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Predictive Analysis of Bamboo-Reinforced Concrete Beam Performance using Artificial Neural Networks

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ABSTRACT: Bamboo, which is a fast-growing and ecologically friendly material for structural applications, is being considered quite appropriate. Some physical and mechanical property test are conducted in the specimen of messy and manga bamboo. Moisture content test, density test, compressive test & tensile test. The tensile strength of bamboo is high and can reach up to 109.9 to 118.37 Mpa. This makes bamboo a pretty alternative to steel in reinforcement loading applications. The bamboo reinforced concrete composite elements can be used as an alternative to concrete, steel, and wood used in housing and other products required in day-to-day applications. This study presents an artificial neural networks (ANN)based method model using MATLAB for predicting deflection of bamboo reinforced beam, for mentioned four beam of Messy & Manga specimen are manufactured in the laboratory under one point loading after the 28 days curing, an experimental inquiry is done to collect data of regular load increments the ANN modeling are prediction use the applied load, flexure strength of reinforced beam. Percentage of reinforcement, length, which depth of the beam are taken as input. Deflection of beam obtained as output, the performance of ANN method is satisfactory the force casting the deflection behavior of coefficient of determination (R^2) – 0.9985. As a result the ANN model can be utilized to anticipate serviceability behavior.

KEYWORDS: Text Bamboo Reinforced Concrete, Universal testing machine (UTM), Tensile Strength, Compression Strength, Flexural Strength, Artificial Neural Network (ANN).

I. INTRODUCTION

Steel costs have risen dramatically in recent years. Steel is difficult to get in underdeveloped countries due to high pricing, and its use in the building industry is now restricted. Steel manufacture uses a lot of fossil fuels, thus the steel discharge in the construction of structures has been given, demonstrating how research institutions can drastically reduce it. Bamboo, as one of the fastest-growing plants, has a lot of economic potential among the many options for such substitutes. Bamboo has been utilized in Asia for thousands of years to build bridges and buildings. Bamboo is easier to harvest and carry than other plants. As a result, bamboo has lower manufacturing costs than steel. As a result, even countries and locations with no advanced manufacturing technologies or construction skills are projected to be able to use bamboo. The bamboo reinforced concrete composite elements can be used as an alternative to concrete, steel, and wood used in housing and other products required in day-to-day applications.

An artificial neural network (ANN) is a computer simulation of the human brain in its most basic form. A normal brain can adapt to new and changing environments and learn new things. The brain has an incredible ability to comprehend partial, ambiguous, and hazy information and make decisions based on it. We can read other people's handwriting, for example, even if their writing style differs significantly from ours. A child can recognise that a ball and an orange are both round shapes. Even a baby as young as a few days old may know its mother through touch, speech, and smell. Even a fuzzy snapshot can be used to identify a known person.

The brain is a complicated organ that regulates the entire body's functions. Even the most primitive animal's brain has more computing power than the most modern machine. Its purpose is to govern not only the physical portions of the body, but also more complicated actions like as thinking, visualising, dreaming, envisioning, learning, and so on, which are not physically characterised. Even the most modern supercomputers cannot create an artificially thinking machine. Neurons are the cells that make up the brain. The neural network, or brain, is made up of the connectivity of these cells (neurons). In the human brain, there are approximately 1011 neurons and 10,000 connections between them. An artificial neural network (ANN) is a simulation of a natural neural network in which the artificial neurons are connected in the same way as the brain network.

II. DATA ACQUISITION AND EXPERIMENTAL SETUP

In this study data is obtained from the experimental testing of rectangular concrete beam bamboo reinforced concrete (BRC). Four beam each type of specimen messy and manga resp. the bamboo strip are used to cast the beam as a reinforcement before cast and conducting experiment on bamboo reinforced we done mechanical and physical property test on the bamboo such as compressive strength lest tensile strength & moisture content test, density test resp.. as reference to IS 8242 - 1976 & IS 6874 - 2008.

As per result in our experiment moisture content test of specimen manga is 11.88%and messy is 11.36% the optimum moisture content is between 10-12% so that it is satisfactory. The optimum density of bamboo is 0.5-1.0 gm/cm² as per our experiment manga & messy density is 0.621 & 0.920 gm/cm² the mechanical property test are compressive and tensile strength this test are conducted in UTM. the compressive strength of messy is 102.22 KN/mm² & manga is 90.49 KN/mm². the tensile strength of messy & manga is 118.37N/mm² & 109.9 N/mm² resp.

After this we cast the BRC beam in size 150x150x700 mm.M20 grade concrete used. The beams are tested after 28 days curing. Tested are conducted in UTM with capacity 1000 KN under one point loading then find the ultimate load & flexural strength of BRC beam.



Fig. 1 Bamboo Reinforcement



Fig. 2 Beams of Testing



Fig. 3 One point loading



Table. 1 BRC Beam Testing Result

Beam Type	Length in mm	Width in mm	Depth in mm	Reinforcement percentage	Load in KN	Deflection in mm
Messy	700	150	150	1	19.09	4.57
	700	150	150	1	27.4	4.38
	700	150	150	1	23.19	4.48
	700	150	150	1	17.98	6.49
Manga	700	150	150	1	19.09	4.57
	700	150	150	1	27.4	4.38
	700	150	150	1	23.19	4.48
	700	150	150	1	17.98	6.49

Flexure Strength = $P \cdot L / BD^2$

Where,

P = Load at Failure in N

L = Span in mm

B = Width in mm

D = Height in mm

F.S = $0.7 \sqrt{f_{ck}}$

= $0.7 \sqrt{20}$

= 3.13 N/mm²

Minimum strength required is 3.13 N/mm² which is easily achieved in all messy specimens tested above.

III. ARTIFICIAL NEURAL NETWORK

Each neuron gives an output by applying a transformation function (tanh, purlin, losing, etc.) to its net input, and the neuron fires it if the output is greater than the threshold value, with bias added. For finalizing the weights and bases, network training an iterative process of reducing the error between the target output and network output. Standard Back prepositions conjugate gradient. BFGS Algorithm, LM Algorithm. Stochastic Gradient Algorithm, and other training algorithms are utilized based on one order, second and global methods Training automatically stops if a user specified value of an error reached.

Working of ANN

Work flow for the general neural network design process has seven primary steps:

- Collect data
- Create the network.
- Configure the network
- Initialize the weights and biase
- Train the network.
- Validate the network (post-training analysis)

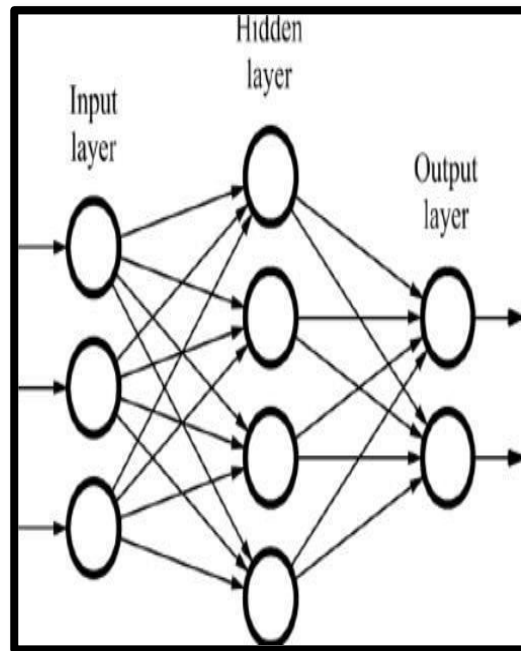


Fig. 4 ANN Network

IV. RESULTS

Predicting and validating data (Data for training ANN)

Table no 6. Showing Data for training ANN

INPUT					OUTPUT
Length in mm	Width in mm	Depth in mm	Reinforcement percentage	Load in kN	Deflection in mm
1000	75	150	1.49	0	0
1000	75	150	1.49	0.3	0.01
1000	75	150	1.49	0.6	0.03
1000	75	150	1.49	0.89	0.04
1000	75	150	1.49	1.19	0.05
1000	75	150	1.49	1.49	0.06
1000	75	150	1.49	1.79	0.07
1000	75	150	1.49	2.09	0.08
1000	75	150	1.49	2.38	0.11
1000	75	150	1.49	2.68	0.11



1000	75	150	1.49	2.98	0.12
1000	75	150	1.49	3.28	0.14
1000	75	150	1.49	3.58	0.15
1000	75	150	1.49	3.87	0.18
1000	75	150	1.49	4.17	0.2
1000	75	150	1.49	4.47	0.22
1000	75	150	1.49	4.77	0.25
1000	75	150	1.49	5.06	0.26
1000	75	150	1.49	5.36	0.32
1000	75	150	1.49	5.66	0.35
1000	75	150	1.49	5.96	0.38
1000	75	150	1.49	6.26	0.42
1000	75	150	1.49	6.55	0.45
1000	75	150	1.49	6.85	0.49

Data for sampling ANN

Beam Type	Length in mm	Width in mm	Depth in mm	Reinforcement percentage	Load in KN	Deflection in mm
Messy	700	150	150	1	19.09	4.57
	700	150	150	1	27.4	4.38
	700	150	150	1	23.19	4.48
	700	150	150	1	17.98	6.49
Manga	700	150	150	1	19.09	4.57
	700	150	150	1	27.4	4.38
	700	150	150	1	23.19	4.48
	700	150	150	1	17.98	6.49

Results of ANN :

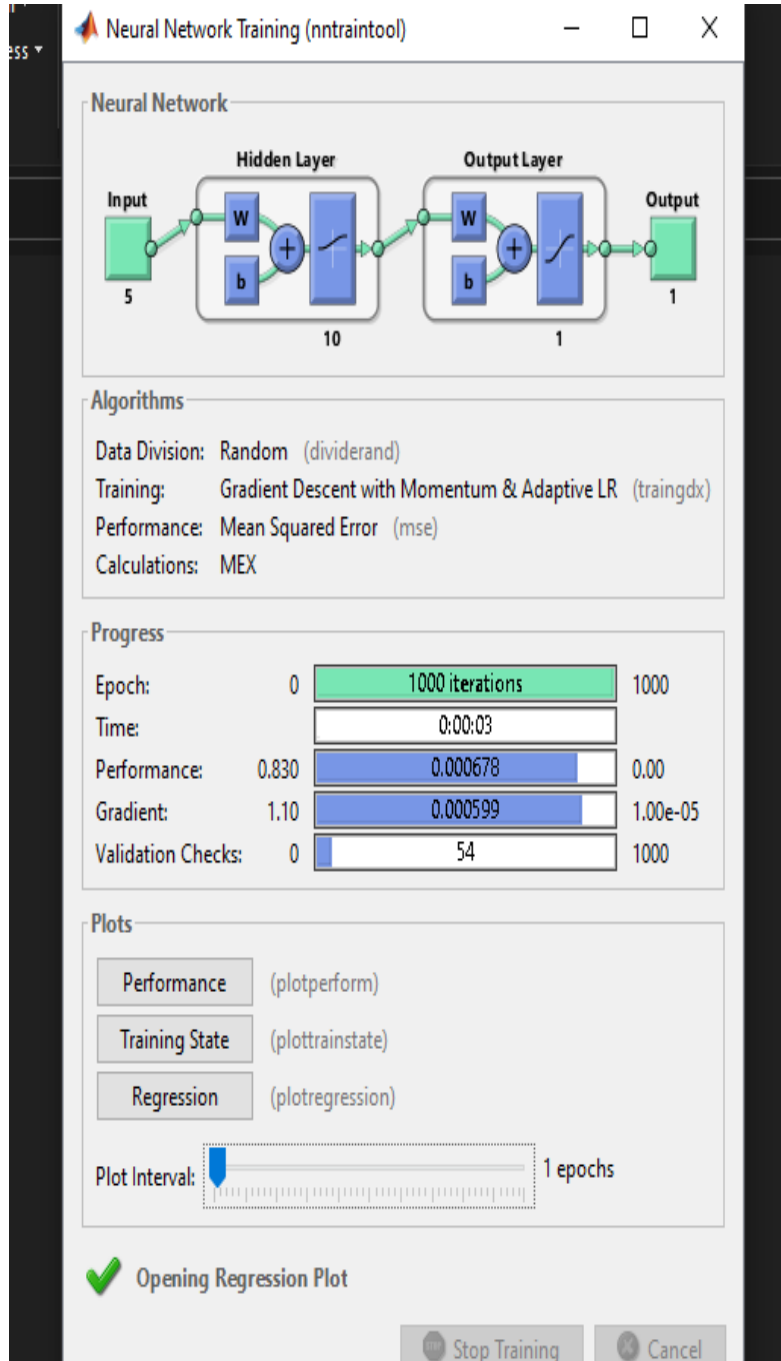


Fig. 5 Training Network

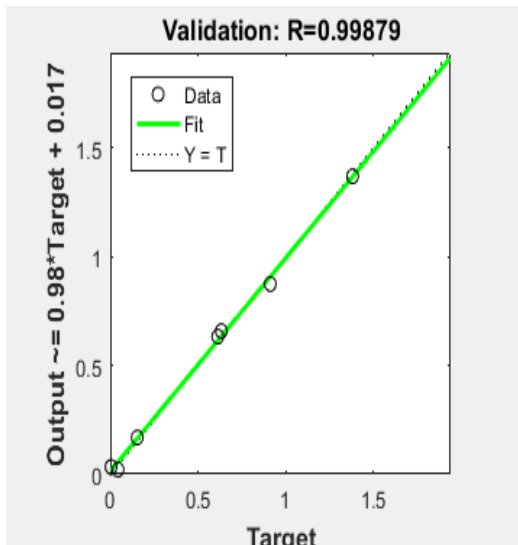


Fig. 6 Training Dataset

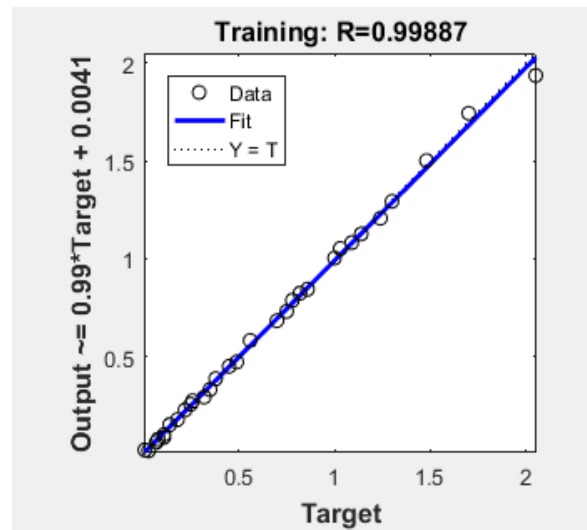


Fig. 7 Validating

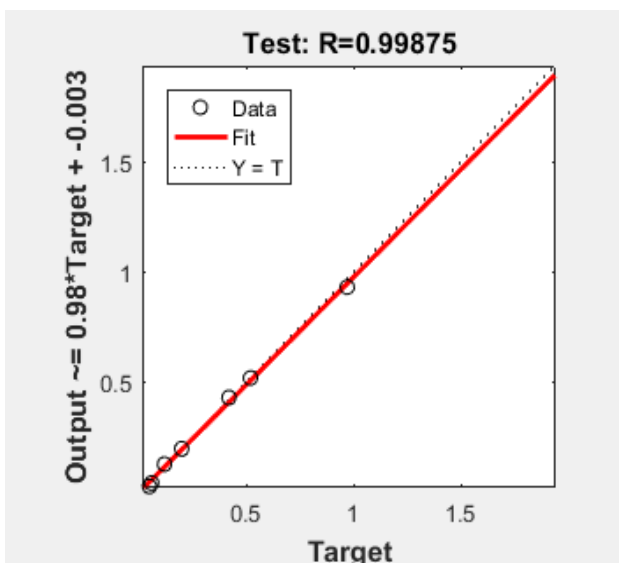


Fig. 8 Testing Dataset

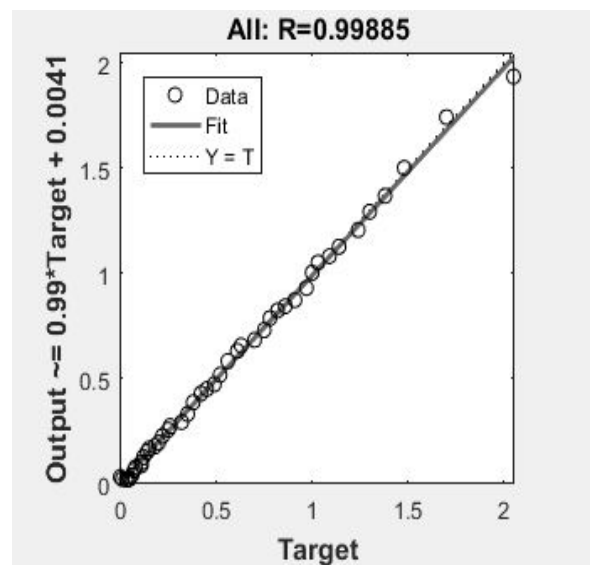


Fig. 9 All Dataset

V. CONCLUSION AND FUTURE WORK

Bamboo Reinforcement effectively can be used in concrete beam without compromising with compressive and flexural strength.

For the flexural strength 8 beam were casted in which 4 specimens each for messy and manga comparing each other with beam size 150mmx150mmx700mm, the result clearly showed that the average of manga is less than that of messy bamboo. The avg. flexural strength of messy obtained from test is 3.31 N/mm². Which almost achieved in all Messay specimens tested above.

On the flexural strength of bamboo this conclude that it is possible to use bamboo as a reinforcing for masonry structure. Though tensile strength is about 1/3rd that of steel. This is sufficient for masonry structure and provides a

more economical and environment friendly alternative that is accessible to every section of the society. However, there is still ample scope for research on the subject.

Similarly, the deflection of several concrete beams is predicted under load, different size, different percentage of reinforcement by using ANN. The ANN result closely matched with the experimental values of deflection. The regression values of ANN for training, validating and testing are 0.99887, 0.99879 and 0.99875 respectively.

In future studies, the dataset for the training ANN model can be expanded by using different percentage of reinforcement and different varieties of bamboo. Further more, experimental data can be obtained for large size of beam and column to determine the actual site conditions. The present study evaluated for the short term service life. Experimental studies can also be performed on other structural elements (i.e concrete column and slab) that use bamboo strips as reinforcement material.

REFERENCES

1. ISO 22157Part 1: - bamboo – determination of physical and mechanical properties. 2004
2. ISO 22157 part 2: - Determination of physical and mechanical properties of bamboo. Laboratory manual.2004
3. IS 456: 2000 reinforced concrete code of practice.
4. IS 6874:2008 methods of tests for bamboo
5. Illustrated Design of Reinforced concrete buildings. Author by Dr.V.L. Shaha and Dr. S.R.Karve..
6. K.U.Muthu, N.S.Kumar and H.Ravi Kumar –“Concrete Filled Steel Tubular Columns -A critical review,” cement and concrete composite, elixir international journal 45 (2021) 8034-8038
7. Arpit Sethi and Vijay baradiya, experimental investigation on the behavior of bamboo reinforced concrete member, ISSN:- 2319-7308.
8. Md. Shohel Rana and Shakila Zahan. Data prediction from set of sampled data using Artificial Neural Network ISSN -2277-7105.10.
9. Mateusz Kaczmarek and Agnieszka szymanska . Application of Artificial Neural Network DOI . 1515/sgem 2016-0014711
10. Atul Agrawal. Dandor Maity| Neural Network-based approach to predict the deflection of plain steel reinforced and bamboo reinforced concrete beams from experimental data.
11. Literature review on Bamboo Reinforced concrete. Omkar Gaikwad, Dipak Patil, Mayuri Rathod, Suraj Saw, Vijay Wairagade, (IARJSET) 2019.

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