Nature & Development Foundation

INPUT AND OUTPUT VOLUME CALCULATION MANUAL

Nature & Development Foundation

PREPARED FOR PRIVATE SECTOR ENTERPRISES IN THE TIMBER SECTOR OF GHANA

BY

NATURE & DEVELOPMENT FOUNDATION (NDF) IN COLLABORATION WITH THE GHANA FORESTRY COMMISSION WITH FUNDING FROM UKAID.

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ACRONYMS

DOTIC	Domestic Timber inspection certificate
FLEGT	Forest Law Enforcement Governance and Trade
LIC	Log Inspection Certicate
LMCC	Log Measurement and Conveyance Certificate
LTC	Log Transfer Certificate
OWPIC	Other Wood Products Inspection Certificate
VPA	Voluntary Partnership Agreement

1 INTRODUCTION

1.1 Who can use the Training manual?

This manual can be used by all timber companies processing logs into timber products. Because of the peculiarity of a large sections of the targeted audience with technicalities in the timber sector, the manual is tailored towards their needs and answers questions and issues relating to their role in the supply of legal timber to both the domestic and international markets.

1.2 Objectives of Training Manual

The main objective of this training manual is to build the capacity of processing mills to comply with FLEGT compliance and address non-compliance to Ghana's Legality System. Specifically, this training manual is design to help millers to easily perform the input and output calculation of their wood products.

1.3 Design of Training Manual

This manual has been designed solely for the purpose of training and equipping millers with the requisite know-how on the harvesting and trading in legal wood in Ghana. This manual is not iterative, meaning it is not structured to be used in sequential manners. Where it deemed fit, the user can refer and apply. It is practical and results oriented.

2 CONSIGNMENT INPUT AND OUTPUT

The consignment input and output is defined as the efficiency of production done at the sawmills and or plymill. It is calculated as the production input of logs against product output. In other words, the volume of logs fed into a machine and the volume of desired/useful products (lumber, etc) that comes out of it.

2.1 Input Calculations

2.1.1 What is the input?

Input is the volume of the raw material that is milled to produce the desired wood product. This volume could be obtained from the Log cross-cut register or an LMCC/LTC.

The input volume is obtained from various sources depending on the product, but since the input/output is based on a mass balance approached, the primary input source is the log crosscut document, that is, Bolting document and LMCC.

2.2 How can one determine the input volume?

The input volume is determined from the source document i.e. LMCC/LTC or Log cross-cut register. For instance, if there are about 10 bolts (crosscut logs) in a crosscut register or LMCC and the processor selects five (5) of them to mill, s/he will add the individual volumes of the 5 bolts from the register and record them as the input volume.

The input volume can be determined using the diameter and length of the log. With these, the volume is calculated with the formula below:

$$Volume\ (m^3) = \frac{\pi}{4} * \left[\frac{D^2}{10000}\right] * L(m)$$

NB: *Alternatively, knowing the diameter at both ends of the log i.e Db and Dt, the length(L), and the Tree Bole,* Log Volume Ready Reckoner *can be used to determine the volume without any rigorous calculations.*

ACTIVITY 1

You are to select bolts from item numbers 2, 3, 7 and 8 (coloured) in the table below and use as input for the processing of lumber. What will be the input volume?

ITEM NO.	LMCC NO.	STOCK NO	SPP CODE	LOG NO	SUFFIX / BOLT	LEN	DB1	DB2	DT1	DT2	VOL
1	CR2020214	25	TRI	13-1	A	3.50	90	90	86	86	2.1
2	CR2020214	25	TRI	13-1	B	3.50	86	86	80	80	2.0
3	CR2020214	25	TRI	13-1	C	3.50	80	80	70	70	1.8
4	CR2020214	28	CEM	2-1	A	3.50	89	97	90	90	2.1
5	CR2020214	28	CEM	2-1	B	3.50	90	90	80	85	2.0
6	CR2020214	26	TRI	11-1	A	3.50	100	100	96	96	2.6
7	CR2020214	26	TRI	11-1	B	3.50	96	96	90	80	2.3
8	CR2020214	26	TRI	11-1	C	3.50	90	80	78	78	2.1
9	WR2020201	12	PIP	3-3	B	3.50	78	79	75	76	2.4
10	WR2020201	12	PIP	3-3	C	3.50	75	76	70	70	2.2
11	WR2020201	11	PET	17-1	A	3.50	110	120	10	103	5.4

2.3 What is the output?

Output is the aggregate of the volumes of the individual pieces of wood product that has been milled. For instance, if 82 pieces of "2 inches x 6 inches x 15 feet" of *Esa* was milled or produced from a bolt/log, the 82 pieces are the output of the log that was milled and the output volume is the aggregate volume of the 82 pieces.

2.3.1 How is the output volume determined?

Below is a step by step process of determining the output volume.

Output volume calculation = Specification x Quantity of consignment

Where specification is the dimension of each piece in the consignment

NB: *Because the volume of the consignment is calibrated in m3, the units of the dimensions is converted from inches and feet to meters.*

Hence, If 1 inch = 0.025 metres then 6 inches = 0.15 metres

If 15 feet = 4.5 metres, then 16 feet = 4.8 metres

Example: If the consignment is made up of:

ESA

2 inches x 6 inches x 15 feet = 82 pieces
(2 x 0.025)m x (6 x 0.025)m x 4.5m x 82

Therefore, the output is 2.768m³

WAWA

1 inch x 12 inches x 15 feet = 50 pieces
(1 x 0.025)m x (12 x 0.025)m x 4.5m x 50

Therefore, the output is 1.688m³

OTIE

2 inches x 8 inches x 16 feet = 37 pieces
(2 x 0.025)m x (8 x 0.025)m x 4.8m x 37

Therefore, the output is 1.776m³

Then, output volume is calculated as:

Esa = (0.05 m x 0.15 m x 4.5 m) x 82 = 2.768m³
Wawa = (0.025m x 0.3m x 4.5m) x 50 = 1.688m³
Otie = (0.05m x 0.2m x 4.8m) x 37 = 1.776m³

Refer to Appendices A for conversion table

2.3 Recovery Rate (Efficiency of Production)

This is the percentage of wood product that was made after the milling or processing of logs (input). It is calculated as the output volume divided by the input volume all multiplied by 100.

Recovery Rate (RC) = *Output/Input* x *100*

Example, with an output volume of 18.00m^3 and an input volume of 22.021m^3, the RC becomes (18.00/22.021) * 100

Thus the RC = 81.740%

This means that output of the bolts (logs) used for production was 81.740%.

3 IMPORTANCE OF INPUT/OUTPUT VOLUMES

3.1 Why should you bother about input/output volumes?

It is important for the miller/processor to bother himself/herself with the calculations of the input/output volumes because of the following reasons;

- Helps track production efficiency.
- Helps track the production efficiency - Keeping records of the volume of materials you fed into your mill and the volume of the desired products you obtained after production enables you to determine the ability (useful products and waste generated) of your production (Machine and Labour).
- Helps in cost benefits analysis - Through this, the operator/miller is able to determine whether he/she is making profit or loss after factoring in all the overheads.
- Links the certificate (LIC, OWPIC, DOTIC) to the source of raw material - The main objective of the FLEGT VPA is the traceability of wood products to the source. With this calculation which results in the issuance of DoTIC, LIC, etc,, it is easy to link the certificates(products) to the source making the product legal and fit for the market.
- Brings about efficiency - The input and output production as stated earlier gives an information of the recovery rates, so if recovery rate is low, the operator investigates and sees how to rectify the situation which could be re-tooling of the machinery at the mill.

ACTIVITY 2

1. Jesus is love sawmills produced 95 pieces of 2 inch x 6 inches x 15 feet by Odum from an input volume of 4.0234, calculate the recovery rate of the production?
2. Jesus reigns wood processing company produced 70 pieces of 1 inch x 12 x 16 from an input volume of 5.878, determine the recovery rate of the production?

4 CONCLUSION

With the current timber legality regime, it is necessary for all millers or their assigned to know how to calculate the input and output and determine the recovery rate in order to improve upon their efficiency, and also assist in reconciliation and traceability of their wood products. This would also save producers and buyers from falling foul of the law and from being harassed at the Forestry Commission checkpoints.

5 APPENDIX

Conversion Table for Most Common Lumber Dimension in Ghana
Imperial (inches & feet) to Metric (meters)

Imperial (Inch, inch & Feet)	Metric (mm, mm, m)	Volume (m^3)
Width X Thickness X Length	**Width X Thickness X Length**	**mm X mm X m/1000000**
1 X 1 X 16	25 X 25 X 4.8	0.003
1 X 1 X 12	25 X 25 X 3.6	0.002
1 X 12 X 14	25 X 300 X 4.2	0.032
1 X 12 X 15	25 X 300 X 4.5	0.034
1 X 12 X 16	25 X 300 X 4.8	0.036
2 X 2 X 14	50 X 50 X 4.2	0.0105
2 X 2 X 15	50 X 50 X 4.5	0.01125
2 X 2 X 16	50 X 50 X 4.8	0.012
2 X 3 X 14	50 X 75 X 4.2	0.016
2 X 3 X 15	50 X 75 X 4.5	0.017
2 X 3 X 16	50 X 75 X 4.8	0.018
2 X 4 X 14	50 X 100 X 4.2	0.021
2 X 4 X 15	50 X 100 X 4.5	0.023
2 X 4 X 16	50 X 100 X 4.8	0.024
2 X 6 X 14	50 X 150 X 4.2	0.032
2 X 6 X 15	50 X 150 X 4.5	0.034
2 X 6 X 16	50 X150 X 4.8	0.036
2 X 8 X 15	50 X 200 X 4.5	0.046

Legend: 1 inch = 25mm, 1 feet = 0.30 m **Volume (m^3) = thickness * width*length/ 1000000**

Courtesy KWC, EU, Ukaid, FAO, Swedish Government

NOTES

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