IMPACT OF WEATHER ON THE OUTPUTS OF MASONS IN THE NIGERIAN CONSTRUCTION SITES
(A Case Study of Abuja, North-Central Nigeria)

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ABSTRACT

Labour productivity is not a new concept in the Nigerian building industry. What is new is the non-inclusion of environmental factors that influence the output of labour on construction sites. This has been a major bane to the productivity of artisans on the construction sites. This paper aims to examine the effect of weather (site temperature) on the output of construction operatives. The objective is to determine the mean output per day of a gang of masons working on blockwork operation in the substructure and superstructure. The area of study was Abuja, the Federal Capital of Nigeria. Seventy (70) operatives were purposively sampled in thirty (30) selected construction sites. The masonry works selected were limited to blockwork operations in the locations specified by Building and Engineering standard of Measurement. The operatives were observed on daily basis on site. Stopwatch and thermometer were employed to measure the time taken to execute a given task at a specific site temperature. The paired sampled T-test was employed to evaluate the extent of effect of the site temperature on the outputs of sampled masons. The results of the analysis show a probability value of 0.000 in wall operations to 0.0325 in pit operation which implies that there is a significant relationship between the site temperature and outputs of masons working on wall operation compared to operations in pit. Therefore, it was concluded that as site temperature increases, the output of masons on wall operations reduces. It is recommended that labour outputs recorded for categories of operations should be adopted by building professionals and contractors in the area of study rather than the continuous usage of labour standard inherited from British colonialist. In addition, construction activity should start early enough on daily basis on site in the sampled area before fatigue sets in.

Keyword: construction, environmental, labour, measurement, productivity.

1. INTRODUCTION

Generally, construction projects in most developing nations are dependent on labour equipped with basic hand tools and equipment especially in Nigeria. Thus, labour cost of construction project ranges from 25 to 50 per cent of the total cost of project works (Gichuchi, 2013). In the view of Ghate and Minde (2016), labour is a critical asset to a construction company. In spite of many technological advances, construction activities cannot be completed without manpower. The quality of the construction largely depends upon the quality of work done by labour. Hence, labour productivity directly affects construction productivity (Mohammed, 2016). An industry ultimately thrives upon the physical input put in by the labourers and the construction industry is no exception, in fact the construction industry is one of the most labour dependent industries operating in Nigeria. It is the groundwork of the labourers, which ultimately runs this industry. Improvement in the productivity of the construction industry has a positive impact on all other industries, as well as on the national economy (Duncan 2002).

Though lot of work has already been done to optimize labour productivity around the world, majority of the projects still stay behind schedule and are completed with cost and time overruns, though this might be due to multiple reasons but labour productivity still dominates the final output. (UK Essay, 2018). According to AWX (2016), different seasons entail their own weather dangers for construction workers, depending on the region they are operating in. In many areas, summer brings extremely high temperatures, dust and potentially even wildfires. These factors can present a threat to worker health and safety. Winter, meanwhile, brings a different set of challenges altogether. Rain and cold can make surfaces slippery, which can be dangerous for labourers walking around a site, and can affect the safety of job using equipment such as scaffolding and ladders, and jobs involving forklifts. Strong winds can be hazardous when working at heights or with machinery such as cranes. In addition, stormy weather can reduce visibility, and there is even a chance of being struck by lightning when in high position, if a small one. These factors can in turn affect labour outputs. Construction artisans are faced with unprecedented weather conditions as extreme cold and heat stress combined with other geographical factors lead to the difference in productivity achieved in normal weather conditions.

Labour productivity measures the overall effectiveness of an organisational system in utilising labour, equipment and capital to put labour efforts into useful output. Poor labour productivity of craftsmen causes cost overrun on building projects and an increase in labour output causes real income and a good standard of living for craftsmen in an economy (Sarri, 2006). The most frequent discussed issue in general management is labour productivity. This is due to the fact that any improvement to the productivity of construction works must have labour as a prime target (Tran and Tookey, 2011).

The inability to determine accurately the labour output on daily basis has contributed to site disputes. Since timely execution of construction projects in Nigeria rely heavily on the human resource as most construction projects are labour intensive. The question that may readily come to mind is what is the effect of site temperature on the output of artisans for masonry works? It is therefore necessary to evaluate the effect of site temperature on masons' outputs for residential construction works by focusing on a selected masonry work using Abuja as a case study.

2. LITERATURE REVIEW

It is common especially in the developing countries to see construction workforce as an important input acquiring a large proportion in the project costs (Kazaz, Manisali and Serdar, 2008) In the same vein, labour-intensive industries, such as construction, are considered high-risk by contractors due to their relatively high labour components. Therefore, understanding the effects of weather on construction labour productivity is crucial (Hanna, Taylor and Sullivan 2005). Kjellstrom, Kovats, Lloyd and Tol (2009) explained that the changing pattern of temperatures across the globe will ultimately lead to a global climate change and an increase in heat load will degrade the productivity of workers in the coming future. In his own view, Diedericks (2009) stated that any temperature below 20^0 F on the construction site will give an average loss of labour productivity up to 50%.

AbouRizk (2011) developed a simulation based framework for quantifying the cold weather region impacts on construction schedules, the framework composed of components that help in understanding and simulating construction projects. This will enable the building professional to quantify the impact of weather alterations on project schedule.

According to Lundgren, Karin, Kuklane, Kalev, Gao, Chuansi, Holmér and Ingvar (2013), heat stress on workers had negative impacts on the productivity overall and the ideal temperature for physical work should be 37^0C. Any more beyond this, will result in physiological effects in the human body thereby reducing its capacity to perform productively. Meglan (2018) subdivided the loss of productivity due to effects of weather into three categories; Low temperature and Wind chill, high temperature and humidity & Wind only effects. The loss of productivity occurs in all three conditions due to different factors in each conditions. It is established that change in humidity also played a detrimental role in the productivity loss of workers on site.
The study employs the work measurement theory that rely on direct observation of the work (directly observation techniques). The direct time study involves the direct stop watch time study of the total time elapse of a given task.

3. RESEARCH METHODOLOGY

The methodology adopted for this paper involved the selection of (blockwork) under masonry work in Building and Civil Engineering Method of Measurement (BESMM 4). The choice of blockwork in masonry trade was considered necessary as it represents 65 per cent of the material used for residential bungalow construction in Abuja. The blockwork item was categorized according to the location/depth /height as follows -:

i. Blockwork in foundation with width exceeding 225mm, 1.0m to 4.0m depth below the earth surface. (Gang Size: - 1 Mason: 2 Labourers and 2 Mason: 3 Labourers).
ii. Blockwork on oversite concrete in wall exceeding 300mm width 1.0m to 2.5m high. (Gang Size 1Mason: 2 Labourers).

It is assumed that differential in weight and thickness of 225mm blocks used on sites were taken to be constant and the sites visited in Abuja started construction of residential buildings at the same time.
Lastly, it is assumed that all the masons observed had trade permit, adequate experience and labourers were assumed to have the same common capability, strength and experience.

The data generated through direct observation of workers and the usage of stop watch on sites were categorised according to output per hour, output per day, and output of mason according to depths, widths, location, and method of placement, number of gangs per operations, weather and climatic conditions. The sampled sites were visited daily in order to observe labour productivity.
Population of the study comprised of 30 purposively sampled gang of masons working on on-going residential constructions in Abuja. The choice of Abuja is influenced by the fact that majority of medium scale construction firms having on-going building construction

sites listed in the Real Estate Developer Association of Nigeria (REDAN) are located in Abuja.

The sampled sites were visited daily and the records of operation were taken in such a way that Hawthorne or Placebo effects were minimized. This is a phenomenon whereby workers tend to improve upon their natural productivity level when being directly observed. The outputs of masons were calculated, taken into consideration the time taken to execute a specific task and the quantity of work done in blockwork operation within the observed time.

Table 3.00 DATA ON THE IMPACT OF SITE TEMPERATURE ON LABOUR OUTPUTS IN BLOCKWORK OPERATIONS

BLOCKWORKS IN SUPERSTRUCTURE				MORNING 8.30-12.30AM						AFTEN SESSION 1.00-5.30PM								
S/N	PROJECT LOCATION	OPERATION LOCATION		GANG SIZE	HEIGHT metres	BLOCK THICKN	NO OF BLK LAID	MORN (AM) TIME SPENT	MORN OUTPUT	NO OF BLK LAID	AFTEN AFTN (PM)	AREA SQ.M	AFTN OUTPUT	TIME SPENT MIN/ HR	BLK LAID	TOTAL SQ.M	MORNG TEMP	AFTN TEMP (^{O}C)
1	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	45	2.25	2	40	2.1666667	4	2	4.416667	85	8.5	27	35
2	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	52	1.7333333	2	42	2.3666667	4.2	2	4.1	94	9.4	32	36
3	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	50	2	2.99999994	48	3	4.8	3	5	98	9.8	32	36
4	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	50	1.9	2	45	2.5666667	4.5	2.4	4.466667	95	9.5	32	34
5	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	42	3.5	3	47	1.5666667	4.7	2.999999936	5.066667	89	8.9	33	36
6	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	55	3.4166667	2	58	2.15	5.8	2	5.566667	113	11.3	28	37
7	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	45	2.3	1.96	62	2.8	6.2	2.2	5.1	107	10.7	27	35
8	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	48	2	2.4	56	2.6	5.6	2.15	4.4	104	10.4	27	33
9	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	52	1.89	2.75	48	3	4.8	1.6	4.89	100	10	30	34
10	ABUJA	Superstru	WALL	1mas, 2 lab	1	225mm	56	2.55	2.2	60	2	6	3	4.55	116	11.6	28	36
11	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	45	3	2	42	1.5	4.2	3	4.5	87	8.7	26	33
12	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	42	2.1	2.928571429	40	1.3333333	4	3.000000075	3.433333	82	8.2	26	35
13	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	48	4	2	48	2.4	4.8	2	6.4	96	9.6	25	36
14	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	42	3.5	1.199999987	52	2.6666667	5.2	1.199999985	6.166667	94	9.4	27	35
15	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	44	2.9333333	1.199999985	53	3	5.3	1.2	5.933333	97	9.7	28	37
16	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	35	2.8333333	1.200000014	45	2.8	4.5	1.5	5.633333	80	8	30	36
17	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	46	2.3	2	55	2.5	5.5	2.2	4.8	101	10.1	29	35
18	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	41	3	1.37	48	2.4	4.8	2	5.4	89	8.9	28	35
19	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	52	2.8	1.86	56	3.1	5.6	1.8	5.9	108	10.8	28	33
20	ABUJA	Superstru	WALL	1mas, 2 lab	1.5	225mm	48	2	2.4	61	2.68	6.1	2.28	4.68	109	10.9	30	35
21	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	38	2.5	1.799999964	43	1.75	4.3	2	4.25	81	8.1	28	36
22	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	40	3.3333333	2.8	45	2.25	4.5	2	5.583333	85	8.5	29	33
23	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	42	2.15	1.953488372	45	2.2	4.5	1.727272727	4.35	87	8.7	28	33
24	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	38	3.8	1.199999987	42	2.6666667	4.2	1.499999981	6.466667	80	8	30	36
25	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	41	1.95	2	40	2.15	4	2	4.1	81	8.1	32	37
26	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	43	2.4166667	1.986206869	48	1.6666667	4.8	2.099999958	4.083333	91	9.1	27	36
27	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	37	2.2	2	42	2.1333333	4.2	1.500000023	4.333333	79	7.9	30	35
28	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	37	2.5	1.96	45	1.9	4.5	2	4.4	82	8.2	31	37
29	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	56	2.6	2.15	52	3.2	5.2	1.63	5.8	108	10.8	26	35
30	ABUJA	Superstru	WALL	1mas, 2 lab	2	225mm	48	2.3	2.1	46	2.5	4.6	1.84	4.8	94	9.4	26	34

Source: Field Survey (2017)

Table 3.1 BLOCKWORKS IN SUBSTRUCTURE (PIT)

					MORNING	SESSION	8.30-10.30(AM)				AFTEN SESSION 12-5.30(PM)							
S/N	PROJECT LOCATION	OPERATION LOCATION	OPERATION	GANG SIZE	DEPTH metres	BLOCK THICKN	NO OF BLK LAID	MORN TIME (hr)	AREA SQ.M	MORN OUTPUT	NO OF LAID	TIME SPENT	AREA SQ.M	AFTN OUTPUT	TIME SPT HR	TOTA BLOCK	TEMP (0C)	TEMP (0c0
1	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	1.5	225mm	38	3.1666667	3.8	1.199999987	32	2.6666667	3.2	1.199999985	5.84	70	27	35
2	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	1.5	225mm	32	2.6666667	3.2	1.199999985	36	3	3.6	1.2	5.67	76	28	37
3	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	1.5	225mm	34	2.8333333	3.4	1.200000014	42	2.8	4.2	1.5	6.2	76	30	36
4	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	1.5	225mm	30	1.6666667	3	1.799999964	35	1.75	3.5	2	3.42	65	28	36
5	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	1.5	225mm	42	1.5	4.2	2.8	45	2.25	4.5	2	3.75	87	29	33
6	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	1.5	225mm	42	2.15	4.2	1.953488372	38	2.2	3.8	1.727272727	4.35	80	28	33
7	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	65	2	6.5	3.25	78	2.5	7.8	3.12	4.5	143	26	36
8	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	78	1.5	7.8	5.2	72	2.3	7.2	3.130434783	3.8	146	24	34
9	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	72	1.8	7.2	4	88	1.6	8.8	5.5	3.4	160	29	35
10	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	88	1.6	8.8	5.5	102	2	10.2	5.1	3.6	190	26	33
11	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	102	2.2	10.2	4.636363636	110	1.8	11	6.111111111	4	212	25	36
12	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	98	1.6	9.8	6.125	92	2	9.2	4.6	3.6	190	27	35
13	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	95	1.8	9.5	5.277777778	96	2.4	9.6	4	4.2	191	26	35
14	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	112	1.5	11.2	7.466666667	86	1.5	8.6	5.733333333	3	198	29	36
15	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	115	2	11.5	5.75	86	1.8	8.6	4.777777778	3.8	201	28	33
16	ABUJA	substruct	BLOCK IN FDN	2mas,3 lab	1.5	225mm	120	2.2	12	5.454545455	78	2	7.8	3.9	4.2	198	25	36
17	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	38	3.1666667	3.8	1.199999987	40	2.6666667	4	1.499999981	5.84	78	30	36
18	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	39	1.95	3.9	2	43	2.15	4.3	2	4.09	82	32	37
19	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	48	2.4166667	4.8	1.986206869	35	1.6666667	3.5	2.099999958	4.09	83	27	36
20	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	44	2.2	4.4	2	32	2.1333333	3.2	1.500000023	4.33	76	30	35
21	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	49	2.5	4.9	1.96	38	1.9	3.8	2	4.4	87	31	37
22	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	38	3.1666667	3.8	1.199999987	35	2.9166667	3.5	1.199999986	6.08	73	32	37
23	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	34	2.8333333	3.4	1.200000014	42	2.2166667	4.2	1.894736814	5.05	76	30	37
24	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	38	1.9	3.8	2	40	2.0833333	4	1.920000031	3.98	78	28	37
25	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	42	2.2	4.2	1.909090909	40	1.8	4	2.86	4	82	28	35
26	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	38	1.8	3.8	2.111111111	32	2.3	3.2	1.39	4.1	70	29	37
27	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	45	2.6	4.5	1.730769231	40	2	4	2	4.6	85	26	33
28	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	36	2.4	3.6	1.5	38	2.5	3.8	1.52	4.9	74	26	36
29	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	40	1.95	4	2.051282051	48	2.2	4.8	2.2	4.15	88	28	36
30	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	46	2	4.6	2.3	45	1.96	4.5	2.3	3.96	91	26	36
31	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2	225mm	43	2.2	4.3	1.954545455	36	1.85	3.6	1.95	4.05	79	25	36
32	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	40	2	4	2	43	2.1666667	4.3	1.984615354	4.17	83	32	36
33	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	42	2.1666667	4.2	1.938461509	45	2.25	4.5	2	4.42	87	26	33
34	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	40	2.6666667	4	1.499999981	45	3.75	4.5	1.2	6.42	85	29	34
35	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	38	3.6666667	3.8	1.036363627	35	3.1166667	3.5	1.12299464	6.78	73	24	33
36	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	32	3.0833333	3.2	1.037837849	30	3.4333333	3	0.873786416	6.51	62	28	34
37	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	26	2.6	2.6	1	38	3.0833333	3.8	1.232432446	5.6	64	27	33.5
38	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	35	2.4166667	3.5	1.448275842	29	3.0333333	2.9	0.956043967	5.45	64	26	36
39	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	30	2.1333333	3	1.406250022	32	2.75	3.2	1.163636364	4.88	62	26	37
40	ABUJA	substruct	BLOCK IN FDN	1mas, 2 lab	2.5	225mm	45	2	4.5	2.25	38	2.5	3.8	1.52	4.5	83	25	35

Source: Field Survey (2017)

3.1 DATA ANALYSIS

The data generated on site through direct observation and the use of stop watch to record the time taken for a given blockwork operation to be performed and the use of thermometer to record the prevailing site temperature both in the morning and afternoon sessions were analysed by employing paired sample t-test statistical tools. This helps to evaluate the extent of effects of site temperature on the output of a gang of mason on site.

Table 3.2 Paired sample T-test results of effect of site temperature on labour output for blockwork

Analysis number	*Variables*	*Work location*	*mean values*	*df*	*t*	$t_{0.05}$	*P*	**Remark**
1	Morn_OutputHr Aftn_OutputHr	Trench	2.06 1.89	46	1.833		0.073	Non-Significant difference
2	Morn_OutputHr Aftn_OutputHr	Pit	1.03 1.06	30	-1.000		0.325	Non-Significant difference
3	Morn_OutputHr Aftn_OutputHr	Pier	1.21 1.38	33	-1.436		0.160	Non-Significant difference
4	**Morn_OutputHr** **Aftn_OutputHr**	**Wall**	**1.58** **2.02**	**44**	**-4.524**		0.000	**Significant difference**

Source: Author's fieldwork (2017)

Notes: sig = significance; df = degrees of freedom; t = calculated value of't' statistic; $t_{0.05}$ = critical value of 't' statistic at 0.05 level of significance; P = probability of 't' statistic

3.2 DISCUSSION OF RESULTS

From the Table 3.2, the variation in site temperature did not have any significant effect on the output of masons during the period of observation in the trench of average depth of 1.5 meters below the ground surface as P-values ranges from 0.073 in trench to 0.325 in pit. The P values calculated were greater than P-value tabulated of 0.05. This implies that operatives were working normally irrespective of the weather condition prevailing on the site at the observed period, provided that every other site influencing factors remain constant.

The same non-significant effect of temperature was recorded on the blockwork operations in the construction of piers in superstructure with Probability value of 0.160 was obtained which is greater than the tabulated P-value of 0.05. But there is a significant effect of temperature on the masons working in the blockwork operations in superstructure (wall) with alpha (P) value present a figure of 0.000 in both morning and afternoon temperature. This was supported by the figures from Table 3.2, the output of operatives reduces as temperature increases from 27^{o}C to 37^{o}C on the sampled site. The reasons for this drop in the output of mason could be attributed to the height of working location as heat intense on them and there is no provision for temporary shed. The masons tend to experience fatigue due to dehydration and sun burns. As a result of this, masons and the unskilled labourers seek a longer time to rest in resting place, thereby reducing the actual time spend on the blockwork operation in wall.

4. CONCLUSION

It is concluded that site temperature had no significant effect on the blockwork operations in the substructure as at the time of observation as outputs of masons remain relatively stable both in the trench and pit operations in the sampled sites. This is in contrast with the outputs of masons during blockwork operations in superstructure (wall operation). The reduction in the output of masons as site temperature increases could be attributed to dehydration in the body as masons are exposed to intense and hot temperature. Therefore, as site temperature increases, the output of masons on wall operations reduces. In a nutshell, the influence of site temperature in the area of study (Abuja) on the daily output of masons working on residential constructions during the period of research was pronounced in the blockwork operations in wall exceeding 230mm wide whereas its effect was not significant in the blockwork operation in the trench and pit in the two periods examined.

5. RECOMENDATIONS

Since it is established from the findings of this study that site temperature has effect on the daily output of artisans on site during blockwork operation in wall at superstructural level, it is therefore recommended that the use of annual cycles to schedule activities mostly affected by weather should be encouraged, the usage will enable blockwork operations in wall to be started early in the day to prevent fatigue of labour due to hot weather. In addition, helmets and overall coats that reduce sun radiation should be provided on the site to prevent sun burns. The setting up of machinery to aid physical labour intensive work when site conditions are adverse should be encouraged. It is also recommended that labour outputs recorded for categories of blockwork operations sampled in this study should be adopted by building professionals and contractors operating in the area of study rather than the continuous usage of labour output standards inherited from British colonialist.

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