Cost survey method is described in clause 5.3 and 5.4 of the manual.



ID	WorkItem	Area	SurveyYear	Paved/Unpa	Unit	Category	UnitPrice	ServiceSco
1.1	Slopes in Cuts	Area1	2016	Unpaved	(Unit)	Road Durability		A)Road Usabili
1.2	Passability	Area2	2016	Paved	(Unit)	Road Usability		A)Road Usabili
1.3	Road Works Advance Warning Sign	Area2	2016	Paved	(Unit)	Road Usability		A)Road Usabili
1.4	(Roughness)	Area2	2016	Paved	(Unit)	Road Usability		A)Road Usabili
1.5	Cleanliness of the road	Area2	2016	Paved	(Unit)	Road User Co		B) Pavement,
1.6	Passability	Area2	2015	Paved	(Unit)	Road Usability		A)Road Usabili
1.7	Road Works Advance Warning Sign	Area2	2015	Paved	(Unit)	Road Usability		A)Road Usabili
1.8	(Roughness)	Area2	2015	Paved	(Unit)	Road Usability		A)Road Usabili
1.9	Cleanliness of the road	Area2	2015	Paved	(Unit)	Road User Co		B) Pavement,
10.1	Riverbeds	Area1	2015	Paved	(Unit)	Road Durability		E) Structures
10.1	Warning signs/Mandatory signs	Area1	2015	Paved	(Unit)	Road Durability		F) Road Furnit
10.1	Information signs, Edge marker posts, Gui	Area1	2015	Paved	(Unit)	Road Durability		F) Road Furnit
10.1	Traffic Signals	Area1	2015	Paved	(Unit)	Road Durability		F) Road Furnit
10.1	Street Lighting	Area1	2015	Paved	(Unit)	Road Durability		F) Road Furnit
10.1	Road Markings/Road studs	Area1	2015	Paved	(Unit)	Road Durability		F) Road Furnit
10.1	Guardrails and Pedestrian rails	Area1	2015	Paved	(Unit)	Road Durability		F) Road Furnit
10.1	Embankment slopes	Area1	2015	Paved	(Unit)	Road Durability		H) Embankmer
10.1	Slopes in Cuts	Area1	2015	Paved	(Unit)	Road Durability		H) Embankmer
10.1	Passability	Area1	2015	Unpaved	(Unit)	Road Usability		A)Road Usabili
10.1	Traffic Regulatory Control Signs	Area1	2015	Unpaved	(Unit)	Road Usability		A)Road Usabili
10.1	Road Works Advance Warning Sign	Area1	2015	Unpaved	(Unit)	Road Usability		A)Road Usabili
10.1	Average Traffic Speed or Roughness	Area1	2015	Unpaved	(Unit)	Road Usability		A)Road Usabili
10.1	Minimum Traffic Speed	Area1	2015	Unpaved	(Unit)	Road Usability		A)Road Usabili
10.1	Cleanliness of the road	Area1	2015	Unpaved	(Unit)	Road User Co		B) Pavement,
10.1	Corrugation Amplitude	Area1	2015	Unpaved	(Unit)	Road User Co		B) Pavement,

6.1 Contents of the table

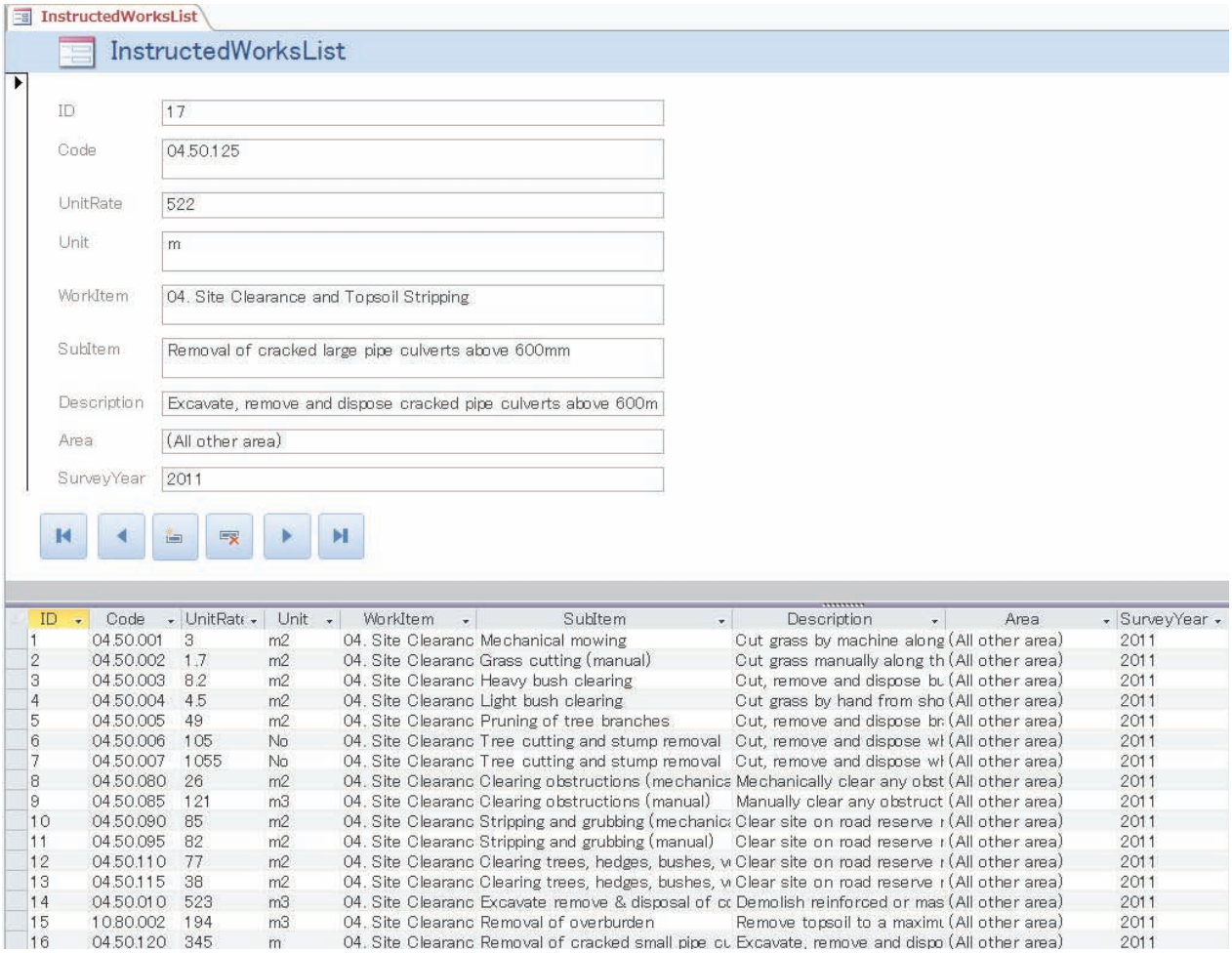
Item	Value type/ value range/ condition	Description	Manual (for admin.)
ID	Letter String	Unique ID. COSTES does not need it	5.4
Area	Letter String	Area is necessary if the same work item has a different value	5.4
Paved/Unpaved	Selection from "Paved" or "Unpaved"	Paved or Unpaved	5.4
Category	Selection from "Road Usability", "Road User Comfort", or "Road Durability"	Category is based on Table 4-19 in the manual	4/5.4
Service Scope	Selection from A) through to H)	Category is based on Table 4-19 in the manual vol.2	4/5.4
Work Item	Letter String	Category is based on Table 4-19 in the manual but expressed as "Service Criteria"	5.4
Survey Year	Numeric value / 2010 to 2030	The year when each item was collected. COSTES recognizes the latest year's unit price if the same item has different value by surveyed year	5.4
Unit	Letter String	Unit will be determined	5.4
Unit Price	Numeric value / 0 to 1000000	Current COSTES does not use Unit Price (Future Option) **If the COSTES file set is distributed to contractor candidates, unit price should be zero for all items in the database.**	5.4

6.2 Data Update

If a new service criterion is added, it is possible to add them one by one. However, do not use the same service criteria in the identical year (COSTES cannot distinguish which item is the correct one).

7. Instructed Works List (Table: Instructed Works List)

Instructed works list for COSTES2015 comes from the format of COSTES 0_1



ID	Code	UnitRat	Unit	WorkItem	SubItem	Description	Area	SurveyYear
1	04.50.001	3	m2	04. Site Clearanc	Mechanical mowing	Cut grass by machine along	(All other area)	2011
2	04.50.002	1.7	m2	04. Site Clearanc	Grass cutting (manual)	Cut grass manually along th	(All other area)	2011
3	04.50.003	8.2	m2	04. Site Clearanc	Heavy bush clearing	Cut, remove and dispose bu	(All other area)	2011
4	04.50.004	4.5	m2	04. Site Clearanc	Light bush clearing	Cut grass by hand from sho	(All other area)	2011
5	04.50.005	49	m2	04. Site Clearanc	Pruning of tree branches	Cut, remove and dispose br	(All other area)	2011
6	04.50.006	105	No	04. Site Clearanc	Tree cutting and stump removal	Cut, remove and dispose wl	(All other area)	2011
7	04.50.007	1055	No	04. Site Clearanc	Tree cutting and stump removal	Cut, remove and dispose wl	(All other area)	2011
8	04.50.080	26	m2	04. Site Clearanc	Clearing obstructions (mechanica	Mechanically clear any obst	(All other area)	2011
9	04.50.085	121	m3	04. Site Clearanc	Clearing obstructions (manual)	Manually clear any obstruct	(All other area)	2011
10	04.50.090	85	m2	04. Site Clearanc	Stripping and grubbing (mechanic	Clear site on road reserve r	(All other area)	2011
11	04.50.095	82	m2	04. Site Clearanc	Stripping and grubbing (manual)	Clear site on road reserve r	(All other area)	2011
12	04.50.110	77	m2	04. Site Clearanc	Clearing trees, hedges, bushes, w	Clear site on road reserve r	(All other area)	2011
13	04.50.115	38	m2	04. Site Clearanc	Clearing trees, hedges, bushes, w	Clear site on road reserve r	(All other area)	2011
14	04.50.010	523	m3	04. Site Clearanc	Excavate remove & disposal of cc	Demolish reinforced or mas	(All other area)	2011
15	10.80.002	194	m3	04. Site Clearanc	Removal of overburden	Remove topsoil to a maximu	(All other area)	2011
16	04.50.120	345	m	04. Site Clearanc	Removal of cracked small pipe cu	Excavate, remove and dispo	(All other area)	2011

7.1 Contents of the table

Item	Value type/ value range/ condition	Description	Manual
ID	Letter String	Unique ID. COSTES does not need it	
Code	Letter String	COSTES does not use the code but may be necessary for the arrangement of items	
Unit Rate	Numeric value / 0 to 1,000,000	Rate for each item per specified unit **If the COSTES file set is distributed to contractor candidates, unit rate should be zero for all items in the database.**	
Unit	Letter String	Unit for each item	
Work Item	Letter String	Category for the item. Suffix as xx. Is preferred	
Sub Item	Letter String	Name and specification of the item	
Description	Letter String	Explanation of each item	
Area	Letter String	Area is necessary if the same work items have different values	
Survey Year	Numeric value / 2010 to 2030	The year when each item was collected. COSTES recognizes the latest year's unit price if the same item has different value by surveyed year	

7.2 Data Update

Addition/Removal of items is possible, one by one. However, completion of all fields is necessary.

Yearly update is possible for the same item (e.g. there are two items and the difference is surveyed yearly). However, two or more unit prices cannot be allocated within an identical year as COSTES searches the latest year's price by each item.

8. Program Configuration (Table: Configuration)

The Administrator can control how COSTES works by setting the following factors:

1: Allow PBC Optional works input (YES/NO)

This option allows/does not allow the input of independent PBC works other than six major labour based works.

2: Allow Instructed Works Input (YES/NO)

This option allows/does not allow the input of instructed works.

3: Allow to select input method of major labour based works one by one (YES/NO)

When this option is "YES", user can select input method per work item. This is advantageous if the user does not know simple/actual quantity. The user can then select each quantity and others can be calculated by using standard quantity per km in the database. However, mixture of input methods might cause complexity in the estimation.

4: Cost estimation by Excel format

When this option is “YES”, COSTES generates not only PDF format cost estimation sheets but also excel format raw-data.

9. Data Distribution

9.1 For Road Authority Officials (Client)/ 8.2 For Contractor Candidates

The difference of database between two user categories is whether the database has “Price” information or not. Price information is included in “UnitPrice1”, “Other PBC Works”, and “Instructed Works” tables.

Road Authorities can use the pre-surveyed unit price as standard value. Then they can check the price before performing cost estimation and modify if possible. Contractor candidates have to register all price sets by their own survey or responsibility. No price data will be given.

COSTES program can automatically open the **jicadata** database because the password is included in the program and almost impossible to open the **jicadata** database unless one has the password. However, distribution version to the contractor candidates should not include any price data for security purposes. In this case, it is recommended that administrators should create two types of database: (1) one including price information: and, (2), another without price information. Please do not remove all the columns of price information because COSTES have to recognize all data fields regardless of the column value.

Appendix 2 Cost Estimation Parameters 2015

1. SRUQs and P/Rs of 6 Major Labour Based Work

Work item	Level	P/R(Simple)		SRUQ(Simple)	
			Unit		Unit
Grass Cutting (m^2)	Heavy	300.0	m^2/md	0.0033	md/m^2
	Normal	1,383.7		0.0007	
	Light	3,304.0		0.0003	
	Total(Ave.)	1,900.3		0.0005	
Cross Culvert (m)	Heavy	11.5	m/md	0.0869	md/m
	Normal	86.1		0.0116	
	Light	155.3		0.0064	
	Total(Ave.)	17.5		0.0570	
Catch Basin (pcs)	Heavy	2.6	pcs/md	0.3810	md/pcs
	Normal	15.0		0.0667	
	Light	69.5		0.0144	
	Total(Ave.)	22.2		0.0449	
Lined Side Ditch (m)	Heavy	31.9	m/md	0.0313	md/m
	Normal	90.6		0.0110	
	Light	1,217.5		0.0008	
	Total(Ave.)	203.8		0.0049	
Unlined Side Ditch (m)	Heavy	114.7	m/md	0.0087	md/m
	Normal	117.1		0.0085	
	Light	1,693.0		0.0006	
	Total(Ave.)	115.2		0.0087	
Carrageway De-silting (m^2)	Heavy	156.6	m^2/md	0.0064	md/m^2
	Normal	365.5		0.0027	
	Light	904.8		0.0011	
	Total(Ave.)	573.0		0.0017	

* use for COSTES

2. KM Standardized Quantities for Each Road Authority

KeNHA

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	6055	33%	2,018.3
Cross Culvert	m	100	64%	64.4
Catch Basin	Pcs	10	33%	3.3
Lined Dich	m	200	50%	99.3
Unlined Ditch	m	1400	35%	496.2
Carriageway	m^2	2000	32%	638.7

Note: Figures are from survey on the Paved Road

KeNHA (2×2Lanes)

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	12110	33%	4,036.7
Cross Culvert	m	200	64%	129.0
Catch Basin	Pcs	20	33%	6.7
Lined Dich	m	400	50%	199.0
Unlined Ditch	m	2800	35%	992.9
Carriageway	m^2	4000	32%	1,278.0

Note: Figures are from survey on the Paved Road

KURA

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	6819	33%	2,273.0
Cross Culvert	m	100	64%	64.5
Catch Basin	Pcs	50	33%	16.7
Lined Dich	m	1400	50%	696.5
Unlined Ditch	m	200	35%	70.9
Carriageway	m^2	2000	32%	639.0

Note: Figures are from survey on the Paved Road

KeRRA

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	2310	33%	777.0
Cross Culvert	m	10	64%	6.5
Catch Basin	Pcs	10	33%	3.3
Lined Dich	m	0		-
Unlined Ditch	m	1800	35%	638.3
Carriageway	m^2	0		-

Note: Figures are from survey on the Unpaved Road

KWS

Item	Unit	Simple Quantity/1km	Actual/Simple	Actual Quantity/1km
Grass Cutting	m^2	2310	33%	770.0
Cross Culvert	m	10	64%	6.5
Catch Basin	pcs	10	33%	3.3
Lined Dich	m	0		-
Unlined Ditch	m	1800	35%	638.3
Carriageway	m^2	0		-

Note: Figures are from survey on the Unpaved Road

3. Unit Rates

Category	Item	Unit	Rate		Remarks
			Mombasa, Nairobi, Kisumu[i]	Other Area[ii]	
Labor	Labor	KSH/day	527.10	484.30	General Labourer
	Foreman	KSH/month	37,079.25	32,716.65	Artisan G I×1.5[iii]
	Supervisor	KSH/month	30,126.00	25,930.35	Artisan G II×1.5
	SCU Leader	KSH/month	37,079.25	32,716.65	Artisan G I×1.5
	SCU Inspector	KSH/month	30,126.00	25,930.35	Artisan G II×1.5
	Driver(Pick up)	KSH/month	18,595.20	15,239.10	Driver
	Driver(Truck)	KSH/month	24,719.50	21,811.10	Driver
Vehicle Cost[iv] (Dry rate)	Truck(2 ton)	KSH/month	191,800.00		Truck flat-bed (2.5-5 ton)
	Pick up (Double Cabin)	KSH/month	88,200.00		Pick Up (4x4)
Fuel Cost[v]	Diesel	KSH/litre	79.99		Price listed is for Nairobi region. Price for other regions vary from region to region
	Gasoline	KSH/litre	102.65		
Fuel Consumption	Truck(2 ton)	km/litre	4.00		
	Pick up	km/litre	10.00		

Note

[i] COLUMN 2 in the Labour Institution Act dated the 20th May, 2015

[ii] COLUMN 4 in the Labour Institution Act dated the 20th May, 2015. Column 3 has been used to estimate General labour rate in the case of Other Areas after considering the market rates.

[iii] Factor for market price

[iv] Fees of Mechanical and Technical Services of MOTI Mechanical and Transport Division

Truck flat-bed (2.5-5 ton); (1,480×7hrs×25days+3000×5days×0.7[iii]) = 191,800 Pick Up (4x4); 1,050×4hrs×30days×0.7[iii] = 88,200

[v] Pump Price for Sep-Oct 2015 from Energy Regulatory Commission

4. Percentage Add-ons(%)

Item	Miscellaneous Costs	Indirect Cost	Overhead and Profit	VAT	
%	5.0	30	10	16.0	

Appendix 3 Concept of SRUQ / Productivity Rate (P/R)

(1) Flow

Direct Cost shall be computed as per the following flow (Figure A3-1).

Figure A3-1 Flow of Estimate of Direct Cost

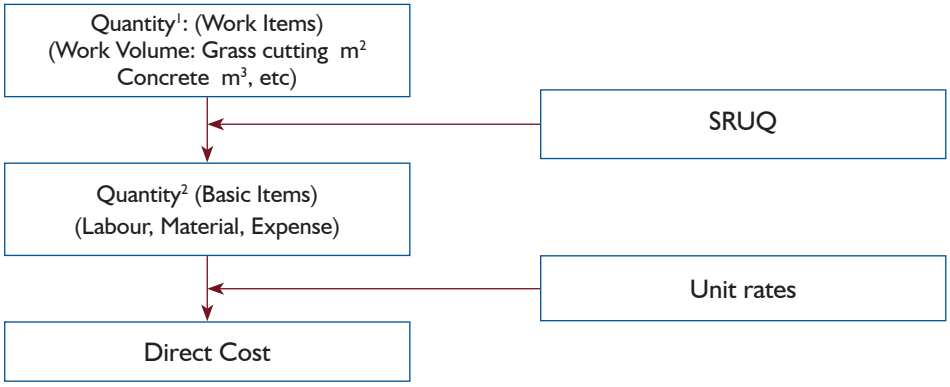


Table A3-1 Formula for Calculating Direct Cost

Q'ty2 / Basic Items (breakdown on labour, equipment, material required for the work)	=	Q'ty1 / Work Volume	×	SRUQ
Direct Cost	=	Q'ty2 / Basic Items (labour, equipment, material)	×	Unit Rates

SRUQ is the conversion rate from Q'ty1 / Work Volume to Q'ty2 / Basic Items (means breakdown of labour, equipment, material required for the work). Examples of SRUQ for concrete mixing are shown in the following table.

Table A3-2 Example of SRUQ (concrete mixing)

(per 10m³)

	Description	Unit	SRUQ	Unit Rate		Rate	Remarks
Quantity 1	Concrete	m³	-	-		-	
Quantity 2	Labourers	Person hours	6.25	100	Ksh/hr	625	
	Supervisor	Person hours	1.25	200	Ksh/hr	250	
	Aggregates	m³	7.5	100	Ksh	750	5% loss included
	Sand	m³	5.5	200	Ksh	1100	5% loss included
	Water	m³	3.0	100	Ksh	300	
	Concrete Mixer	Hours	8.0	200	Ksh	1600	
	Total					4625	Per 10 m³
Unit Rates for concrete mixing							
						462.5	Ksh/m³

(2) Sample of Work Items / Q'ty1

For cost estimate, at first, work items shall be determined. Any work items can be selected as long as their scopes are clearly defined. Sample of work items and SRUQ are shown below.

Table A3-3 Sample of Work Items/Q'ty1

Work Items	Scope of Work	Unit	Q'ty[1]	P/R		Q'ty[2] (Labour, Materials, etc)
Excavation	Excavation, Hauling	m^3	Excavated volume	SRUQl	ma day	Labour
				SRUQm	M3, ton etc.,	Material
				SRUQe	hours	Equipment / Expenses
Concrete	Materials, scaling, weighing, mixing	m^3	Mixed volume	SRUQl	man day	Labour
				SRUQm	M3, ton etc.,	Material
				SRUQe	hours	Equipment / Expenses

Two samples for work items / Q'ty1 for PBC road maintenance works are shown below.

Table A3-4 Work Items and SRUQ for PBC Road Maintenance (individual)

Work Items	Scope of Work	Unit	Q'ty[1]	P/R		Q'ty[2] (Labour, Materials, etc)
Grass cutting	Cutting, Piling, loading	m^2	Area for grass cutting	P/R_{lme}	man day	L/M/EE
Clearing obstructions	Picking up, piling, hauling	m^2	Area of carriage way	P/R_{lme}	man day	L/M/EE
Desilting	Picking up, piling, hauling	m	Length or number of drainages	P/R_{lme}	man day	L/M/EE
Cleaning	cleaning, piling, hauling	m^2	Maintained area	P/R_{lme}	man day	L/M/EE
Pruning trees	Pruning, hauling	m^2	Area of carriage way	P/R_{lme}	man day	L/M/EE

Table A3-5 Work Items and SRUQ for PBC Road Maintenance (average)

Work Items	Scope of Work	Unit	Q'ty[1]	P/R		Q'ty[2] (Labour, Materials, etc)
Maintenance works	All work items	m^2	Maintained area	$SRUQ_{lme}$	man day	L/M/EE

(3) Illustration for SRUQ and calculation of numbers of required labourers

The illustration shows SRUQ and calculation for the number of labourers for PBC works.

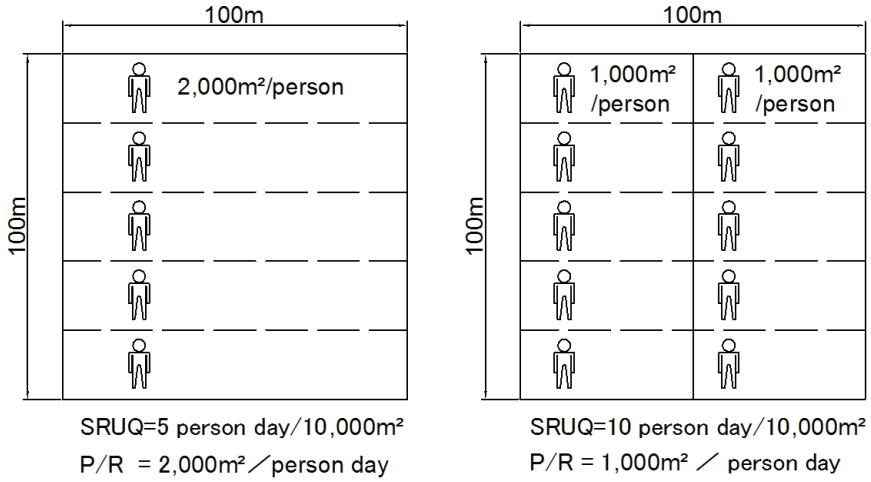


Figure A3-2 Example of SRUQ =5 (persons day/10000m²) and SRUQ= 10 for maintenance Works

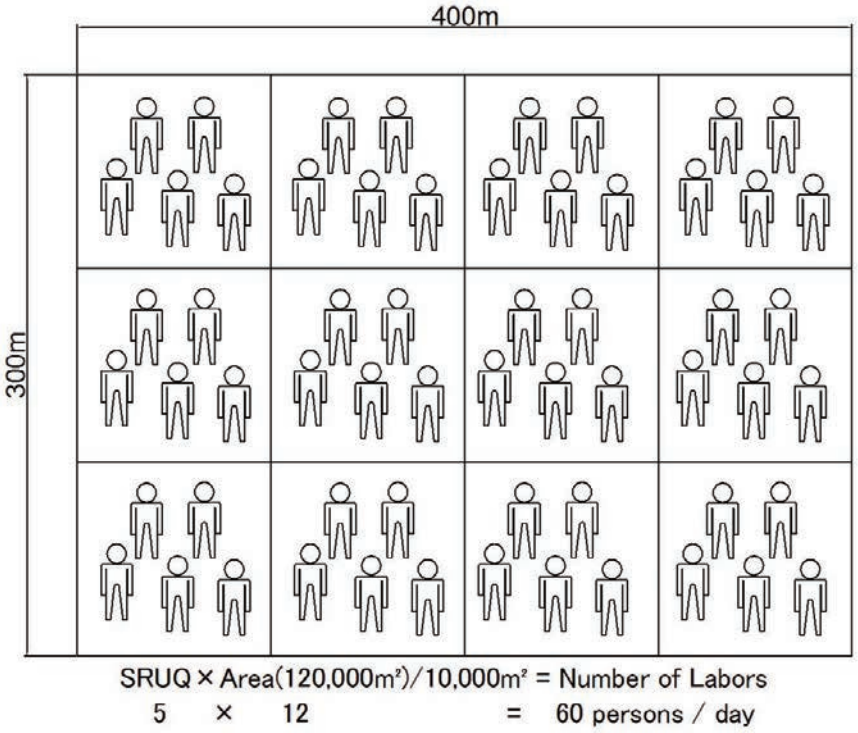


Figure A3-3 Example of calculation of number of labourers from SRUQ (SRUQ = 5 person days/10,000m2)

Appendix 4 Form 1 Site Layout

Form 1 Site Layout

Date:	Start Time:	End Time:
Location:	Weather:	

Appendix 5 Form 2 Work Record Form

Form 2 Work Record Form

Date	Weather	Inspected by
Location	Contractors Name	

Work Item	Number of workers	Start time	End time	workin hours	Work measurement	Work volume	Unit	Remark

Appendix 6 Form 3 Productivity Survey Summary Form (Excel)

Location		Client		Site		Weather		Initial Mobilization Period / Routine Maintenance				No 66 (C)
Width of Road Reserve (Wr)		Width of Carriage Way (Wc)		Left Lined Ditch (LL)		Right Lined Ditch (RL)		Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	0.00 m	Total Length		Number of Labors		Men	

Worked Items		Asset Quantity							Labour Input						SRUQ		Remarks (Equipment)
		Simple Quantity			Actual Quantity		Work Difficulty		Foreman	Supervisor	Labors				(4) Simple SRUQ (man day/ Qty)	(5) Actual SRUQ (man day/ Qty)	
		Q'ty	Unit	Remarks	Q'ty (Vol)	Unit	-Heavy -Normal -Light	Remark	nos	nos	nos	working hours		Man day			
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left		m2			m^2	GW x L										
	Grass Cutting(2) / Right		m2			m^2	GW x L										
2)	Cross Culvert(1)		Pcs			Pcs											
			m				m										
	Cross Culvert(2)					Pcs											
							m										
3)	Catch Basin / Cover(1)					Pcs											
	Catch Basin / Cover(2)					Pcs											
	Catch Basin / No cover(1)					Pcs											
	Catch Basin / No cover(2)					Pcs											
4)	Lined Side Ditch(1)					m	L										
	Lined Side Ditch(2)					m	L										
5)	Unlined Side ditch(1)					m	L										
	Unlined Side ditch(2)					m	L										
6)	Carriage De-sliting(1)					m^2	Lx1.0 (m)										
	Carriage De-sliting(2)					m^2	Lx1.0 (m)										
	Total																

1 day = 7 working hours

Man day

Note) To use one sheet per day

To fill only the number of workers who are engaged in PBC works

Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.

To specify structures to be maintained

To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

Appendix 7 Information on Volume 3 for Contractors' Reference Use

Cost Estimation Manual for Road Maintenance under Performance Based Contracts has 3 separate volumes.

Volume 1 for Cost Estimation Administrator

Volume 2 for Government Cost Estimators

Volume3 for Contractors' Reference Use

The computer system COSTES for PBC 2015 is to be used in conjunction with Volumes 1 and 2, whereas COSTES for PBC 2015 for Contractors is to be used especially for cost estimators from private contractors using Volume 3.

Since the Cost Estimation Manual for Road Maintenance under Performance Based Contracts has been developed essentially for use by government officials and Volume 3 has been prepared for reference use by contractors, the following restrictions have been placed on Volume 3 to safeguard information which should only be confidential to government officials.

Restrictions placed on Volume 3 in comparison to Volumes 1 and 2

(This applies same as for COSTES for PBC 2015 for Contractors.)

1. Cost Estimation Parameters 2015 used in Volume 3 has no information on unit rates and percentage add-ons. However, Volume 3 has information on productivity rates such as SRUQs and P/Rs only. Volumes 1 and 2 have all information.

   In COSTES for PBC 2015, cost estimators for contractors are required to use their own unit rates and percentage add-ons to obtain the Project Cost.
2. For cost estimation for the 6 Major Labour Based Works, Volumes 1 and 2 includes three types of cost estimation including the type using KM Standardized Quantity. Volume 3 does not include the type using KM Standardized Quantity.

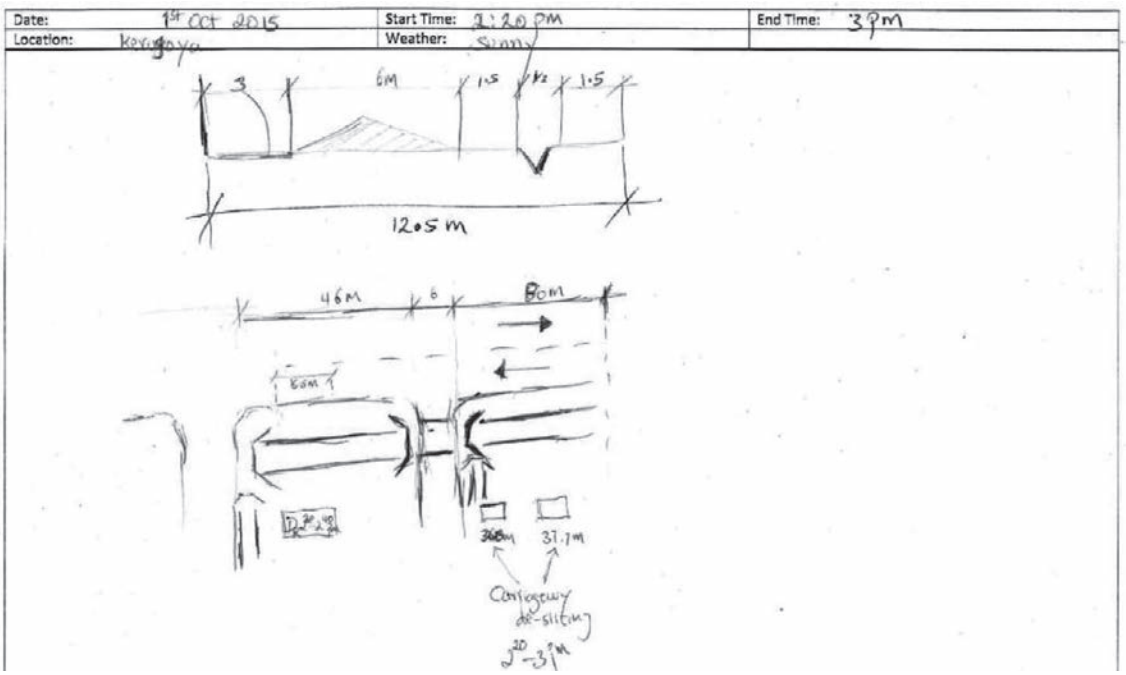
Appendix 8 Training Results for PR Survey done by JICA/KRB in September and October 2015

1. Training Results for PR Survey done by JICA/KRB in October, 2015

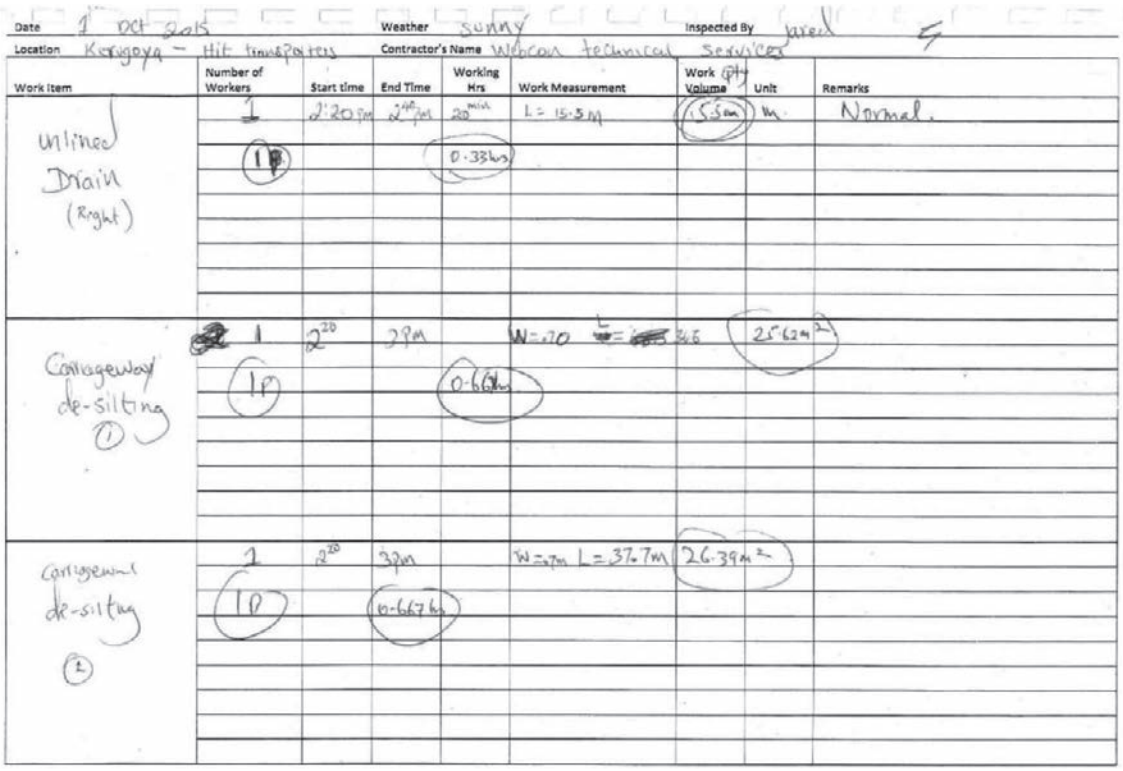
1.1. Form-1, 2, 3

(Oct. 01, 2015, Unlined Ditch Cleaning, Carriage Way Desilting)

Form-1



Form-2



Form-3

Productivity Survey Summary Form **Labour Based Works**

Location	Kerugoya	Client	KURA	Site	Kerugoya - Hit Transporters	Weather	Sunny	Initial Mobilization Period / Routine Maintenance				No. 69
Width of Road Reserve (Wr)	12.50 m	Width of Carriage Way (Wc)	6 m	Left Lined Ditch (LL)	0 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	6.50 m	Total Length	0 m	Number of Labors	0	Men	10/1/2015

Worked Items		Asset Quantity							Labour Input						SRUQ		Remarks (Equipment)
		Simple Quantity			Actual Quantity		Work Difficulty		Foreman	Supervisor	Labors				(4) Simple SRUQ (man day/ Qty)	(5) Actual SRUQ (man day/ Qty)	
		Q'ty	Unit	Remarks	Q'ty (Vol)	Unit	-Heavy -Normal -Light	Remark	nos	nos	nos	working hours					
		a			b				c	d	e	f	j=e×f	Man day	ps = j/7a	pa = j/7b	
1)	Grass Cutting(1) / Left		m²	GW x L		m²							0	0			
	Grass Cutting(2) / Right		m²	GW x L		m²							0	0			
2)	Cross Culvert(1)		Pcs			Pcs							0	0			
			m										0	0			
	Cross Culvert(2)		Pcs			Pcs							0	0			
			m										0	0			
3)	Catch Basin / Cover(1)		Pcs			Pcs							0	0			
	Catch Basin / Cover(2)		Pcs			Pcs							0	0			
	Catch Basin / No cover(1)		Pcs			Pcs							0	0			
	Catch Basin / No cover(2)		Pcs			Pcs							0	0			
4)	Lined Side Ditch(1)		m	L		m							0	0			
	Lined Side Ditch(2)		m	L		m							0	0			
5)	Unlined Side ditch(1)		m	L		m							0	0			
	Unlined Side ditch(2)	15.5	m	L	15.5	m	normal				1	0.3333	0.3333	0.047614286	0.0030	0.0031	
6)	Carriage De-silting(1)	74.3	m²	Lx0.5(m)	52.0	m²	Heavy				2	0.667	1.334	0.190571429	0.0026	0.0037	
	Carriage De-silting(2)		m²	Lx0.5(m)		m²							0				
	Total										3	1.0003	1.6673				
													0.0	1 day = 7 working hours			
													Man day				

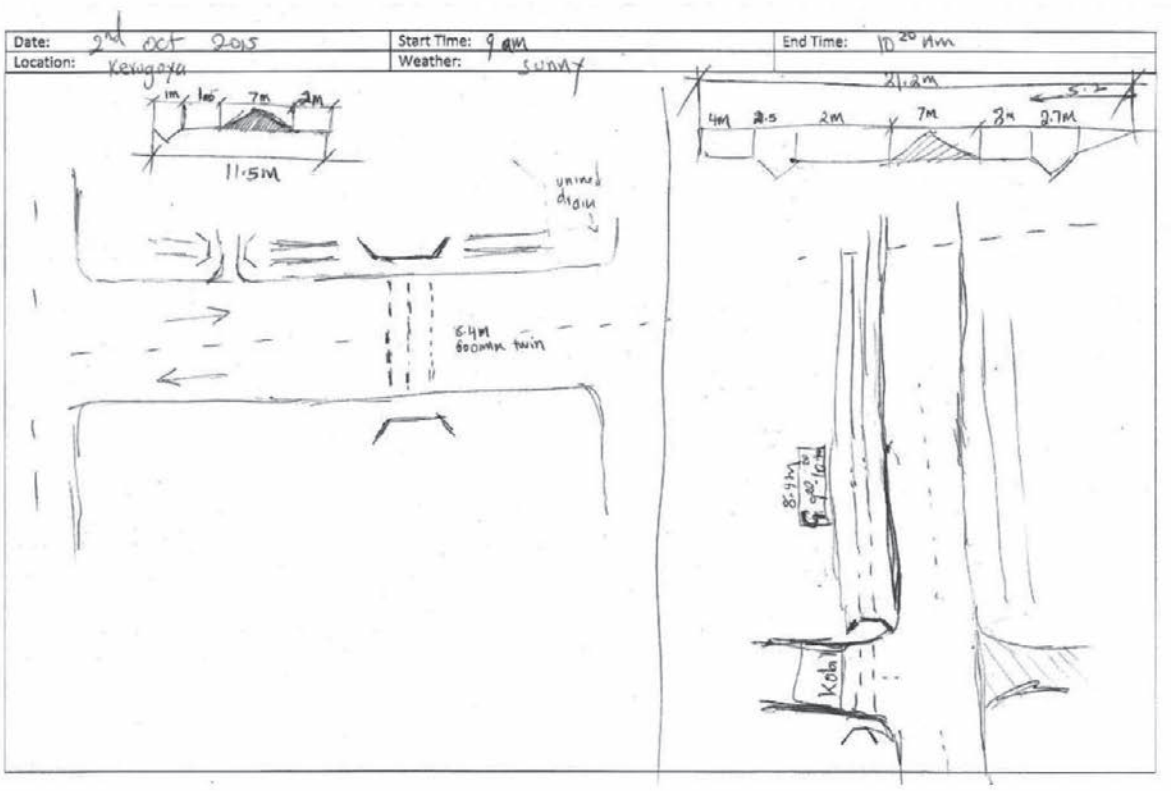
Note:

389.88006
272.916042

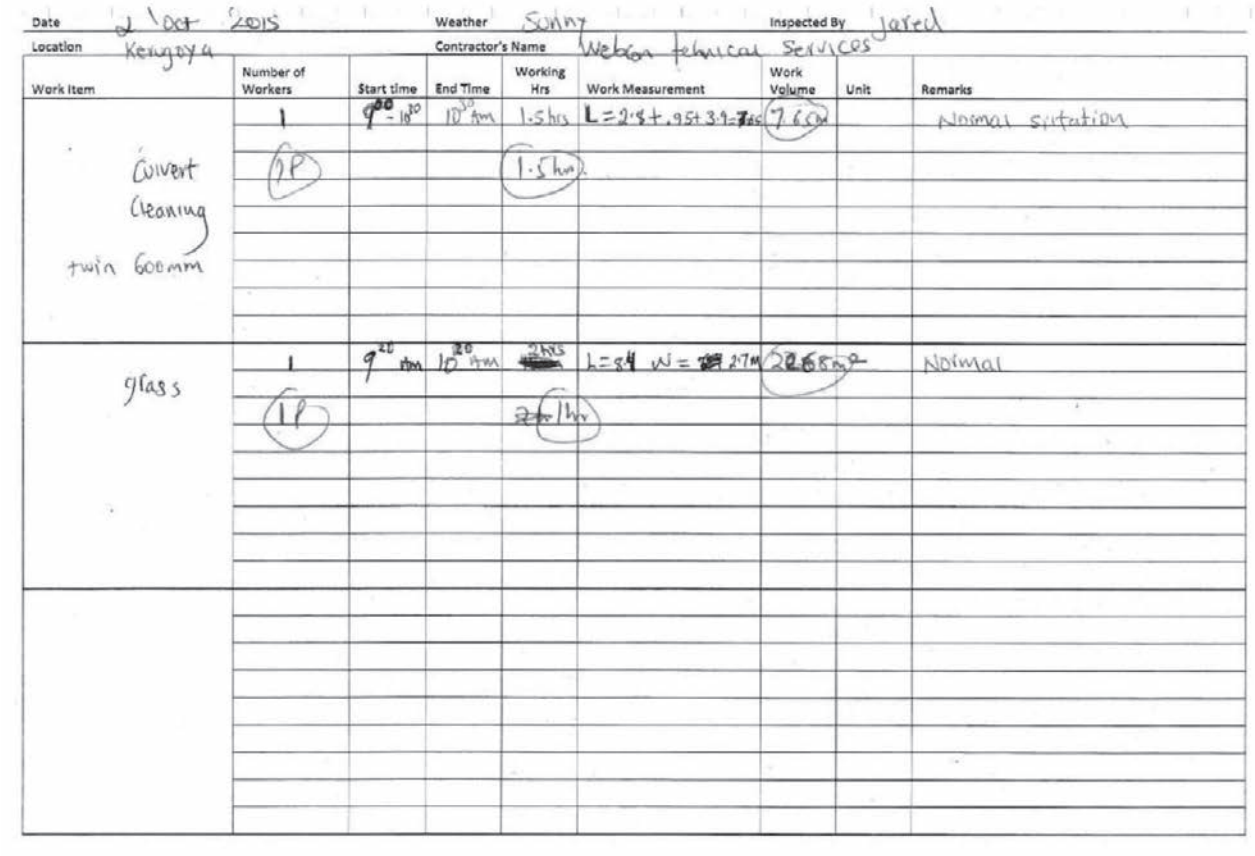
To use one sheet per day
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.
To specify structures to be maintained
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

(Oct. 02, 2015, Grass Cutting, Cross Culvert)

Form-1



Form-2



Date 2 Oct 2015 Weather Sunny Inspected By Jared

Location Kerugoya Contractor's Name Webtan Technical Services

Work Item	Number of Workers	Start time	End Time	Working Hrs	Work Measurement	Work Volume	Unit	Remarks
Culvert Cleaning twin 600mm	1 (2P)	9⁰⁰ - 10³⁰	10³⁰ Am	1.5hrs (1.5hrs)	L=2.8+.95+3.9=7.65	7.65M		Normal situation
glass	1 (1P)	9²⁰ Am	10²⁰ Am	2hrs 2hrs/1hr	L=8.4 W=2.7M	22.68m²		Normal

Form-3

Productivity Survey Summary Form **Labour Based Works**

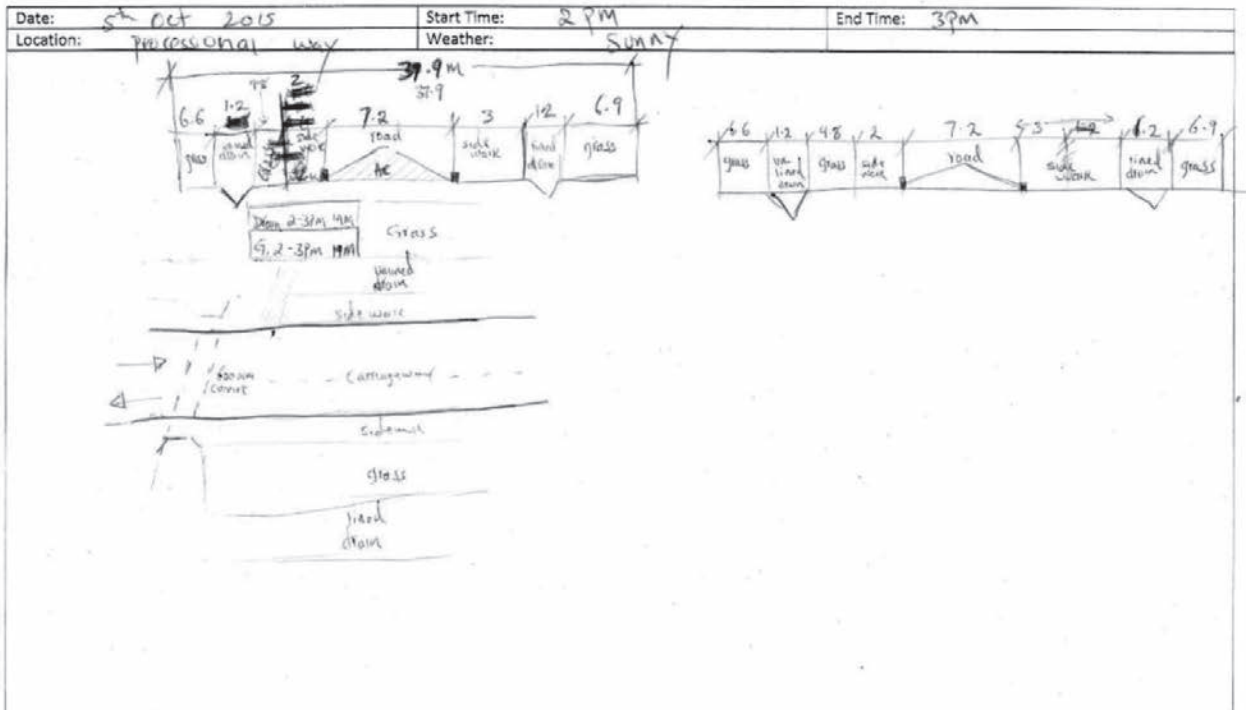
Location	Kerugoya	Client	KURA	Site	KeNHA rd	Weather	Sunny	Initial Mobilization Period / Routine Maintenance			No. 70
Width of Road Reserve (Wr)	21.20 m	Width of Carriage Way (Wc)	6 m	Left Lined Ditch (LL)	0 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	15.50 m	Total Length	0 m	Number of Labors	0	Men	20/2/2015

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	Labors working hours			SRUQ (4) Simple SRUQ (man day/ Qty)	SRUQ (5) Actual SRUQ (man day/ Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f	Man day	ps = j/7a	pa = j/7b	
1)	Grass Cutting(1) / Left		m²	GW x L		m²							0	0			
	Grass Cutting(2) / Right	43.7	m²	GW x L	22.68	m²	Normal				1	1	1	0.142857143	0.0033	0.0063	
2)	Cross Culvert(1)		Pcs			Pcs							0	0			
		7.65	m		7.65		Normal				1	1.5	1.5	0.214285714	0.0280	0.0280	
	Cross Culvert(2)		Pcs			Pcs							0	0			
			m										0	0			
3)	Catch Basin / Cover(1)		Pcs			Pcs							0	0			
	Catch Basin / Cover(2)		Pcs			Pcs							0	0			
	Catch Basin / No cover(1)		Pcs			Pcs							0	0			
	Catch Basin / No cover(2)		Pcs			Pcs							0	0			
4)	Lined Side Ditch(1)		m	L		m							0	0			
	Lined Side Ditch(2)		m	L		m							0	0			
5)	Unlined Side ditch(1)		m	L		m							0	0			
	Unlined Side ditch(2)	15.5	m	L		m	Normal						0	0.047614286			
6)	Carriage De-silting(1)	74.3	m²	Lx1.0(m)		m²	Heavy						0	0.190571429			
	Carriage De-silting(2)		m²	Lx1.0(m)		m²							0				
	Total										2	2.5	2.5				
													0.0		1 day = 7 working hours		
													Man day				

Note)
To use one sheet per day
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.
To specify structures to be maintained
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

(Oct. 05, 2015, Grass Cutting, Unlined Ditch)

Form-1



Form-2

Date 5 Oct 2015 Weather SUNNY Inspected By Jared

Location Processional way Contractor's Name Hoket Construction Company

Work Item	Number of Workers	Start time	End Time	Working Hrs	Work Measurement	Work Volume	Unit	Remarks
grass cutting	1	2pm	3pm	1	l = 19m w = 2.9m	55.2	m^2	
unlined drain	1	2pm	3pm	1	l = 19m	19	m	

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	Nairobi	Client	KURA	Site	Processional way	Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			
Width of Road Reserve (Wr)	37.90 m	Width of Carriage Way (Wc)	7.2 m	Left Lined Ditch (LL)	0 m	Right Lined Ditch (RL)	1.2 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	29.50 m	Total Length	0 m	Number of Labors	0 men	2015/10/5

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	239.4	m2	GW x L	53.2	m2	Normal				1	1	1	0.142857143	0.0006	0.0027	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)		m	L		m							0	0	#DIV/0!	#DIV/0!	
	Lined Side Ditch(2)		m	L		m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	19.0	m	L	19.0	m	Heavy				1	1	1	0.142857143	0.0075	0.0075	
	Unlined Side ditch(2)		m	L		m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)		m2	Lx1.0(m)		m2							0	0	#DIV/0!	#DIV/0!	
	Carriage De-silting(2)		m2	Lx1.0(m)		m2							0	0	#DIV/0!	#DIV/0!	
	Total										2	2	2				

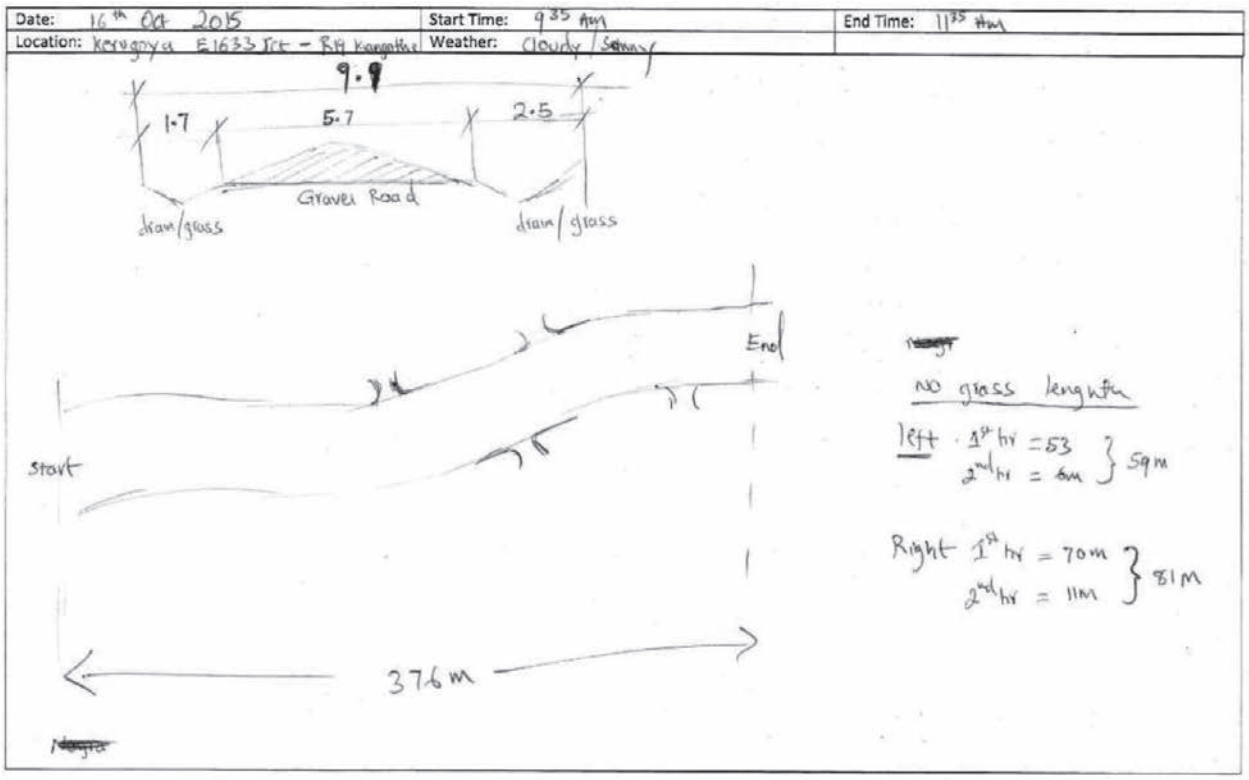
Note)
To use one sheet per day
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.
To specify structures to be maintained
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

0.3 Man Day

1day = 7 working hours

(Oct. 16, 2015, Grass Cutting at KeRRA)

Form-1



Form-2

Date: 6th Oct 2015 Weather: Cloudy / Sunny Inspected By: [signature]

Location: Kerugoya E1633 – R19 Kangetha Contractor's Name: Pertonnas Construction

Work Item	Number of Workers	Start time	End Time	Working Hrs	Work Measurement	Work Volume	Unit	Remarks
Grass cutting Left		9:35	10:35	1 hr	L= 197 W=1.7	334.9	m2	~~high grass~~ Normal
		10:35	11:35	1hr	L=120 W=1.7	204	m2	
Grass Cutting Right		9:35	10:33	1hr	L= 180 W=2.5	450	m2	~~light grass~~ Normal
		10:35	11:35	1 hr	L= 11.5 W=25	287.5	m2	

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	Kerugoya	Client	KURA	Site	KeNHA rd	Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance		No. 66 (C)
Width of Road Reserve (Wr)	21.20 m	Width of Carriage Way (Wc)	6 m	Left Lined Ditch (LL)	0 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	15.20 m	
Total Length	0 m	Number of Labors	0	men						2015/10/2

	Worked Items	Asset Quantity							Labour Input						SRUQ		Remarks (Equipment)
		Simple Quantity			Actual Quantity		Work Difficulty		Foreman	Supervisor	Labors				(4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	
		Q'ty	Unit	Remarks	Q'ty (Vol)	Unit	-Heavy -Normal -Light	Remark	nos	nos	nos	working hours					
		a			b				c	d	e	f	j=e×f	Man day	ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
	Grass Cutting(2) / Right	43.7	m2	GW x L	22.68	m2	Normal				1	1	1	0.142857143	0.0033	0.0063	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		7.65	m		7.65	m	Normal				1	1.5	1.5	0.214285714	0.0280	0.0280	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)		m	L		m							0	0	#DIV/0!	#DIV/0!	
	Lined Side Ditch(2)		m	L		m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)		m	L									0	0	#DIV/0!	#DIV/0!	
	Unlined Side ditch(2)		m	L		m	Normal						0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-sliting(1)		m2	Lx1.0(m)		m2	Heavy						0	0	#DIV/0!	#DIV/0!	
	Carriage De-sliting(2)		m2	Lx1.0(m)		m2							0	0	#DIV/0!	#DIV/0!	
	Total										2	2.5	2.5				

Note) To use one sheet per day 0.4 Man Day 1day = 7 working hours

To fill only the number of workers who are engaged in PBC works

Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.

To specify structures to be maintained

To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

1.2. Example of PR Survey Summary Form

Summary of Survey Result

	Name of Project	RA	Length Maintained	Grass Cutting1				Grass Cutting2				Cross Culvert(1)				Catch Basin / No Cover(1)				Catch Basin / No cover(2)				Lined Side Ditch(1) /de-silted volume				Lined Side Ditch(2) /de-silted volume				Unlined Side ditch(1) / de-silted volume				Unlined Side ditch(2) / de-silted volume				Carriage De-sliting(1) / de-silted area				Carriage De-sliting(2) / de-silted area			
				m2		md		m2		md		pcs				pcs				pcs				m				m				m				m				m2				m2			
				Simple	Actual	Person day		Simple	Actual	Person day		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour	
1	Kiriclnwa(1)	KURA	200.0	2,800.0	337.9	1.00	Normal																	200.0	12.9	1.71	Normal	200.0	7.5	0.90	Normal									200.0	97.2	1.71	Normal	200.0	85.0	1.71	Normal
2	kiriclnwa(2)	KURA	370.5	4,075.5	664.9	3.57	Normal									1.0	1.0	1.14	Heavy					370.5	28.0	4.29	Normal													370.5	70.5	3.75	Normal	370.5	70.5	3.75	Normal
3	Kiriclnwa(3)	KURA	303.0	3,333.0	168.8	0.29	Normal	3,333.0	178.2	0.14	Normal																					303.0	189.0	2.57	Normal	303.0	110.0	1.71	Normal	303.0	90.0	0.86	Normal	303.0	43.4	0.57	Normal
4	Excel Industries	KURA	331.0																													331.0	39.0	0.86	Normal	331.0	29.0	0.86	Normal	331.0	50.0	0.48	Light	331.0	119.7	0.14	Light
5	Likoni Rd	KURA	112.8	282.0	268.4	1.14	Normal	564.0	456.8	1.14	Normal																																				
6	Dennis Prit Rd	KURA	210.0	2,079.0	91.0	0.74	Normal																	192.4	109.0	1.24	Normal													210.0	31.5	0.66	Normal	210.0	31.5	0.66	Normal
7	Dorobo Rd	KURA	304.0	1,124.8	447.7	1.47	Normal	1,124.8	478.8	0.67	Normal																															304.0	91.2	0.86	Normal	486.4	347.4	0.57	Normal
8	Jabavu Lane	KURA	236.0	967.6	484.2	0.43	Normal	967.6	94.0	0.33	Normal													236.0	125.6	0.86	Normal	236.0	73.7	1.05	Normal									236.0	71.0	0.43	Normal	236.0	40.5	0.64	Normal
9	Theta Lane	KURA	65.0	84.5	52.0	0.29	Normal	84.5	49.2	0.86	Normal																																				
10	Processional Way 1st day	KURA	483.4	5,680.0	873.5	1.14	Light	5,680.0	948.7	1.14	Light													483.4	483.4	0.29	Light													483.4	115.6	0.29	Light	483.4	119.7	0.57	Light
11	Processional Way 2nd day	KURA	126.3	1,484.0	647.9	0.86	Normal	1,484.0	948.7	0.64	Normal																																				
12	Ralph Bunche Rd	KURA	352.6	4,513.3	350.3	0.29	Light	4,513.3	398.7	0.36	Light													352.6	64.0	0.29	Normal													352.6	211.6	1.00	Normal	352.6	154.7	0.71	Normal
13	Access to Excel undust1	KURA	435.5																					435.5	88.3	0.52	Normal	435.5	266.6	0.29	Light									435.5	265.7	0.93	Light	435.5	44.1	0.14	Light
14	Access to Excel undust2	KURA	111.1																					111.1	96.1	0.43	Light																		
15	Eastern Bypass service lane	KURA	245.5																					245.5	245.5	0.57	Light	245.5	54.0	0.29	Light																
16	Excel Indust20150303(1).	KURA	225.6	2,639.5	1,266.6	0.64	Normal																	225.6	67.6	0.81	Normal													225.6	67.7	0.59	Normal	225.6	30.6	0.29	Normal
17	Excel Indust20150303(2).	KURA	166.3																					166.3	166.3	0.33	Light																		
18	eastern service lane	KURA	169.0																					169.0	169.0	0.86	Normal																		
19	Eastern Bypass (SL1)	KURA	316.0																																					316.0	163.1	3.57	Normal				
20	Eastern Bypass (SL2)	KURA	230.0																																					598.0	598.0	2.14	Normal				
21	Link rd off airport n/s	KURA	3.0																					3.0	3.0	1.14	Heavy																		
22	Service lane near cabanas	KURA	294.3	3,796.5	51.9	0.29	Normal																																	294.3	90.1	1.14	Light				
23	Service Lane	KURA	210.7																																					210.7	22.7	1.14	Light				
24	Link rd off airport n/s	KURA	5.4																					5.4	5.4	1.71	Heavy																		
25	Eastern Bypass SL	KURA	77.6																													77.6	46.9	1.79	Normal										
26	Mombasa Rd-Eastern Bypass	KURA	200.7																					200.7	150.7	3.36	Normal																		
27	4th Ngong Avenue	KURA	374.6																					52.0	52.0	0.14	Light	70.2	70.2	0.14	Light									374.6	112.4	0.74	Normal				
28	5th Ngong Avenue	KURA	384.6																																					384.6	14.6	0.04	light	384.6	65.3	0.29	Normal
29	3rd Ngong Avenue	KURA	158.7																					53.1	53.1	0.05	Light																	158.7	31.7	0.29	Normal
30	Jabavu Road	KURA	667.5	1,802.3	25.0	0.02	Light																	122.0	122.0	0.19	Light																	667.5	209.9	0.71	Light	667.5	251.5	0.71	Light
31	1st Ngong Avenue	KURA	320.0																																					320.0	84.9	0.25	Light	320.0	31.8	0.11	Light
32	3rd Ngong Avenue	KURA	165.0																																					145.0	72.0	0.29	Light	165.0	82.5	0.14	Light
33	Muringa road	KURA	272.7	886.3	40.0	0.07	Light	886.3	24.0	0.12	Light													272.7	159.4	0.36	Light	272.7	127.0	0.40	Light													272.7	72.7	0.29	Light	272.7	136.4	0.14	Light
34	Ndemi Road	KURA	640.0																					640.0	341.3	0.33	Light	640.0	205.8	0.33	Light													640.0	184.8	0.29	Light	640.0	188.7	0.29	Light
35	Statehouse Road	KURA	1,499.2																					1,499.2	456.7	0.57	Light	1,499.2	552.5	0.43	Light													1,499.2	449.8	1.14	Light	1,499.0	434.2	1.14	Light
36	Turbo Road	KURA	435.6																					53.9	53.9	1.57	Heavy	435.6	139.8	1.19	Normal																
37	Elgeyo Marakwet Rd	KURA	621.2																					621.2	350.2	0.57	Light	621.2	522.9	0.60	Light													621.2	184.6	0.64	Light	621.2	178.1	0.57	Light
38	Makindi Rd	KURA	498.6																																									498.6	96.8	0.36	Light	498.6	68.1	0.31	Light
39	Elgeyo Marakwet Rd	KURA	79.8																					79.8	69.4	0.10	Light																		
40	Gacharage-DB Thika	KeRRA	39.7																																												
41	Kangema - Kiriaini Rd	KeRRA	259.7																																					259.7	102.7	3.04	Heavy				
42	Gacharage-DB Thika	KeRRA	732.4	1,062.0	732.4	0.67	Light	1,062.0	664.7	0.52	Light																													732.4	271.0	3.86	Heavy	732.4	195.5	3.86	Heavy				
43	Kangema - Kiriaini Rd	KeRRA	153.4																																					153.4	153.4	3.38	Heavy				
44	Gacharage-DB Thika	KeRRA	220.4																																					220.4	220.4	1.38	Heavy				
45	Kangema - Kiriaini Rd	KeRRA	901.8																																					901.8	161.8	2.71	Heavy				
46	Gacharage-DB Thika	KeRRA	134.0																																					134.0	134.0	1.33	Heavy				
47	Kangema - Kiriaini Rd	KeRRA	438.2													1.0	1.0	0.01	Light																					438.3	158.7	2.23	Heavy				
48	Gacharage-DB Thika	KeRRA	150.1													1.0	1.0	0.09	Light																					150.1	150.1	1.71	Heavy				
49	Kangema - Kiriaini Rd	KeRRA	56.9																																					56.9	56.9	2.38	Heavy				
50	Kisii-kilgoris(boroko)	KeNHA	16.6									1.0	1.0	0.12	Heavy																									16.6	16.6	4.70	Heavy				
51	Kisii-kilgoris(Magena)	KeNHA	4.3																					4.3	4.3	7.28	Heavy																		
52	Kisii-kilgoris(Magena)	KeNHA	5.8																					3.3	3.3	4.57	Heavy	5.8	5.8	2.14	Heavy														
53	Kisii-kilgoris(Ogembo)	KeNHA	439.0	3,029.1	746.3	0.36	Light	3,029.1	867.1	0.36	Light																																				
54	Kisii-kilgoris(Nyangusu)	KeNHA	6.4									1.0	1.0	0.05	Heavy																									6.4	6.4	3.39	Heavy				
55	Kisii-kilgoris(Menyinkwa)	KeNHA	516.7									12.0	1.0	0.02	Normal																									516.7	21.7	4.70	Heavy				
56	Kisii-kilgoris(near kisii town)	KeNHA	131.1									6.9	6.9	0.12	Normal									131.1	100.7	4.33	Normal																		
57	Kisii-kilgoris(near kisii town)	KeNHA	213.0	2,023.5	638.6	0.40	Light	2,023.5	231.9	0.40	Light													213.0	54.4	3.07	Normal	213.0	19.5	0.86	Normal																
58	Kisii-kilgoris(Menyinkwa)	KeNHA	376.9																																					376.9	8.9	0.36	Normal				
59	Kisii-kilgoris(kisii town)	KeNHA	130.7													1.0	1.0	0.14	Light					65.4	36.2	0.74	Normal	65.4	13.0	0.64	Normal																
60	Kisii-kilgoris(kisii town)	KeNHA	140.4																					70.2	58.8	1.33	Heavy	70.2	65.4	1.33	Heavy																
61	Lanet njoro (pipeline)	KeNHA	74.5																																					74.5	20.3	0.40	Normal				
62	Lanet njoro (near pipeline)	KeNHA	87.6													1.0	1.0	0.05	Light					85.7	85.7	0.19	Light																	87.6	26.3	0.19	Light				
63	Lanet njoro (Nakuru twn)	KeNHA	215.2									4.5	4.5	0.21	Heavy	4.0	4.0	0.11	Light					107.6	96.9	2.50	Heavy	107.6	118.3	1.01	Light																
64	Lanet njoro (pipeline)	KeNHA	32.7																																					19.9	19.9	1.81	Heavy	12.8	12.8	0.81	Heavy				
65	Lanet njoro (Nakuru twn)	KeNHA	129.0													1.0	1.0	0.02	Light					61.7	61.7	2.71	Heavy	67.3	67.3	0.86	Normal																
66(A)	Lanet njoro (pipeline)(A)	KeNHA	42.8																																					21.4	20.5	0.56	Normal	21.4	12.0	0.63	Normal				
66(B)	Lanet njoro (pipeline)(B)	KeNHA	42.8																																					21.4	7.7	0.77	Normal	21.4	6.5	0.14	Normal				
66(C)	Lanet njoro (pipeline)(C).	KeNHA	21.8																																					21.4	13.9	0.85	Normal								
67	Lanet njoro (pipeline)	KeNHA	20.0																																					10.0	6.1	0.49	Normal	10.0	6.9	0.46	Normal				
68	Lanet njoro (Nakuru twn)	KeNHA	74.3									5.5	5.5	1.24	Heavy	2.0	2.0	0.05	Light					17.8	17.8	0.38	Heavy	56.5	56.5	0.62	Heavy																
69	Kerugoya1	KURA																																						15.5	15.5	0.05	Normal					74.3	52.0	0.19	Heavy				
70	Kerugoya2	KURA						43.70	22.68	0.14	Normal	7.7	7.7	0.21	Normal																																				
71	Processional Way	KURA																																															
72	Kerugoya3	KeRRA		639.2	538.9	0.43	Normal	940.00	737.50	0.43	Normal																																						

Heavy			0	0	0.00		0	0	0.00		12	12	1.62		1	1	1.14		0	0	0.00		327	305	23.20		133	128	4.10		3,646	1,513	37.68		745	208	4.67		74	52	0.19		0	0	0.00	
Normal			23,306	5,020	0.00		8,542	2,966	4.36		27	16	0.36		0	0	0.00		0	0	0.00		2,556	881	21.21		1,217	321	5.50		1,253	368	8.69		352	164	3.81		3,689	1,620	16.45		2,054	702	3.44	
Light			18,997	3,406	2.96		16,132	2,470	2.38		0	0	0.00		11	11	0.48		0	0	0.00		4,432	2,681	4.12		2,869	1,917	3.49		0	0	0.00		0	0	0.00		6,891	1,940	8.17		5,934	1,655	4.27	
counts	Heavy		0	0	0		0	0	0		4	4	4		1	1	1		0	0	0		9	9	9		3	3	3		14	14	14		2	2	2		1	1	1		0	0	0	
	Normal		11	11	11		7	7	7		3	3	3		0	0	0		0	0	0		11	11	11		6	6	6		10	10	10		5	5	5		12	12	12		7	7	7	
	Light		7	7	7		5	5	5		0	0	0		7	7	7		0	0	0		13	13	13		8	8	8		0	0	0		0	0	0		15	15	15		11	11	11	

1.3. Example of P/R Computation Form

Summary of SRUQ

		Simple	Actual	Person*day	P/R(Actual)	SRUQ(Actual)	SRUQ(Actual)*1000	Simple/Actual	Actual/Simple	P/R(Simple)	SRUQ(Simple)	SRUQ(Simple)*1000
Grass Cutting(m2)	Heavy	No Data										
	Normal	31,847	7,986	4.355	1,833.8	0.000545328	0.55			8,859.7	0.000112871	0.11
	Light	35,129	5,876	5.336	1,101.3	0.000907981	0.91			5,321.1	0.000187932	0.19
	Total(Ave.)	66,976	13,863	10	1,430.5	0.00069906	0.70	483%	21%	6,911.3	0.00014469	0.14
Cross Culvert(m)	Heavy	12	12	1.619	7.4	0.134916667	134.92			10.4	0.096419045	96.42
	Normal	27	16	0.356	43.6	0.022921452	22.92			61.0	0.01638096	16.38
	Light	No Data										
	Total(Ave.)	39	28	2	13.9	0.071703396	71.70	140%	71%	19.5	0.051243283	51.24
Catch Basin(pcs)	Heavy	1	1	1.143	0.9	1.142857143	1,142.86			0.9	1.142857143	1,142.86
	Normal	No Data										
	Light	11	11	0.475	23.2	0.043194805	43.19			23.2	0.043194805	43.19
	Total(Ave.)	12	12	2	7.4	0.134833333	134.83	100%	100%	7.4	0.134833333	134.83
Lined Side Ditch(m)	Heavy	460	433	27.299	15.9	0.063070622	63.07			29.3	0.034084132	34.08
	Normal	3,773	1,202	26.713	45.0	0.022230222	22.23			83.2	0.012013482	12.01
	Light	7,301	4,598	7.609	604.3	0.001654675	1.65			1,118.3	0.000894206	0.89
	Total(Ave.)	11,534	6,233	62	101.1	0.009886347	9.89	185%	54%	187.2	0.005342702	5.34
Unlined Side Ditch(m)	Heavy	4,391	1,722	42.350	40.7	0.02459982	24.60			108.2	0.009245418	9.25
	Normal	1,605	532	12.500	42.6	0.023489081	23.49			113.3	0.008827966	8.83
	Light	No Data										
	Total(Ave.)	5,997	2,254	55	41.1	0.024337549	24.34	266%	38%	109.3	0.009146848	9.15
Carrageway De-silting(m2)	Heavy	No Data										
	Normal	5,703	2,322	19.893	116.7	0.008568364	8.57			365.5	0.002736169	2.74
	Light	12,825	3,595	12.442	288.9	0.003460832	3.46			904.8	0.001105161	1.11
	Total(Ave.)	18,528	5,917	32	183.0	0.005464973	5.46	313%	32%	573.0	0.001745151	1.75

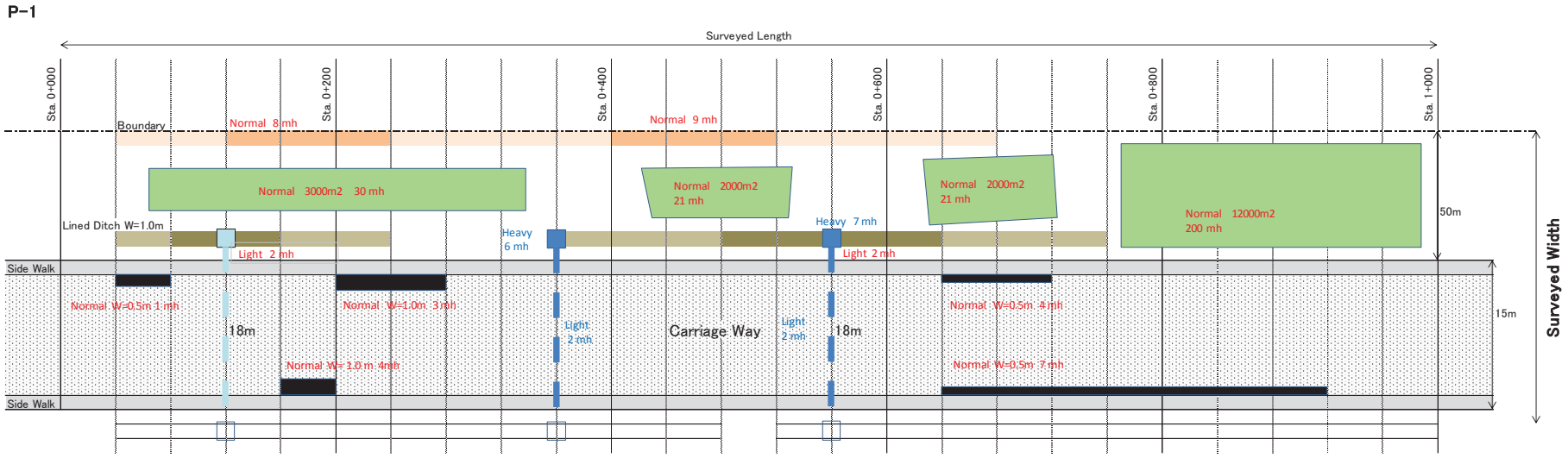
After Correction

		P/R(Actual)	Remarks	SRUQ(Actual)	SRUQ(Actual)*1000	Simple/Actual	Actual/Simple	P/R(Simple)	SRUQ(Simple)	SRUQ(Simple)*1000
Grass Cutting(m2)	Heavy	100	Assumption(From Normal and Little)	0.01	10.00			300.0	0.003333333	3.33
	Normal	1,834		0.000545328	0.55			5,501.3	0.000181776	0.18
	Light	1,101		0.000907981	0.91			3,304.0	0.00030266	0.30
	Total(Ave.)	1,430		0.00069906	0.70	300%	33%	4,291.5	0.00023302	0.23
Cross Culvert(m)	Heavy	7		0.134916667	134.92	(Assumption;3:1)		10.4	0.096419045	96.42
	Normal	44		0.022921452	22.92			61.0	0.01638096	16.38
	Light	100	Assumption(From Heavy and Normal)	0.01	10.00			139.9	0.007146563	7.15
	Total(Ave.)	14		0.071703396	71.70	140%	71%	19.5	0.051243283	51.24
Catch Basin(pcs)	Heavy	1		1.142857143	1,142.86			2.6	0.380952381	380.95
	Normal	5	Assumption(From Heavy and Little)	0.2	200.00			15.0	0.066666667	66.67
	Light	23		0.043194805	43.19			69.5	0.014398268	14.40
	Total(Ave.)	7		0.134833333	134.83	300%	33%	22.2	0.044944444	44.94
Lined Side Ditch(m)	Heavy	16		0.063070622	63.07	(Assumption;3:1)		29.3	0.034084132	34.08
	Normal	45		0.022230222	22.23			83.2	0.012013482	12.01
	Light	604		0.001654675	1.65			1,118.3	0.000894206	0.89
	Total(Ave.)	101		0.009886347	9.89	185%	54%	187.2	0.005342702	5.34
Unlined Side Ditch(m)	Heavy	41		0.02459982	24.60			108.2	0.009245418	9.25
	Normal	43		0.023489081	23.49			113.3	0.008827966	8.83
	Light	600	Assumption(From Lined Side Ditch Little)	0.001666667	1.67			1,596.5	0.000626388	0.63
	Total(Ave.)	41		0.024337549	24.34	266%	38%	109.3	0.009146848	9.15
Carrageway De-silting(m2)	Heavy	50	Assumption(From Normal and Little)	0.02	20.00			156.6	0.006386678	6.39
	Normal	117		0.008568364	8.57			365.5	0.002736169	2.74
	Light	289		0.003460832	3.46			904.8	0.001105161	1.11
	Total(Ave.)	183		0.005464973	5.46	313%	32%	573.0	0.001745151	1.75

2. Analysis of PR Survey

2.1. Ex-samples of PR Survey Results

2.1.1. P-1 Project (2 lanes paved Road)/1

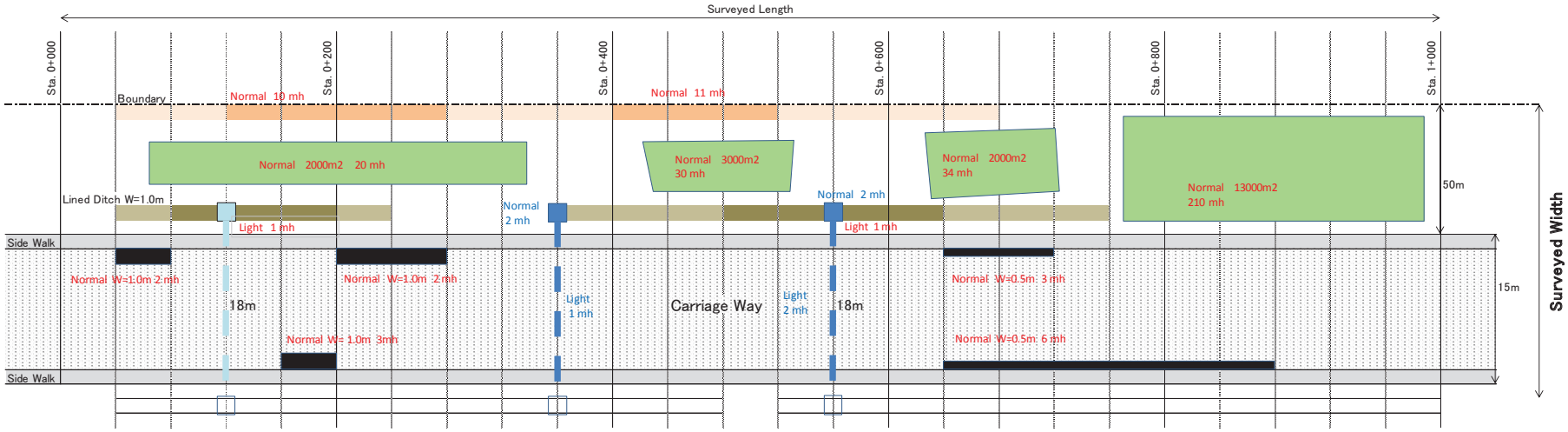


Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.2. P-2 Project (2 lanes paved Road)/2

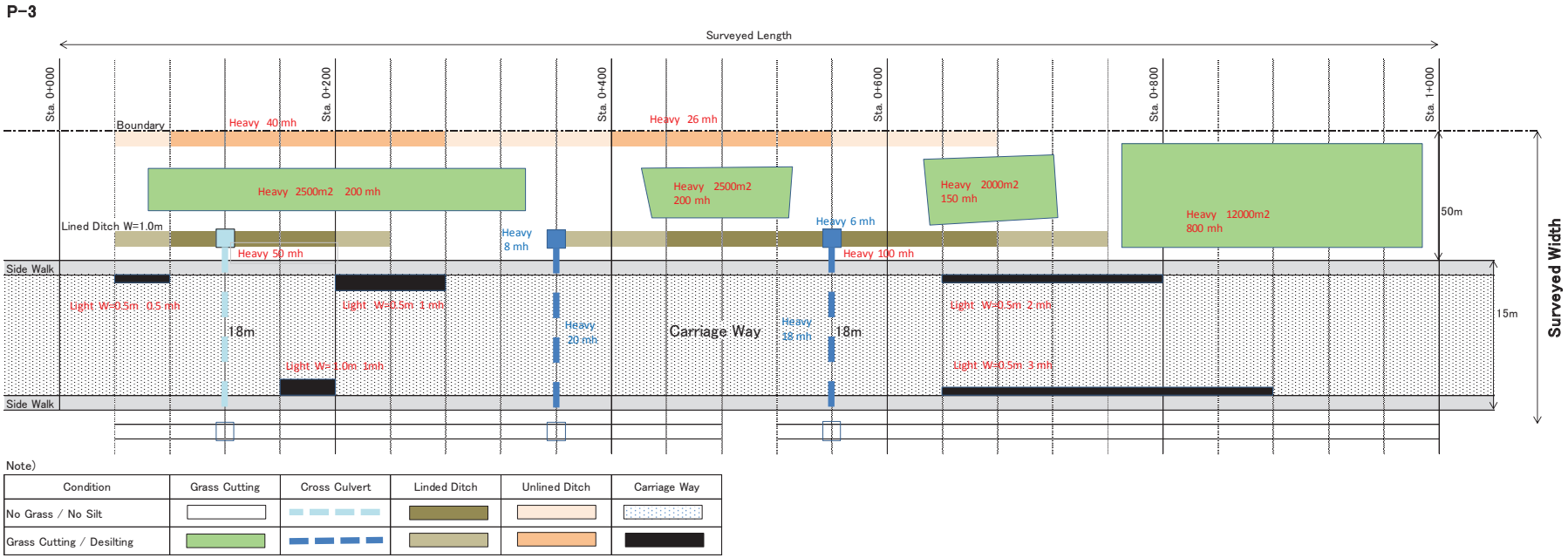
P-2



Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.3. P-3 Project (2 lanes paved Road)/3

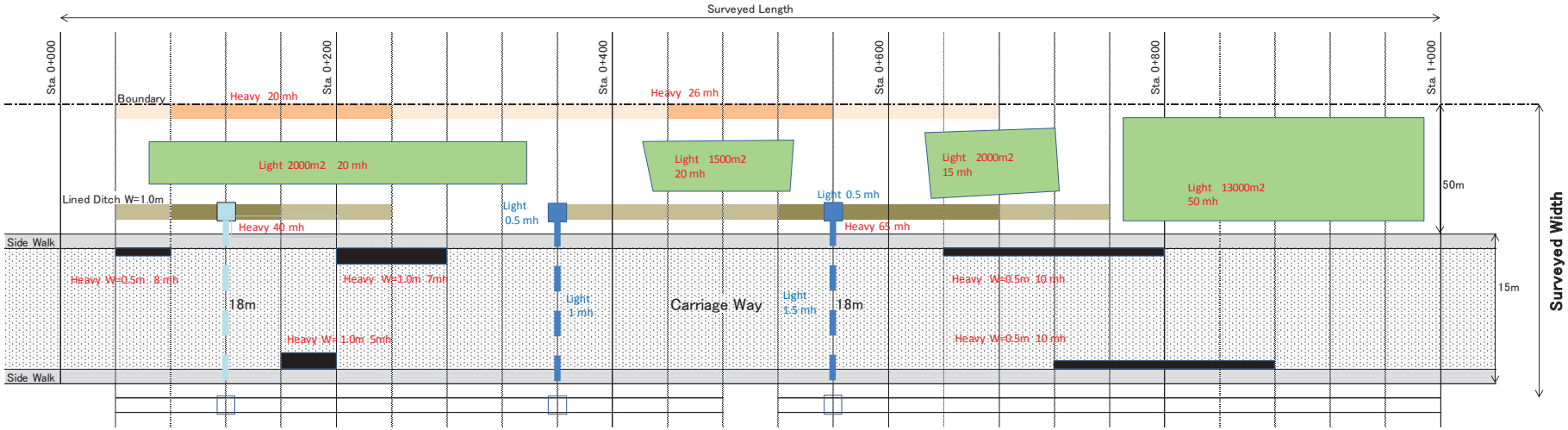


Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.4. P-4 Project (2 lanes paved Road)/4

P-4

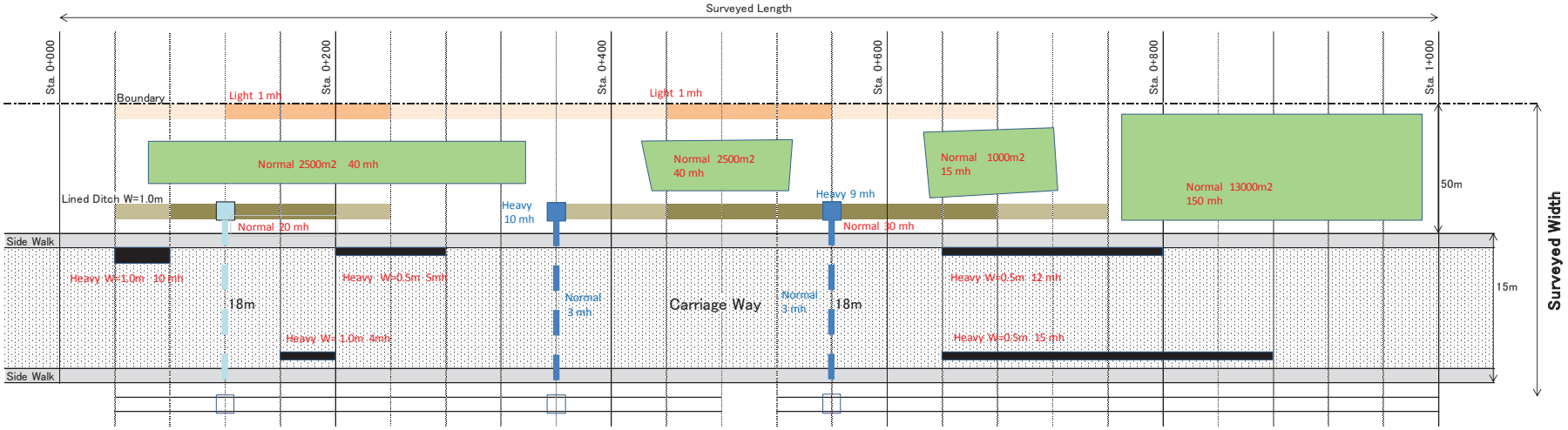


Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.5. P-5 Project (2 lanes paved Road)/5

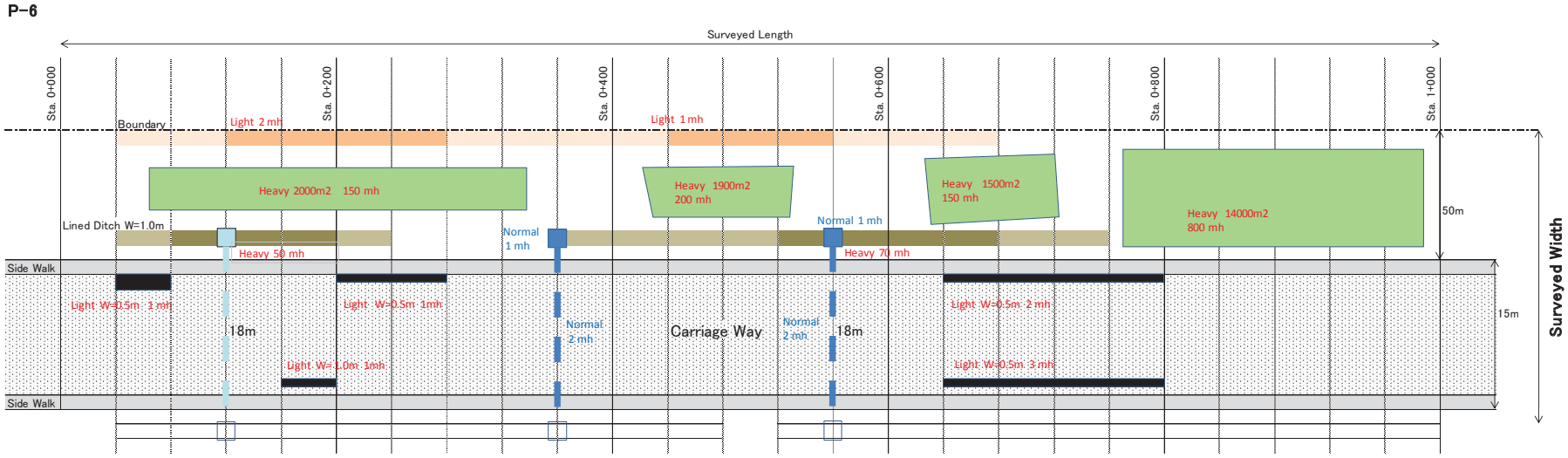
P−5



Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.6. P-6 Project (2 lanes paved Road)/6

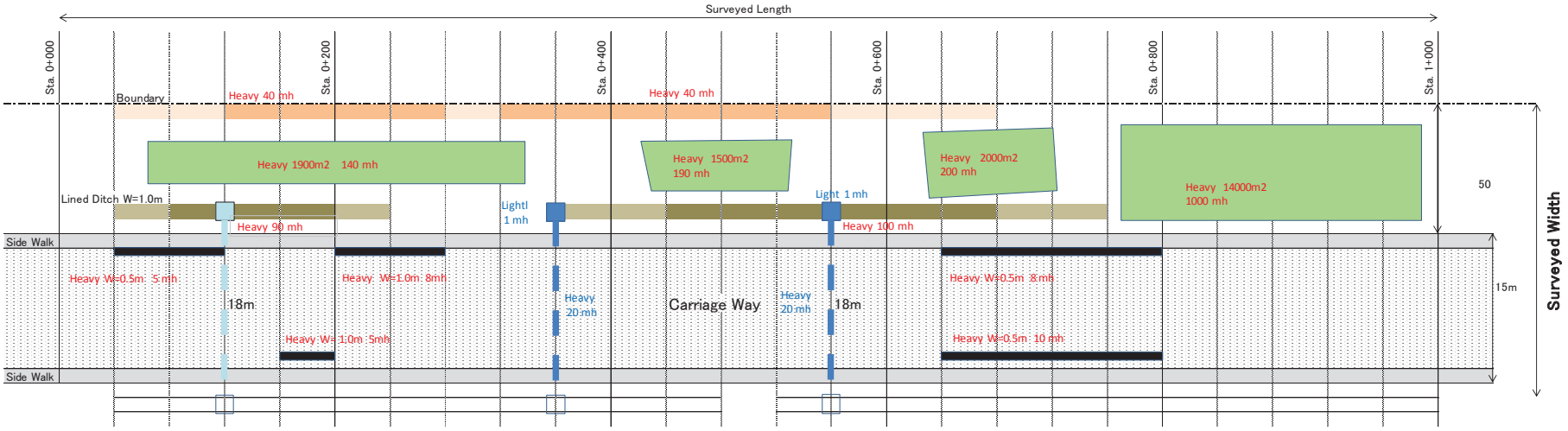


Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.7. P-7 Project (2 lanes paved Road)/7

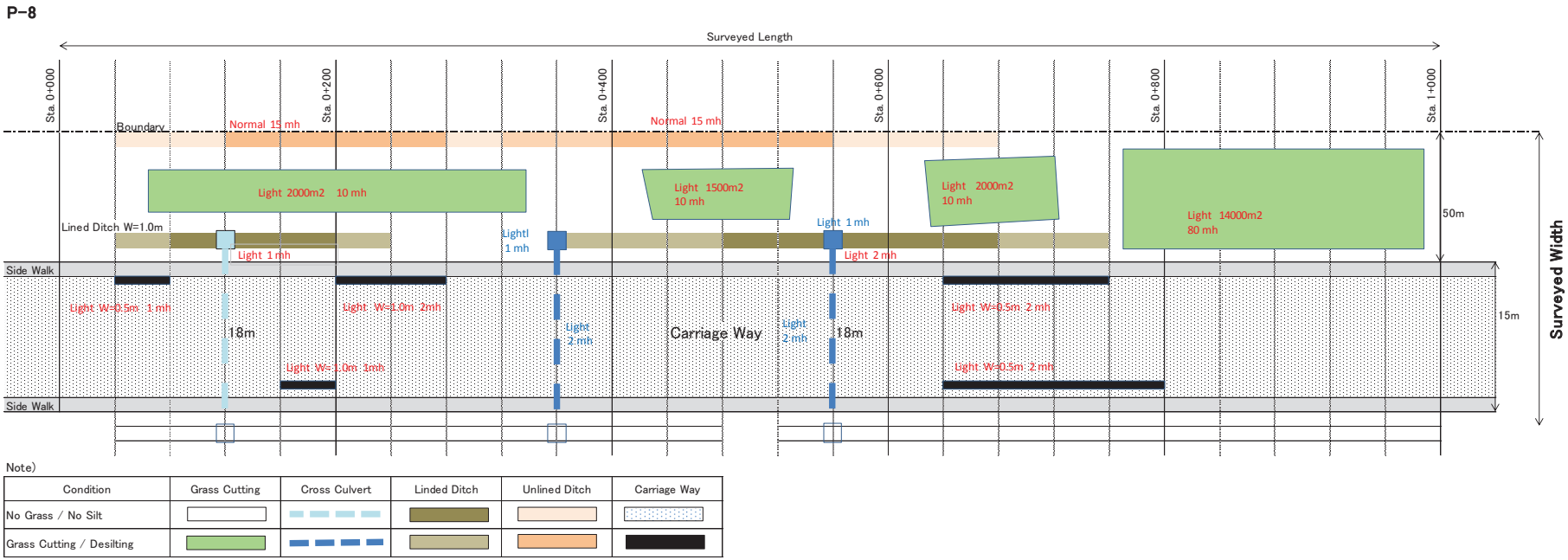
P-7



Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.8. P-8 Project (2 lanes paved Road)/8

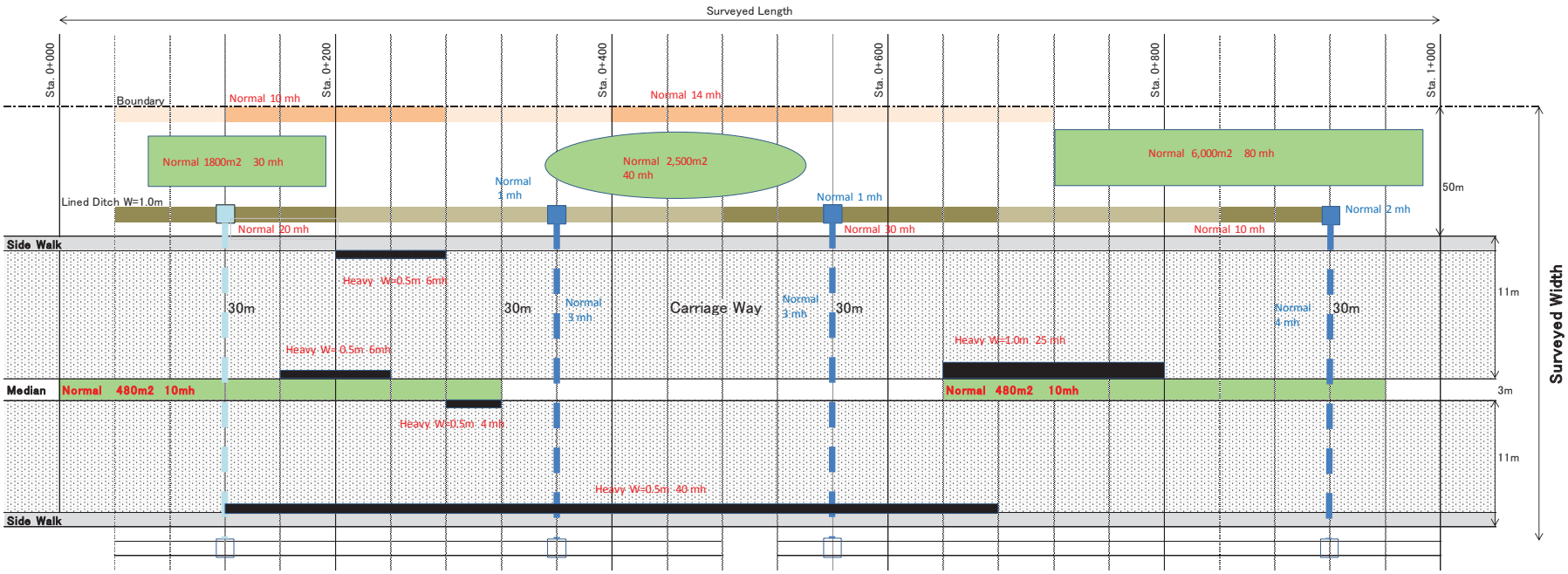


Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.9. P-9 Project (4 lanes paved Road)/1

P-9 with Median

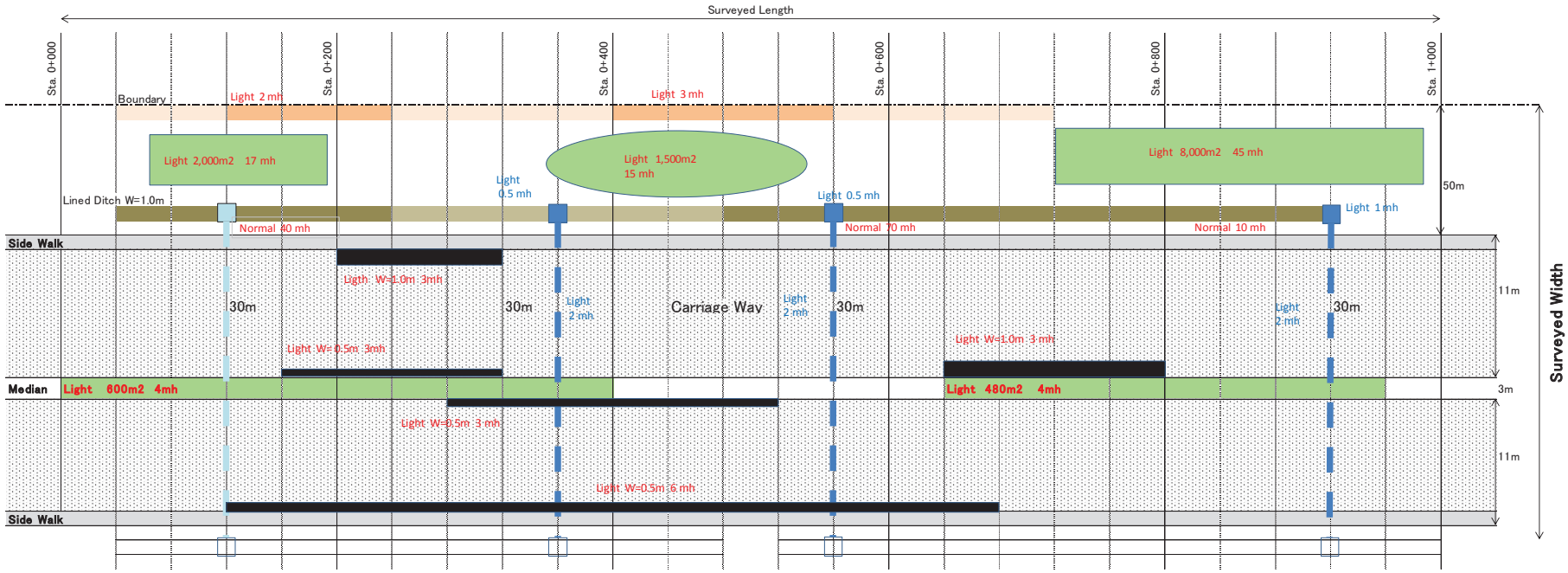


Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.10. P-10 Project (4 lanes paved Road)/2

P-10 (With median)

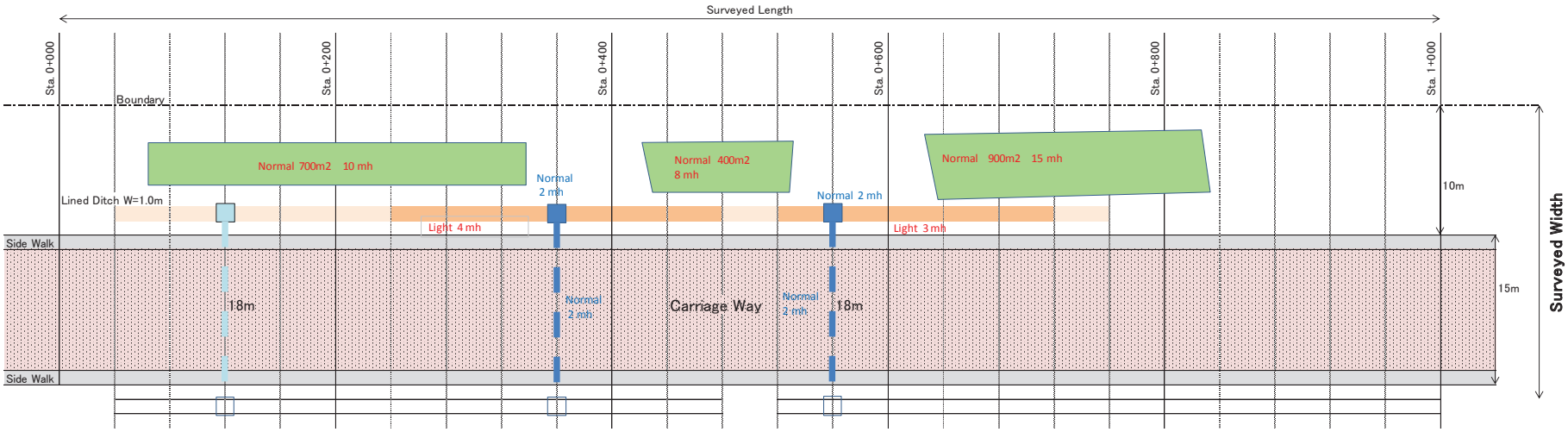


Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.11. P-1 Project (2 lanes unpaved Road)/1

P-11 (Unpaved)

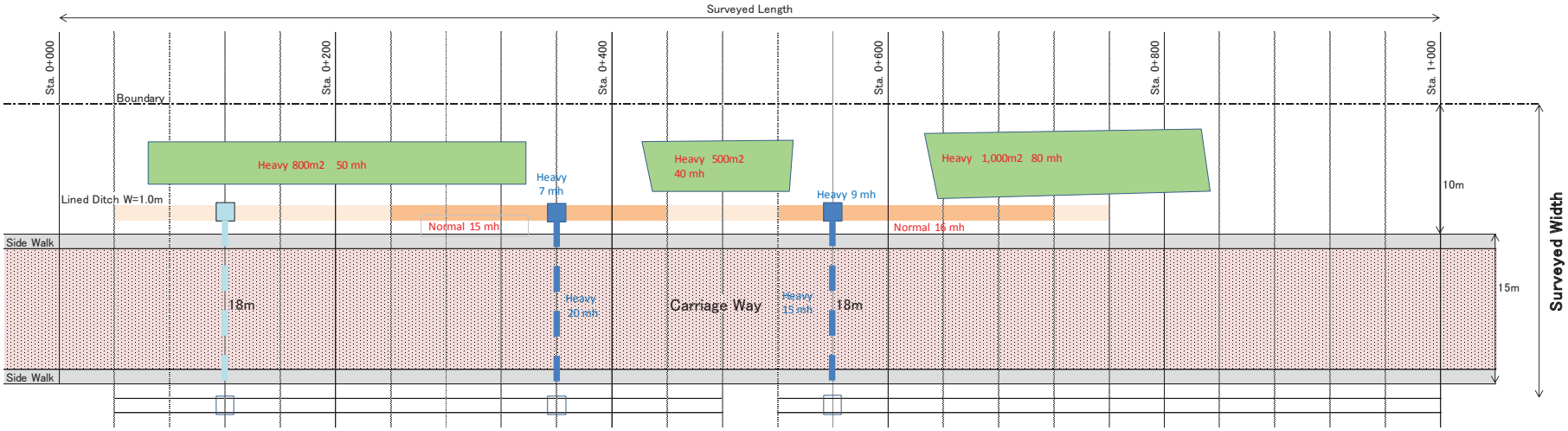


Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.1.12. P-1 Project (2 lanes unpaved Road)/2

P-12 (Unpaved)



Note)

Condition	Grass Cutting	Cross Culvert	Linded Ditch	Unlined Ditch	Carriage Way
No Grass / No Silt					
Grass Cutting / Desilting					

2.2. Examples of Form-3

2.2.1. P-1 Project (2 lanes paved Road)/1

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-1	Client	P-1	Site	P-1	Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men		2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty (a)	Unit	Remarks	Actual Quantity Q'ty (Vol) (b)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos (c)	Supervisor nos (d)	Labors nos (e)	working hours (f)	j=e×f	Man day	SRUQ (4) Simple SRUQ (man day/Qty) ps = j / 7a	(5) Actual SRUQ (man day/Qty) pa= j / 7b	Remarks (Equipment)
1)	Grass Cutting(1) / Left	50,000.0	m2	GW x L	19,000.0	m2	Normal				1	272	272	38.85714286	0.0008	0.0020	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Light				1	4	4	0.571428571	0.0106	0.0159	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Heavy				1	13	13	1.857142857	0.6190	0.9286	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	600.0	m	L	240.0	m	Light				1	4	4	0.571428571	0.0010	0.0024	
	Lined Side Ditch(2)		m	L		m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	640.0	m	L	240.0	m	Normal				1	17	17	2.428571429	0.0038	0.0101	
	Unlined Side ditch(2)		m	L		m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)	1,000.0	m2	Lx1.0(m)	140.0	m2	Normal				1	8	8	1.142857143	0.0011	0.0082	
	Carriage De-silting(2)	1,000.0	m2	Lx1.0(m)	180.0	m2					1	11	11	1.571428571	0.0016	0.0087	
	Total										7	329	329				

Note)
To use one sheet per day — 47.0 Man Day — 1day = 7 working hours
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. — 875
To specify structures to be maintained — 122.5
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.2. P-2 Project (2 lanes paved Road)/2

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-2	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men		2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty (a)	Unit	Remarks	Actual Quantity Q'ty (Vol) (b)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos (c)	Supervisor nos (d)	Labors nos (e)	working hours (f)	j=e×f	Man day	SRUQ (4) Simple SRUQ (man day/Qty) ps = j / 7a	(5) Actual SRUQ (man day/Qty) pa= j / 7b	Remarks (Equipment)
1)	Grass Cutting(1) / Left	50,000.0	m2	GW x L	20,000.0	m2	Normal				1	294	294	42	0.0008	0.0021	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Light				1	3	3	0.428571429	0.0079	0.0119	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Normal				1	4	4	0.571428571	0.1905	0.2857	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	600.0	m	L	280.0	m	Light				1	2	2	0.29	0.0005	0.0010	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	640.0	m	L	280.0	m	Normal				1	21	21	3	0.0047	0.0107	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)	1,000.0	m2	Lx1.0(m)	160.0	m2	Normal				1	9	9	1.285714286	0.0013	0.0080	
	Carriage De-silting(2)	1,000.0	m2		160.0	m2	Normal				1	9	9	1.285714286	0.0013	0.0080	
	Total										7	342	342				

Note)
To use one sheet per day — 48.9 Man Day — 1day = 7 working hours
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. — 777.7777778
To specify structures to be maintained — 124.4444444
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.3. P-3 Project (2 lanes paved Road)/3

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-3	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men		2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	50,000.0	m2	GW x L	19,000.0	m2	Heavy				1	1350	1350	192.8571429	0.0039	0.0102	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Heavy				1	38	38	5.428571429	0.1005	0.1508	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Heavy				1	14	14	2	0.6667	1.0000	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	600.0	m	L	360.0	m	Heavy				1	150	150	21.42857143	0.0357	0.0595	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	640.0	m	L	360.0	m	Heavy				1	65	65	9.285714286	0.0145	0.0258	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)	1,000.0	m2	Lx1.0(m)	140.0	m2	Light				1	3.5	3.5	0.5	0.0005	0.0036	
	Carriage De-silting(2)	1,000.0	m2		160.0	m2					1	4	4	0.571428571	0.0006	0.0036	
	Total										7	1624.5	1624.5				

Note)
To use one sheet per day — 232.1 — 1day = 7 working hours
To fill only the number of workers who are engaged in PBC works — Man Day
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. — 2000
To specify structures to be maintained — 280
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.4. P-4 Project (2 lanes paved Road)/4

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-4	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men		2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	50,000.0	m2	GW x L	18,500.0	m2	Light				1	105	105	15	0.0003	0.0008	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Light				1	2.5	2.5	0.357142857	0.0066	0.0099	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Light				1	1	1	0.142857143	0.0476	0.0714	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	600.0	m	L	240.0	m	Heavy				1	105	105	15	0.0250	0.0625	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	640.0	m	L	280.0	m	Heavy				1	45	45	6.428571429	0.0100	0.0230	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)	1,000.0	m2	Lx1.0(m)	140.0	m2	Heavy				1	25	25	3.571428571	0.0036	0.0255	
	Carriage De-silting(2)	1,000.0	m2		120.0	m2					1	15	15	2.142857143	0.0021	0.0179	
	Total										7	298.5	298.5				

Note)
To use one sheet per day — 42.6 — 1day = 7 working hours
To fill only the number of workers who are engaged in PBC works — Man Day
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. — 280
To specify structures to be maintained — 39.2
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.5. P-5 Project (2 lanes paved Road)/5

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-5	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance		No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men	2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	50,000.0	m2	GW x L	19,000.0	m2	Normal				1	245	245	35	0.0007	0.0018	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Normal				1	6	6	0.857142857	0.0159	0.0238	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Heavy				1	19	19	2.714285714	0.9048	1.3571	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	600.0	m	L	360.0	m	Normal				1	50	50	7.142857143	0.0119	0.0198	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	640.0	m	L	240.0	m	Light				1	2	2	0.285714286	0.0004	0.0012	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-sliting(1)	1,000.0	m2	Lx1.0(m)	160.0	m2	Heavy				1	27	27	3.857142857	0.0039	0.0241	
	Carriage De-sliting(2)	1,000.0	m2		140.0	m2					1	19	19	2.714285714	0.0027	0.0194	
	Total										7	368	368				

Note)
To use one sheet per day
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.
To specify structures to be maintained
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

52.6 Man Day

1day = 7 working hours

259.2592593

41.48148148

2.2.6. P-6 Project (2 lanes paved Road)/6

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-6	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance		No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men	2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	50,000.0	m2	GW x L	19,400.0	m2	Heavy				1	1300	1300	185.7142857	0.0037	0.0096	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Normal				1	4	4	0.571428571	0.0106	0.0159	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Normal				1	2	2	0.285714286	0.0952	0.1429	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	600.0	m	L	280.0	m	Heavy				1	120	120	17.14285714	0.0286	0.0612	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	640.0	m	L	280.0	m	Light				1	3	3	0.428571429	0.0007	0.0015	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-sliting(1)	1,000.0	m2	Lx1.0(m)	140.0	m2	Light				1	4	4	0.571428571	0.0006	0.0041	
	Carriage De-sliting(2)	1,000.0	m2		120.0	m2					1	4	4	0.571428571	0.0006	0.0048	
	Total										7	1437	1437				

Note)
To use one sheet per day
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site.
To specify structures to be maintained
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

205.3 Man Day

1day = 7 working hours

1750

245

2.2.7. P-7 Project (2 lanes paved Road)/7

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-7	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men		2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Asset Quantity: Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	Labors working hours			SRUQ (4) Simple SRUQ (man day/Qty)	SRUQ (5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f	Man day	ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	50,000.0	m2	GW x L	19,400.0	m2	Heavy				1	1530	1530	218.5714286	0.0044	0.0113	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Heavy				1	40	40	5.714285714	0.1058	0.1587	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Light				1	2	2	0.285714286	0.0952	0.1429	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	600.0	m	L	360.0	m	Heavy				1	190	190	27.14285714	0.0452	0.0754	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	640.0	m	L	400.0	m	Heavy				1	80	80	11.42857143	0.0179	0.0286	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)	1,000.0	m2	Lx1.0(m)	200.0	m2	Heavy				1	21	21	3	0.0030	0.0150	
	Carriage De-silting(2)	1,000.0	m2		120.0	m2					1	15	15	2.142857143	0.0021	0.0179	
	Total										7	1878	1878				

Note)
To use one sheet per day — 268.3 Man Day — 1day = 7 working hours
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. — 333.3333333
To specify structures to be maintained — 66.66666667
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.8. P-8 Project (2 lanes paved Road)/8

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-8	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men		2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Asset Quantity: Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	Labors working hours			SRUQ (4) Simple SRUQ (man day/Qty)	SRUQ (5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f	Man day	ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	50,000.0	m2	GW x L	19,500.0	m2	Light				1	110	110	15.71428571	0.0003	0.0008	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Light				1	4	4	0.571428571	0.0106	0.0159	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Light				1	2	2	0.285714286	0.0952	0.1429	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	600.0	m	L	320.0	m	Light				1	3	3	0.428571429	0.0007	0.0013	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	640.0	m	L	320.0	m	Normal				1	30	30	4.285714286	0.0067	0.0134	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)	1,000.0	m2	Lx1.0(m)	160.0	m2	Light				1	5	5	0.714285714	0.0007	0.0045	
	Carriage De-silting(2)	1,000.0	m2		120.0	m2					1	3	3	0.428571429	0.0004	0.0036	
	Total										7	157	157				

Note)
To use one sheet per day — 22.4 Man Day — 1day = 7 working hours
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. — 1400
To specify structures to be maintained — 224
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.9. P-9 Project (4 lanes paved Road)/1

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-9	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	22 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	42.00 m	Total Length	1000 m	Number of Labors	0 men	2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	53,000.0	m2	GW x L	11,260.0	m2	Normal				1	170	170	24.28571429	0.0005	0.0022	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		120.0	m		90.0	m	Normal				1	10	10	1.428571429	0.0119	0.0159	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	4.0	Pcs		3.0	Pcs	Normal				1	4	4	0.571428571	0.1429	0.1905	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	880.0	m	L	440.0	m	Normal				1	60	60	8.571428571	0.0097	0.0195	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	680.0	m	L	320.0	m	Normal				1	24	24	3.428571429	0.0050	0.0107	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)	2,000.0	m2	Lx1.0(m)	240.0	m2	Heavy				1	37	37	5.285714286	0.0026	0.0220	
	Carriage De-silting(2)	2,000.0	m2		300.0	m2					1	44	44	6.285714286	0.0031	0.0210	
	Total										7	349	349				

Note)
To use one sheet per day — 49.9 Man Day — 1day = 7 working hours
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. 378.3783784
To specify structures to be maintained 45.40540541
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.10. P-10 Project (4 lanes paved Road)/2

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-10	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance			No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	22 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	42.00 m	Total Length	1000 m	Number of Labors	0 men	2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	(5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	53,000.0	m2	GW x L	12,580.0	m2	Light				1	85	85	12.14285714	0.0002	0.0010	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		120.0	m		90.0	m	Light				1	6	6	0.857142857	0.0071	0.0095	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	4.0	Pcs		3.0	Pcs	Light				1	2	2	0.285714286	0.0714	0.0952	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)	880.0	m	L	640.0	m	Normal				1	110	110	15.71428571	0.0179	0.0246	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	680.0	m	L	280.0	m	Light				1	5	5	0.714285714	0.0011	0.0026	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-silting(1)	2,000.0	m2	Lx1.0(m)	360.0	m2	Light				1	8	8	1.142857143	0.0006	0.0032	
	Carriage De-silting(2)	2,000.0	m2		400.0	m2					1	9	9	1.285714286	0.0006	0.0032	
	Total										7	225	225				

Note)
To use one sheet per day — 32.1 Man Day — 1day = 7 working hours
To fill only the number of workers who are engaged in PBC works
Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. 1750
To specify structures to be maintained 315
To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.11. P-11 Project (2 lanes unpaved Road)/1

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-11	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance		No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men	2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Asset Quantity: Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	Labors working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	SRUQ (5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	10,000.0	m2	GW x L	2,000.0	m2	Normal				1	33	33	4.714285714	0.0005	0.0024	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Normal				1	4	4	0.571428571	0.0106	0.0159	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Normal				1	4	4	0.571428571	0.1905	0.2857	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)		m	L		m					1		0	0	#DIV/0!	#DIV/0!	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	720.0	m	L	440.0	m	Light				1	7	7	1	0.0014	0.0023	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-sliting(1)		m2	Lx1.0(m)		m2					1		0	0	#DIV/0!	#DIV/0!	
	Carriage De-sliting(2)		m2			m2							0		#DIV/0!	#DIV/0!	
	Total										6	48	48				

Note) To use one sheet per day — 6.9 — 1day = 7 working hours

To fill only the number of workers who are engaged in PBC works — Man Day

Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. #DIV/0!

To specify structures to be maintained #DIV/0!

To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.2.12. P-12 Project (2 lanes unpaved Road)/2

Form-3

Productivity Survey Summary Form **Labor Based Works**

Location	P-12	Client		Site		Weather	Sunny	Initial Mobilization Period ／ Routine Maintenance		No. 66 (C)
Width of Road Reserve (Wr)	65.00 m	Width of Carriage Way (Wc)	15 m	Left Lined Ditch (LL)	1 m	Right Lined Ditch (RL)	0 m	Grass Cutting Width (GW)=(Wr)-(Wc)-(LL)-(RL)	49.00 m	Total Length	1000 m	Number of Labors	0 men	2015/10/12

	Worked Items	Asset Quantity: Simple Quantity Q'ty	Unit	Remarks	Asset Quantity: Actual Quantity Q'ty (Vol)	Unit	Work Difficulty -Heavy -Normal -Light	Remark	Labour Input: Foreman nos	Supervisor nos	Labors nos	Labors working hours		Man day	SRUQ (4) Simple SRUQ (man day/Qty)	SRUQ (5) Actual SRUQ (man day/Qty)	Remarks (Equipment)
		a			b				c	d	e	f	j=e×f		ps = j / 7a	pa= j / 7b	
1)	Grass Cutting(1) / Left	10,000.0	m2	GW x L	2,300.0	m2	Heavy				1	170	170	24.28571429	0.0024	0.0106	
	Grass Cutting(2) / Right		m2	GW x L		m2							0	0	#DIV/0!	#DIV/0!	
2)	Cross Culvert(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
		54.0	m		36.0	m	Heavy				1	35	35	5	0.0926	0.1389	
	Cross Culvert(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
			m			m							0	0	#DIV/0!	#DIV/0!	
3)	Catch Basin / Cover(1)	3.0	Pcs		2.0	Pcs	Heavy				1	16	16	2.285714286	0.7619	1.1429	
	Catch Basin / Cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(1)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
	Catch Basin / No cover(2)		Pcs			Pcs							0	0	#DIV/0!	#DIV/0!	
4)	Lined Side Ditch(1)		m	L		m					1		0	0	#DIV/0!	#DIV/0!	
	Lined Side Ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
5)	Unlined Side ditch(1)	720.0	m	L	400.0	m	Normal				1	31	31	4.428571429	0.0062	0.0111	
	Unlined Side ditch(2)		m			m							0	0	#DIV/0!	#DIV/0!	
6)	Carriage De-sliting(1)		m2	Lx1.0(m)		m2					1		0	0	#DIV/0!	#DIV/0!	
	Carriage De-sliting(2)		m2			m2							0		#DIV/0!	#DIV/0!	
	Total										6	252	252				

Note) To use one sheet per day — 36.0 — 1day = 7 working hours

To fill only the number of workers who are engaged in PBC works — Man Day

Total number of workers or equipment shall tally the number of workers or equipment for PBC works on site. #DIV/0!

To specify structures to be maintained #DIV/0!

To fill the maintained Q'ty which includes places/areas that don't require any actual maintenance works

2.3. Summary Form for Ex-samples of PR Survey Results

Summary of Survey Result

	Name of Project	RA	Length Maintained	Grass Cutting1				Cross Culvert(1)				Catch Basin / No Cover(1)				Lined Side Ditch(1) /de-silted volume				Unlined Side ditch(1) / de-silted volume				Carriage De-sliting(1) / de-silted area				Carriage De-sliting(2) / de-silted area		
				m2				pcs				pcs				m				m				m2				m2		
				Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour		Simple	Actual	Labour
						Person day				Person day				Person day				Person day				Person day						Person day			
1	P-1	KRB	1,000.0	50,000.0	19,000.0	42.00	Normal	54.0	36.0	0.57	Light	3.0	2.0	1.86	Heavy	600.0	240.0	0.57	Light	640.0	240.0	2.43	Normal	2,000.0	320.0	2.71	Normal			
2	P-2	KRB	1,000.0	50,000.0	20,000.0	42.00	Normal	54.0	36.0	0.43	Light	3.0	2.0	0.57	Normal	600.0	280.0	0.29	Light	640.0	280.0	3.00	Normal	2,000.0	320.0	2.57	Normal			
3	P-3	KRB	1,000.0	50,000.0	19,000.0	192.86	Heavy	54.0	36.0	5.43	Heavy	3.0	2.0	2.00	Heavy	600.0	360.0	21.43	Heavy	640.0	360.0	9.29	Heavy	2,000.0	300.0	1.07	Light			
4	P-4	KRB	1,000.0	50,000.0	18,500.0	15.00	Light	54.0	36.0	0.36	Light	3.0	2.0	0.14	Light	600.0	240.0	15.00	Heavy	640.0	280.0	6.43	Heavy	2,000.0	260.0	5.71	Heavy			
5	P-5	KRB	1,000.0	50,000.0	19,000.0	35.00	Normal	54.0	36.0	0.86	Normal	3.0	2.0	2.71	Heavy	600.0	360.0	7.14	Normal	640.0	240.0	0.29	Light	2,000.0	300.0	6.57	Heavy			
6	P-6	KRB	1,000.0	50,000.0	19,400.0	185.71	Heavy	54.0	36.0	0.57	Normal	3.0	2.0	0.29	Normal	600.0	280.0	17.14	Heavy	640.0	280.0	0.43	Light	2,000.0	260.0	1.14	Light			
7	P-7	KRB	1,000.0	50,000.0	19,400.0	218.57	Heavy	54.0	36.0	5.71	Heavy	3.0	2.0	0.29	Light	600.0	360.0	27.14	Heavy	640.0	400.0	11.43	Heavy	2,000.0	320.0	5.14	Heavy			
8	P-8	KRB	1,000.0	50,000.0	19,500.0	15.71	Light	54.0	36.0	0.57	Light	3.0	2.0	0.29	Light	600.0	320.0	0.43	Light	640.0	320.0	4.29	Normal	2,000.0	280.0	1.14	Light			
9	P-9	KRB	1,000.0	53,000.0	11,260.0	24.29	Normal	120.0	90.0	1.43	Normal	4.0	3.0	0.57	Normal	880.0	440.0	8.57	Normal	680.0	320.0	3.43	Normal	4,000.0	540.0	11.57	Heavy			
10	P-10	KRB	1,000.0	53,000.0	12,580.0	12.14	Light	120.0	90.0	0.86	Light	4.0	3.0	0.29	Light	880.0	640.0	15.71	Normal	680.0	280.0	0.71	Light	4,000.0	760.0	2.43	Light			
11	P-11	KRB	1,000.0	10,000.0	2,000.0	4.71	Normal	54.0	36.0	0.57	Normal	3.0	2.0	0.57	Normal					720.0	440.0	1.00	Light							
12	P-12	KRB	1,000.0	10,000.0	2,300.0	24.29	Heavy	54.0	36.0	5.00	Heavy	3.0	2.0	2.29	Heavy					720.0	400.0	4.43	Normal							

Heavy		160,000	60,100	621.43		162	108	16.14		12	8	8.86		2,400	1,240	80.71		1,920	1,040	27.14		10,000	1,420	29.00		0	0	0.00	
Normal		213,000	71,260	148.00		282	198	3.43		13	9	2.00		2,360	1,440	31.43		3,320	1,560	17.57		4,000	640	5.29		0	0	0.00	
Light		153,000	50,580	42.86		336	234	2.79		13	9	1.00		1,800	840	1.29		2,680	1,240	2.43		10,000	1,600	5.79		0	0	0.00	
counts	Heavy	3	3	3		2	2	2		3	3	3		4	4	4		3	3	3		3	3	3		0	0	0	
	Normal	3	3	3		2	2	2		2	2	2		1	1	1		3	3	3		2	2	2		0	0	0	
	Light	2	2	2		4	4	4		3	3	3		3	3	3		2	2	2		3	3	3		0	0	0	

2.4. P/R Computation Form for Ex-samples of PR Survey Results

Summary of SRUQ

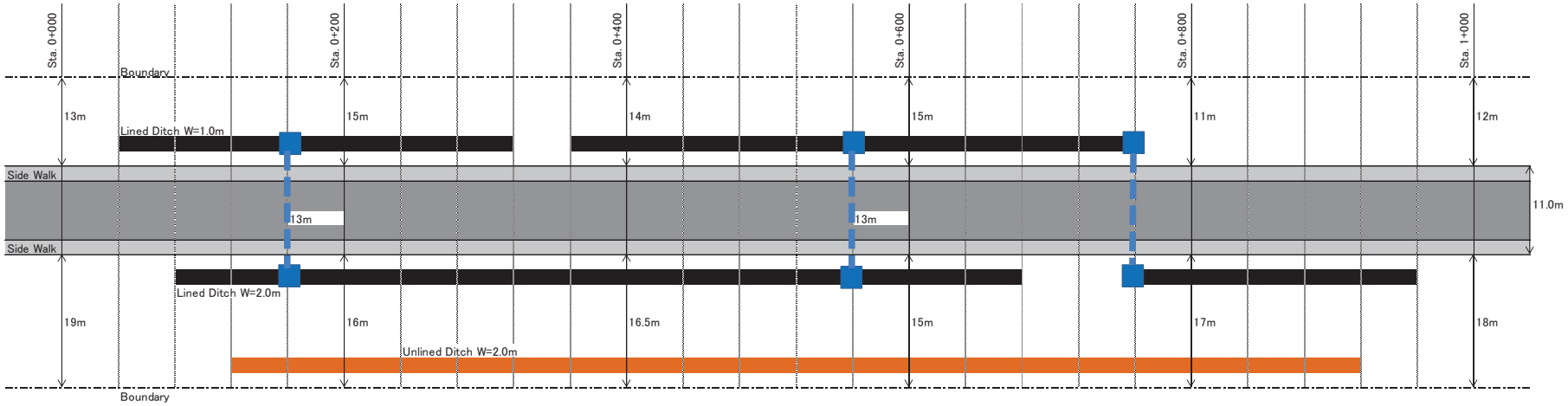
		Simple	Actual	Person*day	P/R(Actual)	SRUQ(Actual)	SRUQ(Actual)*1000	Simple/Actual	Actual/Simple	P/R(Simple)	SRUQ(Simple)	SRUQ(Simple)*1000
Grass Cutting(m2)	Heavy	160,000	60,100	621.429	96.7	0.01033991	10.34			279.6	0.003576508	3.58
	Normal	213,000	71,260	148.000	481.5	0.002076901	2.08			1,392.0	0.000718387	0.72
	Light	153,000	50,580	42.857	1,180.2	0.000847314	0.85			3,412.0	0.00029308	0.29
	Total(Ave.)	526,000	181,940	812	224.0	0.00446458	4.46	289%	35%	647.6	0.001544269	1.54
Cross Culvert(m)	Heavy	162	108	16.143	6.7	0.149470899	149.47			9.7	0.103479853	103.48
	Normal	282	198	3.429	57.8	0.017316017	17.32			83.4	0.011988012	11.99
	Light	336	234	2.786	84.0	0.011904762	11.90			121.3	0.008241758	8.24
	Total(Ave.)	780	540	22	24.2	0.041402116	41.40	144%	69%	34.9	0.028663004	28.66
Catch Basin(pcs)	Heavy	12	8	8.857	0.9	1.107142857	1,107.14			1.3	0.757518797	757.52
	Normal	13	9	2.000	4.5	0.222222222	222.22			6.6	0.152046784	152.05
	Light	13	9	1.000	9.0	0.111111111	111.11			13.2	0.076023392	76.02
	Total(Ave.)	38	26	12	2.2	0.456043956	456.04	146%	68%	3.2	0.312030075	312.03
Lined Side Ditch(m)	Heavy	2,400	1,240	80.714	15.4	0.065092166	65.09			28.6	0.034927504	34.93
	Normal	2,360	1,440	31.429	45.8	0.021825397	21.83			85.4	0.011711189	11.71
	Light	1,800	840	1.286	653.3	0.001530612	1.53			1,217.6	0.000821304	0.82
	Total(Ave.)	6,560	3,520	113	31.0	0.032224026	32.22	186%	54%	57.8	0.017290941	17.29
Unlined Side Ditch(m)	Heavy	1,920	1,040	27.143	38.3	0.026098901	26.10			79.0	0.012654013	12.65
	Normal	3,320	1,560	17.571	88.8	0.011263736	11.26			183.1	0.005461205	5.46
	Light	2,680	1,240	2.429	510.6	0.001958525	1.96			1,053.1	0.000949588	0.95
	Total(Ave.)	7,920	3,840	47	81.5	0.012276786	12.28	206%	48%	168.0	0.005952381	5.95
Carrageway De-silting(m2)	Heavy	10,000	1,420	29.000	49.0	0.020422535	20.42			321.1	0.003114437	3.11
	Normal	4,000	640	5.286	121.1	0.008258929	8.26			794.0	0.001259487	1.26
	Light	10,000	1,600	5.786	276.5	0.003616071	3.62			1,813.4	0.000551451	0.55
	Total(Ave.)	24,000	3,660	40	91.3	0.010948478	10.95	656%	15%	598.9	0.001669643	1.67

After Correction

		P/R(Actual)	Remarks	SRUQ(Actual)	SRUQ(Actual)*1000	Simple/Actual	Actual/Simple	P/R(Simple)	SRUQ(Simple)	SRUQ(Simple)*1000
Grass Cutting(m2)	Heavy	97		0.01033991	10.34			290.1	0.003446637	3.45
	Normal	481		0.002076901	2.08			1,444.5	0.0006923	0.69
	Light	1,180		0.000847314	0.85			3,540.6	0.000282438	0.28
	Total(Ave.)	224		0.00446458	4.46	300%	33%	672.0	0.001488193	1.49
Cross Culvert(m)	Heavy	7		0.149470899	149.47	(Assumption;3:1)		9.7	0.103479853	103.48
	Normal	58		0.017316017	17.32			83.4	0.011988012	11.99
	Light	84		0.011904762	11.90			121.3	0.008241758	8.24
	Total(Ave.)	24		0.041402116	41.40	144%	69%	34.9	0.028663004	28.66
Catch Basin(pcs)	Heavy	1		1.107142857	1,107.14			2.7	0.369047619	369.05
	Normal	5		0.222222222	222.22			13.5	0.074074074	74.07
	Light	9		0.111111111	111.11			27.0	0.037037037	37.04
	Total(Ave.)	2		0.456043956	456.04	300%	33%	6.6	0.152014652	152.01
Lined Side Ditch(m)	Heavy	15		0.065092166	65.09	(Assumption;3:1)		28.6	0.034927504	34.93
	Normal	46		0.021825397	21.83			85.4	0.011711189	11.71
	Light	653		0.001530612	1.53			1,217.6	0.000821304	0.82
	Total(Ave.)	31		0.032224026	32.22	186%	54%	57.8	0.017290941	17.29
Unlined Side Ditch(m)	Heavy	38		0.026098901	26.10			79.0	0.012654013	12.65
	Normal	89		0.011263736	11.26			183.1	0.005461205	5.46
	Light	511		0.001958525	1.96			1,053.1	0.000949588	0.95
	Total(Ave.)	81		0.012276786	12.28	206%	48%	168.0	0.005952381	5.95
Carrageway De-silting(m2)	Heavy	49		0.020422535	20.42			321.1	0.003114437	3.11
	Normal	121		0.008258929	8.26			794.0	0.001259487	1.26
	Light	277		0.003616071	3.62			1,813.4	0.000551451	0.55
	Total(Ave.)	91		0.010948478	10.95	656%	15%	598.9	0.001669643	1.67

3. Analysis of Standardized Quantity Survey

3.1. Ex-sample of Survey Results (2 lanes road)



3.2. Results of Survey (2 lanes road)

Summary of Standardized Quantity Survey (Simple Q'ty)

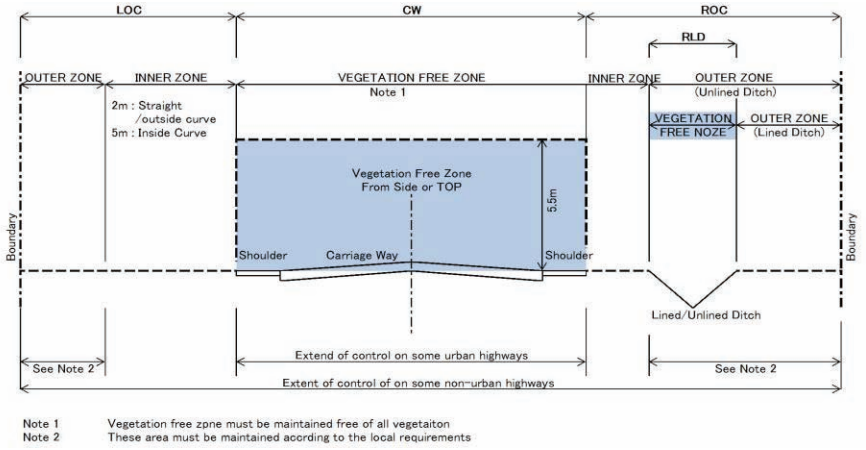
Road Name Ngong Road

Location From Prestige towards Ngong

Lengh 1 km

Work Item	Unit	Quantity	Remarks
Grass Cutting	m2	27,900	
Cross Culvert	m	39	
Catch Basin	pcs	6	
Lined Ditch	m	1,460	
Unlined Ditch	m	740	
Carriage Way Cleaning	m2	2,000	L x 2m

Simple Quantity Survey for Lined/Unlined Ditch



Note 1 Vegetation free zone must be maintained free of all vegetaiton
Note 2 These area must be maintained acording to the local requirements

Station	Distance (D)	Left		Center	Right		Grass Cutting Width	Grass Cutting Width	Grass Cutting Area	Cum. Grass cutting area
		Lined Ditch	Inner & Outer Zone	Carriage Way	Inner & Outer Zone	Lined Ditch				
		LLD	LOC	CW	ROC	RLD	LOC+ROC-LLD-RLD	Average (W)	Average (D)x(W)	
0+000		0	13	11	19	0	32			
0+200	200	1	15	11	16	2	28	30	6,000	6,000
0+400	200	1	14	11	16.5	2	27.5	27.75	5,550	11,550
0+600	200	1	15	11	15	2	27	27.25	5,450	17,000
0+800	200	0	11	11	17	2	26	26.5	5,300	22,300
1+000	200	0	12	11	18	0	30	28	5,600	27,900

Note) LOC :Left Off Carriageway

Simple Quantity Survey for Lined/Unlined Ditch

Left				
Lined or Unlined	From	To	Length	
			Lined	Unlined
Lined	0+060	0+320	260	0
Lined	0+360	0+400	40	0
Lined	0+400	0+600	200	0
Lined	0+600	0+760	160	0
				0
				0
				0
				0
				0
				0
				0
				0
				0
Total			660	

Right				
Lined or Unlined	From	To	Length	
			Lined	Unlined
Lined	0+080	0+200	120	0
Lined	0+200	0+400	200	0
Lined	0+400	0+600	200	0
Lined	0+600	0+680	80	0
Lined	0+760	0+960	200	0
Unlined	0+120	0+200		80
	0+200	0+400		200
	0+400	0+600		200
	0+600	0+800		200
	0+800	0+860		60
Total			800	740

Simpe Quantity Survey for Catch Basin

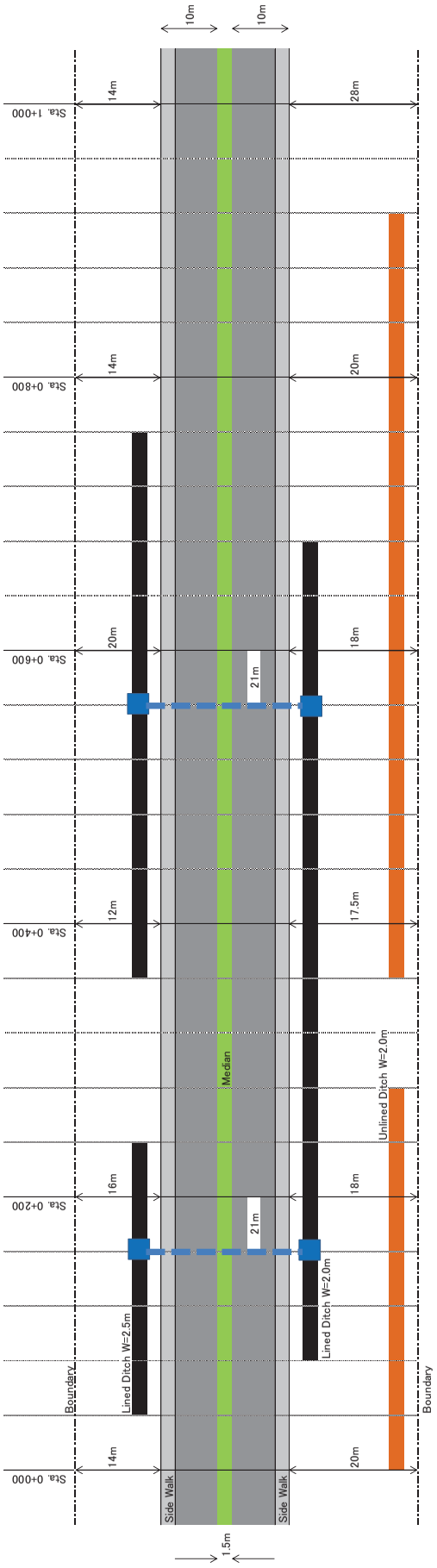
Left	
At	Number
0 + 160	1
0 + 450	1
0 + 760	1
Total	3

Right	
At	Number
0 + 160	1
0 + 560	1
0 + 760	1
Total	3

Simpe Quantity Survey for Cross Culvert

At	Length (m)
0 + 160	13
0 + 560	13
0 + 760	13
Total	39

3.3. Ex-sample of Survey Results (4 lanes road)



3.4. Results of Survey (4 lanes road)

Summary of Standardized Quantity Survey (Simple Q'ty)

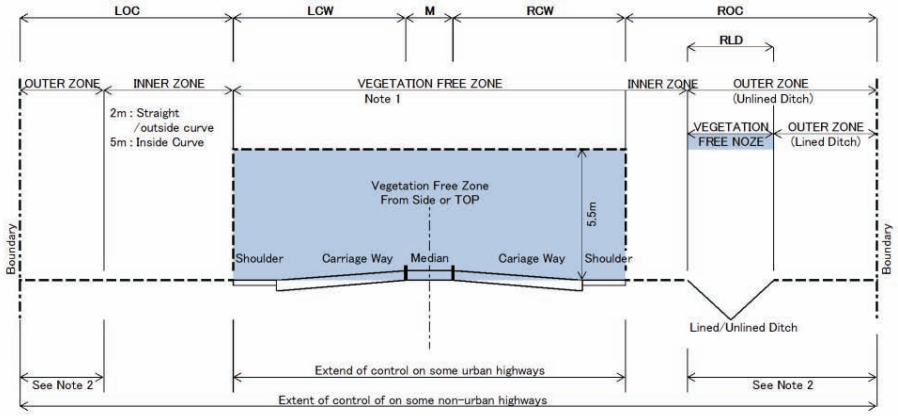
Road Name Ngong Road

Location From Prestige towards Ngong

Lengh 1 km

Work Item	Unit	Quantity	Remarks
Grass Cutting	m2	7,900	
Cross Culvert	m	42	
Catch Basin	pcs	4	
Lined Ditch	m	1,200	
Unlined Ditch	m	840	
Carriage Way Cleaning 4 Lanes	m2	4,000	L x 2m x 2

Simple Quantity Survey for Lined/Unlined Ditch



Note 1 Vegetation free zpne must be maintained free of all vegetaiton
Note 2 These area must be maintained accrding to the local requirements

Station	Distance	Left			Center	Right			Grass Cutting Width	Grass Cutting Width	Grass Cutting Area
		Lined Ditch	Inner & Outer Zone	Carriage Way	Median	Carriage Way	Inner & Outer Zone	Lined Ditch			
		LLD	LOC	LCW	M	RCW	ROC	RLD	LOC+M+ROC-LLD-RLD	Average	Average
0+000		0.0	14.0	10.0	1.5	10.0	20.0	0.0	35.5		
0+200	200	2.5	16.0	10.0	1.5	10.0	18.0	2.0	31.0	33.3	6,650.0
0+400	200	2.5	12.0	10.0	1.5	10.0	17.0	2.0	26.0	28.5	5,700.0
0+600	200	2.5	20.0	10.0	1.5	10.0	18.0	2.0	35.0	30.5	6,100.0
0+800	200	0.0	14.0	10.0	1.5	10.0	20.0	0.0	35.5	35.3	7,050.0
1+000	200	0.0	14.0	10.0	1.5	10.0	28.0	0.0	43.5	39.5	7,900.0
											33,400.0

Note) LOC : Left Off Carriageway

Simple Quantity Survey for Lined/Unlined Ditch

Left				
Lined or Unlined	From	To	Length	
			Lined	Unlined
Lined	0+040	0+240	200	0
Lined	0+360	0+400	40	0
Lined	0+400	0+600	200	0
Lined	0+600	0+760	160	0
				0
				0
				0
				0
				0
				0
				0
				0
				0
				0
				0
Total			600	

Right				
Lined or Unlined	From	To	Length	
			Lined	Unlined
Lined	0+080	0+200	120	0
Lined	0+200	0+400	200	0
Lined	0+400	0+600	200	0
Lined	0+600	0+680	80	0
Unlined	0+000	0+200		200
	0+200	0+280		80
	0+360	0+400		40
	0+400	0+600		200
	0+600	0+800		200
	0+800	0+920		120
Total			600	840

Simpe Quantity Survey for Catch Basin

Left	
At	Number
0 + 160	1
0 + 450	1
Total	2

Right	
At	Number
0 + 160	1
0 + 560	1
Total	2

Simpe Quantity Survey for Cross Culvert

At	Length (m)
0 + 160	21
0 + 560	21
Total	42

Appendix 9: Recommendations by KRB on Indirect Cost, Overhead/Profit and Build-up of Unit Rates

KENYA ROADS BOARD
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Financing Road Maintenance

13th October, 2015

KRB/PP /38.00/ A/Vol. IV (32)

JICA Experts (KeNHA)
P.O Box 49712 - 00100
NAIROBI.

Attn. Mr Hiroshi Tsujino

Dear Sir,

RE: FINAL DRAFT ON COST ESTIMATION MANUAL FOR ROAD MAINTENANCE UNDER PERFORMANCE BASED CONTRACTS

KRB has reviewed the CEM submitted vide email on 17th September, 2015. KRB would like to commend JICA for the well prepared guidelines which will contribute to improvement in planning and implementation of procurement of road maintenance works in the country.

KRB recommends for a further review of the following unit rates in the cost estimation manual:

1. **Indirect Cost** – The example given in Table 6.4 is for projects in Japan and may not be applicable in Kenyan context. It is recommended that a review of road infrastructure projects is carried out to determine the % of indirect costs. In the interim, it is proposed that the percentage of indirect cost is set to a maximum 30% of direct cost, just like other classical road contracts.
2. **Overhead & Profit** – The example given in Table 6.4 is for projects in Japan and may not be , applicable, in Kenyan context. It is recommended that a review of road, infrastructure projects is, carried out to determine the % of indirect costs In the interim, it is proposed that the maximum percentage for profit and overheads margin is set at 10% of direct and indirect cost. The manual should also clearly state that the profit margin and other overheads include those directly incurred by the contractor but not the client. .

3. **Labour Cost** – These costs should be based on gazetted Government wage rates by Region and occupation as issued by the Ministry of Labour.

4. **Vehicle Costs** – These rates should be based on rates from Government Mechanical and Transport Services of Ministry of Transport and Infrastructure, Mechanical and Transport Division as reviewed from time to time.

5. **Fuel Cost –** The fuel rates used should be those provided by the Energy Regulatory Commission of Kenya.

This is submitted for your information and further action.

Yours faithfully,

CP A Rashid Mohamed,
General Manager, Finance
FOR: EXECUTIVE DIRECTOR

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Eng. Margaret Ogai	Kenya Roads Board
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Winnie Owiti	Kenya National Highways Authority
Opuge Ephraim	Kenya National Highways Authority
Eunice Wanjiru	Kenya National Highways Authority
Julius Kaliti	Kenya Institute of Highways and Building Technology
Walter Ochieng	Kenya Wildlife Services
Eng. Maurice Akech	National Construction Authority
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SEAMLESS CONNECTIVITY

MINISTRY OF TRANSPORT AND INFRASTRUCTURE

HARAMBEE

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