Excellence Through Precision & Integrity

Teclab ltd THE ENGINEERS LABORATORY

Uganda
Rwanda
Tanzania

CERTIFICATE OF ANALYSIS

Date: 29-Mar-18

1. Project: Design of improved stove that uses high density rocks to maintain heat
2. Client: Mr Asiimwe Antony Bantu & Nuwagaba Gilbert
3. Samples Description: 14/10 mm Hand Crushed Aggregates
4. Nature of test: Specific Gravity, Water Absorption
5. Test Method: AASHTO T84/85
6. Sample Ref. 2018/S118
7. Results: As Summarised below

Summary of Laboratory Test Results

Sample Test Identification	Spcific Gravity	Water Absorption (%)
14/10 mm Hand Crushed Aggregates	2.72	0.42

8. Remarks
8.1 This report relates only to the samples tested.
8.2 All tested samples will be immediately discarded after receipt of results by the client

Checked by

Arthur Mutabazi
Materials Engineer
Teclab Ltd

Approved by:

TECLAB LIMITED THE ENGINEERS LABORATORY P. O. BOX 24934, KAMPALA

Alex Ssenyondo Mulira
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Figure S1: Certificate of analysis for specific gravity and water absorption tests carried out

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Determination of Aggregate Relative Density

Project :	Design of improved stove that uses high density rocks to maintain heat		
Project No:	2018/S112		
Client:	Mr Asiimwe Antony Bantu & Nuwagaba Gilbert		
Location	N/A	**Sampling date:**	26-Mar-18
Aggregate size :	14/10	**Testing date:**	26-Mar-18
Sample Reference	S1		
Description of aggregates:	14/10 hand crushed single size aggregates		
Ref :	**AASHTO T84/85**		

Sample No.		1	2	
Weight of oven dry sample in air , A	g	824.7	811.4	
Weight of saturated surface dry sample in air (SSD) , B	g	828.5	814.4	
Absorption (%) = ((B-A)/A)*100		0.46	0.37	

Technician *(Signature)* :	**Checked by** *(Signature)* :	**Approved by** *(Signature)* :

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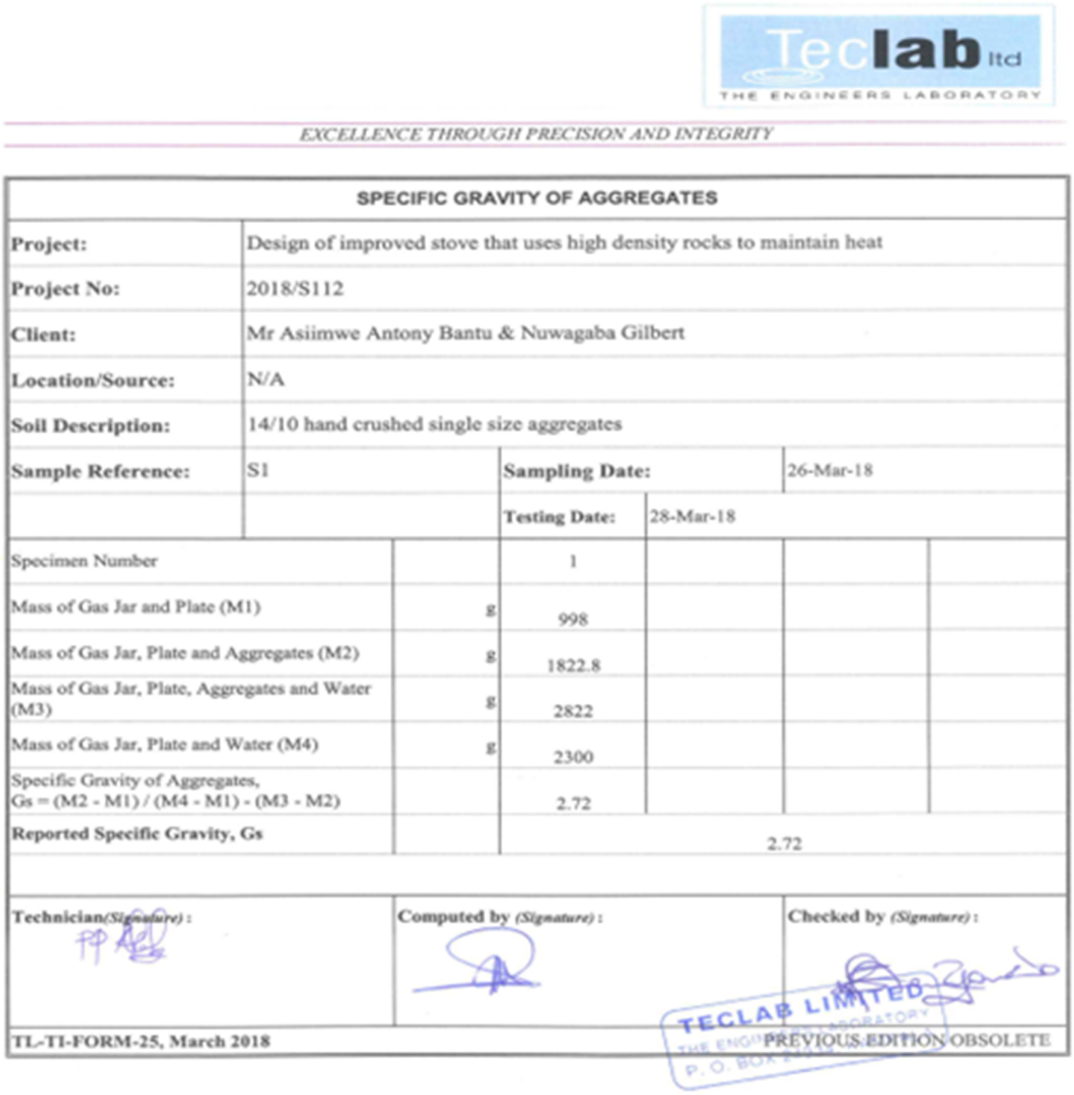
Figure S2: Water absorption results for granite rock aggregates



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SPECIFIC GRAVITY OF AGGREGATES

Project:	Design of improved stove that uses high density rocks to maintain heat					
Project No:	2018/S112					
Client:	Mr Asiimwe Antony Bantu & Nuwagaba Gilbert					
Location/Source:	N/A					
Soil Description:	14/10 hand crushed single size aggregates					
Sample Reference:	S1		**Sampling Date:**		26-Mar-18	
			Testing Date:	28-Mar-18		
Specimen Number		1				
Mass of Gas Jar and Plate (M1)	g	998				
Mass of Gas Jar, Plate and Aggregates (M2)	g	1822.8				
Mass of Gas Jar, Plate, Aggregates and Water (M3)	g	2822				
Mass of Gas Jar, Plate and Water (M4)	g	2300				
Specific Gravity of Aggregates, Gs = (M2 - M1) / (M4 - M1) - (M3 - M2)		2.72				
Reported Specific Gravity, Gs		2.72				

Technician *(Signature)* :

Computed by *(Signature)* :

Checked by *(Signature)* :

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Figure S3: Specific gravity results for granite rock aggregates

NARO

NaFORRI

NATIONAL FORESTRY RESOURCES RESEARCH INSTITUTE

P O Box 1752, Kampala; Tel: 071 161161, 0752 161161 Fax: 0414 383028
E-mail: naforridir@infocom.co.ug

Date: 6th April, 2018

Name of client: Mr. Asiimwe Anthony Bantu and Mr. Nuwagaba Gilbert
Description of sample: Granite rock
Sample Number: NaFF/0002/UCU/3/4/2018
Origin: East African Granite, Nyagatare-Rwanda
Initial weight: 401.65g
Activity: Thermal test
Receipt Date: 2nd April 2018
Test Method: Oven heating

RESULTS

Maximum temperature of granite in the stove: 150°C			
Start Time: 1:50pm			
S/n	Time (minutes)	mass (g)	Temperature (°C)
1	0	401.65	24.8
2	20	401.34	220
3	40	401.24	293
4	60	401.24	284
5	80	401.22	289
6	100	401.22	292
7	120	401.21	294

Checked by:

Name: NYABIZI GEORGE Date: 6/4/18
Senior Technician

Approved by:

Name: Turinayo Yonah Date: 6th/4/2018
Research Scientist

DIRECTOR
NATIONAL FORESTRY RESOURCES
RESEARCH INSTITUTE

Figure S4: Thermal test results

NARO

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P O Box 1752, Kampala; Tel: 071 161161, 0752 161161 Fax: 0414 383028
E-mail: naforridir@infocom.co.ug

Date: 6th April, 2018

Name of client: Mr. Asiimwe Anthony Bantu and Mr. Nuwagaba Gilbert
Description of sample: Charcoal stove prototype
Sample Number: NaFF/0001/UCU/3/4/2018
Activity: Water boiling test (WBT)
Receipt Date: 2nd April 2018
Test Method: Volunteer in Technical Assistance (VITA) protocol

RESULTS

SUMMARY RESULTS

			Tests (n = 4)					
S/n	Performance measuress	Unit of measure	1	2	3	4	MEAN	STDEV
1	Thermal efficiency	%	24.8	29.4	35.7	25.2	28.8	5.1
2	Water boiling rate	min/ltr	14.9	15.5	14.1	14.8	14.8	0.6
3	Specific fuel consumption	g/liter water boiled	53.1	45.0	36.0	53.7	47.0	8.3
4	Fire power	W	1773.8	1443.8	1273.5	1800.4	1572.9	257.2
5	Fuel Use Reduction	%	76.1	79.7	83.8	75.8	78.8	3.7

PRIMARY DATA

			Tests (n = 4)					
S/n	Parameters	Unit of measure	1	2	3	4	MEAN	STDEV
1	Thermal efficiency	%	24.8	29.4	35.7	25.2	28.8	5.1
2	Mass of water boiled	g	2925	2875	2850	2800	2862.5	52.0
3	Specific heat capacity of water	J/g°C	4.186	4.186	4.186	4.186	4.186	0
4	Water boiling temperature	°C	96.8	96.8	96.8	96.8	96.8	0
5	Initial water temperature before test	°C	24.7	24.5	21.8	23.2	23.55	1.34
6	Water vaporised	g	100	100	75	100	93.75	12.5
7	Latent heat of veporisation	J/g	2260	2260	2260	2260	2260	0
8	Fuel consumed	g	150	125	100	145	130	23
9	Lower Heating Value of char (LHV)	J/g	29800	29800	29800	29800	29800	0
10	Effective mass of water boiled	g	2825.00	2775.00	2775.00	2700.00	2768.75	51.54
11	Time to boiling water	min	42.00	43.00	39.00	40.00	41.00	1.83
12	Water boiling rate	min/ltr	14.87	15.50	14.05	14.81	14.81	0.59
13	Fuel consumed	g	150.00	125.00	100.00	145.00	130.00	22.73
14	Specific fuel consumption	g/liter water boiled	53.10	45.05	36.04	53.70	46.97	8.29
15	Fire power	W	0.00	0.00	0.00	0.00	0.00	0.00
16	Specific fuel consumption - 3-stone stove (Kris De Decker, 2015)	g/liter water boiled	222	222	222	222	222	0
17	Fuel Use Reduction	%	76.08	79.71	83.77	75.81	78.84	3.73

Checked by:

Name: NIYIBIZI GEORGE Date: 6/4/18
Senior Technician

Approved by:

Name: Turinayo Yonah K Date: 6th/4/2018
Research Scientist

DIRECTOR
NATIONAL FORESTRY RESOURCES
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Figure S5: Water boiling test results