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Bending Strength Characteristics of Sawdust- Crete Laminated Composite Slab

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Abstract
This paper presents the bending characteristics of sawdust-crete laminated composite slab. The materials used in the laboratory experiments include: Ordinary Portland Cement, river sand, gravel, sawdust, plywood, nails, reinforcement bars, stirrups and water. Manual mixing method was adopted and all sawdust-crete ingredients were batched by weight. A total of 48 slabs of size 1200mm x 1000mm x 100mm, 1200mm x 1000mm x 125mm, 1200mm x 1000mm x 150mm and 1200mm x 100mm x 175mm were cast for flexural strength from the mix ratios 0.75:1:2:2 and 0.75:1:3:3. Out of the 48 slabs cast, 32 were produced from sawdust-crete laminated composite (with 12.5mm and 20mm as the thickness of plywood for the laminate), 8 were produced from normal concrete ingredients (coarse aggregates, fine aggregates, cement and water) with 10mm rebar and mix ratio of 0.45:1:2:4. The remaining 8 slabs were made from plain sawdust-crete with mix ratio of 0.75:1:3:3. During the experiment, the maximum deflection for the slab was observed to occur at the slab with size 1200mm x 1000mm x 100mm no matter the core content used to produce the slab while the minimum deflection occurs at the size 1200mm x 1000mm x 175mm. The deflection of slab decreases with increase in slab thickness while flexural strength increases with increase in slab thickness. The flexural strength results of slab were compared by percentage difference and the results shows that there is significant difference between the two sets of slabs. Also, by comparing the results of plain sawdust-crete slab to that of sawdust-crete laminated composite slab, the result show that laminates with plywood increases flexural strength up to 68.4%. Conclusively, laminated sawdust-crete can be used for slabs that is not carrying too much load like residential houses.

Keywords: Laminate slab, Sawdust-crete, Flexural strength, Deflection

1.0 INTRODUCTION

A slab is a flat two-dimensional planar structural element having thickness that is very small compared to its other two dimensions [1]. It behaves primarily as a flexural member. Their primary function is to carry vertical loads, fixed and transient loads to beams and columns [2]. Slab can be produced using different construction materials like wood (timber), steel, and composite members like concrete, steel-composite, plywood etc. The early form of slab is timber (wood) slab; it has good compressive and flexural strength but the major problem of timber slab is that it can sustain a very much greater load for a short period of time than they can for a longer period of time, or permanently [3]. BS 5268-2, [4] takes account of this by quoting duration of loading factors for long-term, medium-term, short-term and very short-term loadings. A timber beam and slab does not deflect by the full calculated amount until several hours after the application of a load. The testing clause of BS 5268-2 [4] requires that only 80% of the calculated deflection should have taken place after 24 hours. Another problem associated with timber slab is that the strength of timber is not equal in all directions [3]. Therefore, there is a need to get a material that can have equal strength in all directions. In a bid to have such material, the idea of composite construction comes up, of which concrete slab is a form of it.

Concrete slab is the most commonly used slab either inform of plain, reinforced, or pre-stressed concrete in building construction. The design of concrete slab can be seen in BS 8110 Part 1 [5]. The actual problem associated with concrete slab is self-weight as greater load it carries is itself weight. In other to solve the problem of self-weight for concrete slab, a lot of lightweight materials have been used as replacement to components of concrete. Some of these materials are agricultural and industrial waste which includes sawdust, palm kernel shell, fly ash, coconut shells among others which are produced from milling stations, and so on [6]. Other forms of composite slabs that are in use include particle-board, plywood, oriented strand board,

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cement-bonded particle-board and wood fibre-boards. The composite member like plywood have good flexural strength but most time the problem associated with it is excessive deflection as can be seen in literature review [7].

Okoroafor, et al [8] present the structural characteristics of sawdust-sand-cement composite. Therefore, in this work, composite slabs were produced using plywood as laminas; sawdust, sand and cement as core contents and investigations were carried out to determine the deflection and flexural strength. The advantage of this work is that if the sawdust-sand-cement composite (otherwise called sawdust-crete) laminated composite slab proves to have good flexural strength and the deflection falls within allowable deflection for slab, it will reduce the weight transferred to foundation from slab. Also, it will help for waste recycling of sawdust.

2.0 REVIEW OF LITERATURES

The production of reinforced concrete slab involves the use of cement, water, fine and coarse aggregate at times admixture [9]. The chief material contributing much to weight of concrete member being coarse and fine aggregates of which using another material that has lightweight and reliable in strength as well as withstanding the applied load will be an advantage. The following researchers have worked on sawdust related concrete.

Erik [10], studied the wood-wool slabs: – Manufacturing, properties and uses. From results of their work, they proved that the strength of wood-wool slab, both in compression and bending stands the test of time more especially when it is not exposed to humidity. The slab can also be used for wall because of its load bearing capacity.

Waldeman *et al.* [11], studied the structural and other properties of modified wood. Their concentration was on the durability, dimensional stability and hardness. They proved that modified wood has advantages over the unmodified wood for construction of slab.

Miyatake *et al*. [12], researched on the manufacture of wood strand cement composite for structural use. They developed a new composite composed of wood strands and a cement-based matrix named cement strand slab (CSS); the strength properties of CSS produced by them was reported to have sufficient strength in terms of compression and bending (the modulus of rupture of 20-45MPa and modulus of elasticity of 20-25MPa) to be used as structural member.

Zziwa *et al*. [13], carried out research on production of composite bricks from sawdust using Portland cement as a binder he was able to show that the mean compressive strength of the block was 1.61N/mm^2.

Del Menezzi et al. [14], studied the production and properties of a medium density wood cement boards produced with oriented strands and silica fume. Their study tried to solve the problem that can be associated with the use of wood cement board which is the inhibitory effects of wood on the setting time of cement and the high specific gravity of the final product. Their work provided the solution to the problem by the use of silica fumes and strands of wood.

Maharani, [15], studied the physical properties of sawdust and effect of mills and sawdust particles. From his work, the physical properties of sawdust were developed.

Okutu, [16], investigated structural implications of replacing concrete floor slabs with timber in composite construction, He found out that in buildings with columns closer than 9m apart, and with imposed loads of 4kN/m^2 or less, using timber meant a reduction in the amount of steel in the frame. The loads to the foundations were reduced significantly in all of his case studies.

Fakhrul et al., [17], carried out studies on properties of wood sawdust and wheat flour reinforced polypropylene composite. Their results show that the average tensile strength of the composite decreases with addition of sawdust and wheat flour.

Kasim et al. [18], carried out research on the mechanical properties of wood shavings-cement lightweight composite, they proved that the compressive strength and tensile strength of the wood-cement matrix have satisfactory values for light weight structures.

There is no published work on the use of plywood with sawdust-crete to produce slab; despite the good bending characteristics (20 – 48Mpa) of plywood member. In order to produce a member that will be reliable and having minimal deflection such idea give birth to this research on the use of Plywood laminate and sawdust-crete to produce a slab that can be used for light structural members with minimal deflection.

3.0 MATERIAL AND METHODS

3.1 Materials

The materials used for this work are (i) Ordinary Portland cement (ii) Sawdust (iii) Laminated Plywood (iv) Sharp river sand coarse aggregate (v) Nails (vi) Water (vii) 10mm reinforcement bars (viii) stirrups for holding of the plywood at 250mm intervals to avoid separation

The materials are discussed in details in sections 3.1.1 to 3.1.7.

3.1.1 Cement

Dangote brand of ordinary Portland cement which conforms to the requirements of BS EN 197 [19] was used.

3.1.2 Sawdust

To carry out this work, sawdust was obtained from the Wood Processing market in Ogbo-Osisi, Owerri North, Imo State, Nigeria. First, the sawdust was washed and boiled to remove any resin from it in Plate 1.

Plate 1: *Boiling of Sawdust to remove any Resin for proper bonding.*

After boiling for about 3 hours the particles were dried completely. The particles were classified according to their granulometry, in sieves of different sizes.

3.1.3 Aggregate

The aggregates used in this research were coarse aggregate and fine aggregate. The fine aggregates used were obtained from a flowing river (Otamiri River) purchased from mining site located inside Federal University Owerri, Imo State. It was sun-dried for seven days inside the laboratory before usage. The aggregates used were free from deleterious matters. The maximum diameter of sand used was 5mm while that of coarse aggregate used was 19mm. The compacted bulk density of the coarse aggregate is 1615kg/m^3 and the non-compacted bulk density is 1400kg/m^3.

3.1.4 Water

Water used for this research work was obtained from a borehole within the premises of Federal University of Technology, Owerri, Imo State. The water is potable and conformed to the standard of BS EN 1008 [20]. Since it meets the standard for drinking, it is also good for making concrete and curing concrete.

3.1.5 Nails

The nails used for this research work was two inches' steel nails conforming to BS 1202 [21].

3.1.6 Plywood

The plywood for the project was obtained from Owerri timber Market. The grade of plywood used was C-C grade that is, grade C group 1 veneers as was written on it with the following:

i) 2400mm x 1200mm x 12.5mm (Three plies 12.5mm thick)
ii) 2400mm x 1200mm x 20mm (Five plies 20mm thick)

The plywood was visually selected to make sure that there was no defect on it in line with BS EN 635 [22]. They were cut to 1200mm x 1000mm and used to produce slabs to the following dimensions: - 1200mm x 1000mm x 100mm, 1200mm x 1000mm x 125mm, 1200mm x 1000mm x 150mm and 1200mm x 1000mm 175mm.

3.1.7 Reinforcement Bars

The reinforcement was in line with BS 4449 [23], and 10mm size Reinforcement Bars was use for the control slab.

3.2 Methods

The mixing method used for the production of sawdust-crete was manual method; The mix ratios for batching were 0.75: 1:1:1, 0.75:1:2:2 and 0.75 :1:3:3; the mix ratios stand for water cement ratio, cement, sand and sawdust respectively. The mix ratio for convectional slab is 0.45:1:2:4 which stand for water cement ratio, cement, sand and coarse aggregates respectively as recommended by Okoroafor et al. [8].

3.2.1 Flexural Strength Test of Slab

Flexural strength tests were carried out in order to determine the Flexural strength of the Sawdust-crete plywood laminated slab, the test was carried out in according to BS EN 12390 [24]. The flexural strength f_{cf} (in N/mm^2) is given by the Equation 3.1.

$$f_{cf} = \frac{F \ x \ L}{d_1 x d_2{}^2} \tag{3.1}$$

Where F is the breaking load (in N); d_1 and d_2 are the lateral dimensions of the cross-section (in mm); for beam d_1 = 150mm, d_2 = 150mm and for slab d_1 = 1000mm, d_2 = depth of slab (Plate 3.2 and Figure 3.1 shows setup); L is the distance between the supporting rollers (in mm); for beam L = 300 and for slab L= 900.

3.2.2 Production of Laminated Composite Slab and Control Slab

The plywood for the laminates were sawn into size 1200mm x 1000mm x 100mm, 1200mm x 1000mm x 125mm, 1200mm x 1000mm x 150mm, and 1200mm x 1000mm x 175mm; after sawing, with the help of nails and stirrups the laminates were formed. To make sure that there was proper bond between sawdust-crete and the plywood, stirrups were used at intervals of 300mm to hold the top and bottom members of the laminates. Plate 3.3 shows the cross section of the laminated slabs.

Plate 2: *Arrangement of slab during crushing as required by BS EN 12390 [24].*

Plate 3: *Cross section of sawdust-crete laminated composite slabs.*

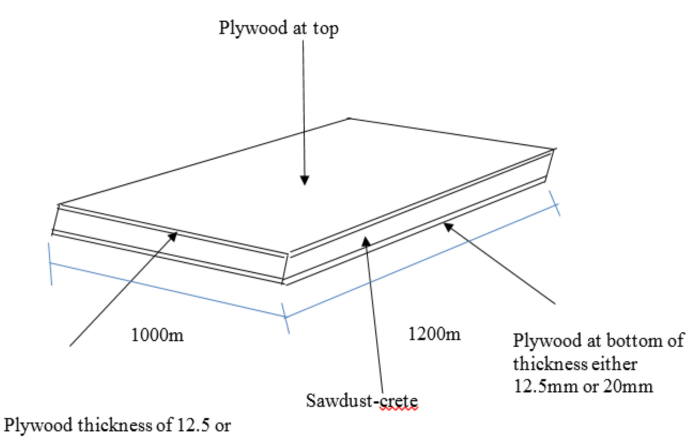

Figure 1: *Typical example of the plywood laminate.*

The conventional slabs were produced using mix ratio of 0.45:1:2:4 considering the same slab sizes stated above. The reinforcements were cut into 1.1m (main bar at 200mm c/c) and 900mm (distribution bar at 200mm c/c) and they were arranged to form a mesh which was used to reinforced conventional slab samples.

The Sawdust-crete laminated plywood slab, were produced using manual mixing method and proper vibration was applied so as to obtain good compaction of the composite. A total of 32 slabs were produced from the two mix ratios used and the mix ratio were, 0.75: 1:2:2 and 0.75: 1:3:3; two slabs from each mix and for two different thickness of plywood of 12.5mm and 20mm. Also 16 more slabs were produced as a conventional with dimensions 1200 x 1000 x 175 mm, 1200 x 1000 x 150mm, 1200 x 1000 x 125mm and 1200 x 1000 x 100mm; 8 of the conventional slabs were produced from normal concrete components (coarse aggregate, fine aggregate, cement and water) with mix ratio 0.45:1:2:4 and reinforced with 10mm steel bars while the remaining 8 were produced with sawdust-crete with mix ratio 0.75:1:3:3 and without reinforcements. The convectional slabs were used to compare the results from Sawdust-crete laminated composite slab. The whole slabs (both with Sawdust-crete laminated plywood and with reinforcement) were cured by spraying water on it for 28 days, and tested with Magunus frame (as can be seen in plate 3.2) thereafter. The compression load at failure were recorded and used in Equation (3.1) to determine the flexural strength of the Sawdust-crete laminated plywood slab.

3.2.3 Deflection of Sawdust-crete Laminated Composite

The deflection of sawdust-crete laminated composite and conventional slab were measured using displacement of water approach as can be seen in Plate 3.4. The instrument used was constructed using the principle of incompressibility of water. The load from the slab was allowed to act on the T-flange pump that was filled with water and connected to burette that contain water to a particular level. When the slab fails, the changes in height of water in the burette and pump pipe were recorded and having known the areas of the T-flange pump and the burette, the deflection was computed.

Plate 4: *Deflection measurement using principle of incompressibility of water*

4.0 RESULTS AND DISCUSSIONS

4.1 Results

The results are as presented in Table 4.1 and 4.2, for the 28-day flexural strengths of the sawdust-crete laminated composite slabs.

Table 1: 28-day Flexural Strength of sawdust-crete laminated slab, conventional slab and plain sawdust-crete slab

Mix ratio	Thickness of plies	Sample Size	Sample number	Crushing Load in KN	Flexural Strength of the Slab in (MPa)	Average Flexural Strength In MPa
1:2:2	12.5mm	1200mmX1000mmX100mm	A	24.51	2.206	
1:2:2	12.5mm	1200mmX1000mmX100mm	B	23.74	2.137	2.17
1:2:2	12.5mm	1200mmX1000mmX125mm	A	41.89	2.413	
1:2:2	12.5mm	1200mmX1000mmX125mm	B	41.70	2.402	2.41
1:2:2	12.5mm	1200mmX1000mmX150mm	A	68.93	2.757	
1:2:2	12.5mm	1200mmX1000mmX150mm	B	65.85	2.634	2.70
1:2:2	12.5mm	1200mmX1000mmX175mm	A	105.55	3.102	
1:2:2	12.5mm	1200mmX1000mmX175mm	B	110.28	3.241	3.17
1:2:2	20mm	1200mmX1000mmX100mm	A	27.04	2.434	
1:2:2	20mm	1200mmX1000mmX100mm	B	28.01	2.521	2.48
1:2:2	20mm	1200mmX1000mmX125mm	A	45.49	2.620	
1:2:2	20mm	1200mmX1000mmX125mm	B	45.10	2.598	2.61

Mix ratio	Thickness of plies	Sample Size	Sample number	Crushing Load in KN	Flexural Strength of the Slab in (MPa)	Average Flexural Strength In MPa
1:2:2	20mm	1200mmX1000mmX150mm	A	64.95	2.834	
1:2:2	20mm	1200mmX1000mmX150mm	B	70.85	2.945	2.89
1:2:2	20mm	1200mmX1000mmX175mm	A	116.75	3.431	
1:2:2	20mm	1200mmX1000mmX175mm	B	117.46	3.452	3.44
1:3:3	12.5mm	1200mmX1000mmX100mm	A	19.16	1.724	
1:3:3	12.5mm	1200mmX1000mmX100mm	B	21.38	1.924	1.82
1:3:3	12.5mm	1200mmX1000mmX125mm	A	36.25	2.088	
1:3:3	12.5mm	1200mmX1000mmX125mm	B	36.88	2.124	2.11
1:3:3	12.5mm	1200mmX1000mmX150mm	A	58.53	2.341	
1:3:3	12.5mm	1200mmX1000mmX150mm	B	60.68	2.423	2.38
1:3:3	12.5mm	1200mmX1000mmX175mm	A	98.40	2.892	
1:3:3	12.5mm	1200mmX1000mmX175mm	B	96.43	2.803	2.85
1:3:3	20mm	1200mmX1000mmX100mm	A	26.10	2.349	
1:3:3	20mm	1200mmX1000mmX100mm	B	25.13	2.262	2.31
1:3:3	20mm	1200mmX1000mmX125mm	A	42.22	2.432	
1:3:3	20mm	1200mmX1000mmX125mm	B	42.64	2.456	2.44
1:3:3	20mm	1200mmX1000mmX150mm	A	68.63	2.745	
1:3:3	20mm	1200mmX1000mmX150mm	B	70.35	2.814	2.80
1:3:3	20mm	1200mmX1000mmX175mm	A	102.8	3.021	
1:3:3	20mm	1200mmX1000mmX175mm	B	100.96	2.967	2.99
		Normal concrete Slab with 10mm reinforcement				
1:2:4	Reinforced	1200mmX1000mmX100mm	A	76.61	6.895	
1:2:4	Reinforced	1200mmX1000mmX100mm	B	77.36	6.962	6.93
1:2:4	Reinforced	1200mmX1000mmX125mm	A	137.64	7.928	
1:2:4	Reinforced	1200mmX1000mmX125mm	B	135.83	7.824	7.87
1:2:4	Reinforced	1200mmX1000mmX150mm	A	206.83	8.273	
1:2:4	Reinforced	1200mmX1000mmX150mm	B	208.55	8.342	8.31
1:2:4	Reinforced	200mmX1000mmX175mm	A	321.56	9.45	

Mix ratio	Thickness of plies	Sample Size	Sample number	Crushing Load in KN	Flexural Strength of the Slab in (MPa)	Average Flexural Strength In MPa
1:2:4	Reinforced	200mmX1000mmX175mm	B	328.37	9.65	9.55
		Sawdust-crete Slab (without reinforcement)				
1:3:3	Plain	1200mmX1000mmX100mm	A	7.74	0.697	
1:3:3	Plain	1200mmX1000mmX100mm	B	7.79	0.701	0.699
1:3:3	Plain	1200mmX1000mmX125mm	A	14.29	0.823	
1:3:3	Plain	1200mmX1000mmX125mm	B	14.10	0.812	0.818
1:3:3	Plain	1200mmX1000mmX150mm	A	25.58	1.023	
1:3:3	Plain	1200mmX1000mmX150mm	B	27.55	1.102	1.063
1:3:3	Plain	1200mmX1000mmX175mm	A	44.98	1.322	
1:3:3	Plain	1200mmX1000mmX175mm	B	42.60	1.252	1.287

Table 2: 28-day Flexural Strength and Deflection Result for Sawdust-crete laminated Composite Slab and Conventional Slabs

Mix ratio	Thickness of plies	Sample Size	Sample number	Flexural Strength of the Slab in (MPa)	Average Flexural Strength In MPa	Deflection in mm At crushing
1:2:2	12.5mm	1200mmX1000mmX100mm	A	2.206		110
1:2:2	12.5mm	1200mmX1000mmX100mm	B	2.137	2.17	105
1:2:2	12.5mm	1200mmX1000mmX125mm	A	2.413		90
1:2:2	12.5mm	1200mmX1000mmX125mm	B	2.402	2.41	85
1:2:2	12.5mm	1200mmX1000mmX150mm	A	2.757		50
1:2:2	12.5mm	1200mmX1000mmX150mm	B	2.634	2.70	52
1:2:2	12.5mm	1200mmX1000mmX175mm	A	3.102		25
1:2:2	12.5mm	1200mmX1000mmX175mm	B	3.241	3.17	28
1:2:2	20mm	1200mmX1000mmX100mm	A	2.434		90
1:2:2	20mm	1200mmX1000mmX100mm	B	2.521	2.48	95
1:2:2	20mm	1200mmX1000mmX125mm	A	2.620		73
1:2:2	20mm	1200mmX1000mmX125mm	B	2.598	2.61	80
1:2:2	20mm	1200mmX1000mmX150mm	A	2.834		45
1:2:2	20mm	1200mmX1000mmX150mm	B	2.945	2.89	43
1:2:2	20mm	1200mmX1000mmX175mm	A	3.431		20
1:2:2	20mm	1200mmX1000mmX175mm	B	3.452	3.44	25

Mix ratio	Thickness of plies	Sample Size	Sample number	Flexural Strength of the Slab in (MPa)	Average Flexural Strength In MPa	Deflection in mm At crushing
1:3:3	12.5mm	1200mmX1000mmX100mm	A	1.724		115
1:3:3	12.5mm	1200mmX1000mmX100mm	B	1.924	1.82	110
1:3:3	12.5mm	1200mmX1000mmX125mm	A	2.088		94
1:3:3	12.5mm	1200mmX1000mmX125mm	B	2.124	2.11	96
1:3:3	12.5mm	1200mmX1000mmX150mm	A	2.341		55
1:3:3	12.5mm	1200mmX1000mmX150mm	B	2.423	2.38	65
1:3:3	12.5mm	1200mmX1000mmX175mm	A	2.892		30
1:3:3	12.5mm	1200mmX1000mmX175mm	B	2.803	2.85	34
1:3:3	20mm	1200mmX1000mmX100mm	A	2.349		100
1:3:3	20mm	1200mmX1000mmX100mm	B	2.262	2.31	104
1:3:3	20mm	1200mmX1000mmX125mm	A	2.432		84
1:3:3	20mm	1200mmX1000mmX125mm	B	2.456	2.44	90
1:3:3	20mm	1200mmX1000mmX150mm	A	2.745		46
1:3:3	20mm	1200mmX1000mmX150mm	B	2.814	2.80	53
1:3:3	20mm	1200mmX1000mmX175mm	A	3.021		30
1:3:3	20mm	1200mmX1000mmX175mm	B	2.967	2.99	35
		Normal concrete Slab with 10mm reinforcement				
1:2:4	Reinforced	1200mmX1000mmX100mm	A	6.895		40
1:2:4	Reinforced	1200mmX1000mmX100mm	B	6.962	6.93	35
1:2:4	Reinforced	1200mmX1000mmX125mm	A	7.928		20
1:2:4	Reinforced	1200mmX1000mmX125mm	B	7.824	7.87	24
1:2:4	Reinforced	1200mmX1000mmX150mm	A	8.273		10
1:2:4	Reinforced	1200mmX1000mmX150mm	B	8.342	8.31	15
1:2:4	Reinforced	200mmX1000mmX175mm	A	9.45		10
1:2:4	Reinforced	200mmX1000mmX175mm	B	9.65	9.55	12
		Sawdust-Crete Slab (without reinforcement)				
1:3:3	Plain	1200mmX1000mmX100mm	A	0.697		20
1:3:3	Plain	1200mmX1000mmX100mm	B	0.701	0.699	20

Mix ratio	Thickness of plies	Sample Size	Sample number	Flexural Strength of the Slab in (MPa)	Average Flexural Strength In MPa	Deflection in mm At crushing
1:3:3	Plain	1200mmX1000mmX125mm	A	0.823		15
1:3:3	Plain	1200mmX1000mmX125mm	B	0.812	0.818	15
1:3:3	Plain	1200mmX1000mmX150mm	A	1.023		10
1:3:3	Plain	1200mmX1000mmX150mm	B	1.102	1.063	10
1:3:3	Plain	1200mmX1000mmX175mm	A	1.322		5
1:3:3	Plain	1200mmX1000mmX175mm	B	1.252	1.287	5

4.2 Discussion of Results

From the Table 4.1 and 4.2, it can be deduced that for a particular mix ratio and with the same thickness of plies used as the lamina, the increase in core (sawdust-crete) causes increase in the flexural strength and reduction in the deflection value respectively.

The increase in the volume of sawdust in sawdust-crete used as the core causes reduction in the flexural strength no matter the thickness of slab under consideration. The use of plies as a laminate increases the flexural strength of the sawdust-crete greatly as can be seen in the Table 4.1 and 4.2.

The maximum flexural strength of sawdust-crete laminated composite slab obtained was 3.44mpa and it occurs for 20mm plies. This means that the increase in the thickness of plies used for the laminate increases the flexural strength.

The average flexural strength of sawdust-ctete laminated composite slab ranges from 2.11Mpa to 3.44Mpa. The flexural strength of reinforced concrete slab with 10mm rebar's gives 6.93Mpa to 9.55Mpa but the permissible stress in bending for concrete ranges from 2.5Mpa to 16Mpa.

Comparing the sawdust-crete laminated composite slab with that of conventional slab shows that the percentage difference for 12.5mm laminate ranges from 66.41% to 75% for mix ratio of 1:2:2 and 1:3:3 respectively while that for 20mm laminate ranges from 64.23% to 66.95%.

Comparing plain sawdust-crete slab with laminated sawdust-crete composite slab, shows that the percentage difference between them ranges from 57.38% to 68.40%.

5.0 CONCLUSION AND RECOMMENDATION

The average flexural strength of sawdust-ctete laminated composite slab ranges from 2.11Mpa to 3.44Mpa, that of convectional slab with 10mm rebar's ranges from 6.93Mpa to 9.55Mpa but the permissible stress in bending for concrete ranges from 2.5Mpa to 16Mpa for slab. Therefore, the flexural strength is within limit for light structural slab. Therefore, Sawdust-crete laminated composite slab is highly recommended to be use for light structural members that are not carrying much loads since it has weight advantage as compared with those of conventional slab.

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