

**STRUCTURAL TESTING AND CHARACTERIZATION OF  
SRI LANKAN YELLOW BAMBOO  
BAMBUSA VULGARIS**

Rajasekaran Vipushnan

198005R

Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

Sri Lanka

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Thesis submitted in partial fulfilment of the requirements for the degree Master of  
Science in Civil Engineering

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## DECLARATION

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.....

.....

Date: 06/07/2021

R. Vipushnan

“The above candidate has carried out research for the Master’s thesis under my supervision.”

Name of Supervisor: Prof. M.T.R. Jayasinghe

*UOM Verified Signature*

Signature: .....

Date: 11/07/2021

Name of Supervisor: Dr. H. G.H. Damruwan

Signature: ..... *UOM Verified Signature*

Date: 14/07/2021

Name of Supervisor: Dr. Shawn Platt

Signature: ..... *UOM Verified Signature*

Date: 14/07/2021

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Department of Civil Engineering

University of Moratuwa

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## ABSTRACT

Bamboo is a woody grass belonging to the sub family *Bambusoideae* of the family *Poaceae* (*Gramineae*). The increasing need for sustainable building construction and the use of natural local materials have made bamboo a popular material. Sri Lanka is an island nation located south of the Indian peninsula. It is a tropical country with distinct dry and wet seasons. Sri Lanka has nearly 5000 ha of natural bamboo forests and another 5000 ha of domestically cultivated land, scattered mainly in the South Western zone which amounts to 0.5% of the total forest cover in Sri Lanka. However, with the restoration of cascading reservoir systems in the Eastern Province, there is potential to have many marginal lands converted to bamboo plantations hence allowing for the growth and harvesting of bamboo in a sustainable manner for use in construction as a structural material.

Sri Lanka is home to ten endemic species of bamboo. In addition, several exotic species have been introduced to the country. The bamboo plant has a variety of uses. Industrial utilization of bamboo can be through primary or secondary value addition, which enhances the market value of bamboo. Bamboo in construction is found in either full-culm or engineered form. Bamboo is limited in its application through its durability and its tendency to split. Hence it needs to be processed and treated to ensure its long-term usage. Bamboo structures should be detailed appropriately for the full protection of treated bamboo. Bamboo used for construction has to undergo harvesting, grading, cleaning, preservative treatment, and storage. Determination of structural parameters of Sri Lankan bamboo could be based on ISO standards since other standards are often based on ISO standards themselves and are more suitable for bamboo species from those particular countries of those respective standards. To date, the mechanical characterization of Sri Lankan bamboo species has not been found in literature.

The widespread availability of *Bambusa Vulgaris* (Sri Lankan Yellow bamboo) led to it being chosen for investigation in this study. All bamboo culm sections in this study were obtained from a single supplier with initial moisture content and dimensions obtained on

delivery. Once culm data was measured for all culms, a random selection of culms underwent preservation treatment prior to testing.

The mechanical characterization tests provided a set of structural parameters including; average strength values in compression, shear, flat ring flexure and tension for *Bambusa Vulgaris* (Sri Lankan Yellow bamboo). All Strength values tend to show gradual increase from bottom towards the top of the culm. Comparison of treated vs. untreated strength values across all four tests showed no significant increase in strength initially due to preservation treatment. Average densities of test samples tend to show a strong relationship with their respective strengths, whereas average diameter does not. Comparison of average strength values of *Bambusa Vulgaris* (Sri Lankan Yellow bamboo) with the same species from Kenya as well as relatable other species from Thailand revealed that the average strength values of *Bambusa Vulgaris* (Sri Lankan Yellow bamboo) to be lower compared to the respective average strength values of other species except in the case of tensile strength. Sri Lankan *Bambusa Vulgaris* showed characteristic strengths of 17.0N/mm<sup>2</sup>, 2.0N/mm<sup>2</sup>, 16.0N/mm<sup>2</sup> and 20.0N/mm<sup>2</sup> for compressive strength, shear strength, bending strength in flat ring flexure and tensile strength respectively.

**Key words:** *Bambusa Vulgaris*, flat ring flexure, compressive strength, shear strength,

# CONTENTS

DECLARATION .....	i
ACKNOWLEDGEMENT .....	ii
ABSTRACT .....	iv
CONTENTS .....	vi
LIST OF FIGURES .....	x
LIST OF TABLES .....	xii
1. INTRODUCTION .....	1
1.1 General .....	1
1.2 Scope of research.....	2
1.3 Objectives .....	3
1.4 Methodology .....	3
1.5 Arrangement of the thesis.....	3
2. LITERATURE REVIEW .....	5
2.1 Bamboo in Sri Lanka.....	5
2.2 Utilization of Bamboo .....	6
2.3 Bamboo as a Construction Material .....	7
2.4 Preparation for Full Culm Bamboo Construction .....	9
2.4.1 Harvesting and Grading.....	9
2.4.2 Preservation treatment methods.....	10
2.5 Design of Bamboo Structures.....	13
2.5.1 Design Standards .....	13
2.5.2 Design Values .....	16
2.6 Summary .....	19



3. EXPERIMENTAL PROGRAMME .....	21
3.1 Introduction .....	21
3.2 Fabrication of Test Apparatus .....	21
3.2.1 Culm Data Measurement Frame .....	21
3.2.2 Compressive Strength Testing Plates .....	22
3.2.3 Shear Strength Testing Plates .....	23
3.2.4 Flat ring flexure plates .....	24
3.3 Handling of Culms .....	25
3.4 Culm Data Measurement.....	26
3.5 Preservation Treatment of Poles.....	28
3.6 Structural Testing .....	29
3.6.1 Preparation of Samples .....	29
3.6.2 Compressive Strength Testing.....	32
3.6.3 Shear Strength Testing.....	33
3.6.4 Flat Ring Flexure Testing.....	33
3.6.5 Tensile Testing.....	34
3.7 Summary .....	35
4. RESULTS AND DISCUSSION .....	37
4.1 Bamboo Provenance.....	37
4.2 Moisture Content Check.....	38
4.3 Culm Data Measurement.....	39
4.4 Compressive Strength.....	43
4.4.1 Test Results.....	43
4.4.2 Relationship with Diameter .....	45

4.4.3 Relationship with Density.....	46
4.4.4 Effect of Preservation Treatment.....	46
4.5 Shear Strength .....	48
4.5.1 Test Results.....	48
4.5.2 Relationship with Diameter .....	50
4.5.3 Relationship with Density.....	50
4.5.4 Effect of Preservation Treatment.....	51
4.6 Flat Ring Flexure.....	53
4.6.1 Test Results.....	53
4.6.2 Relationship with Diameter .....	55
4.6.3 Relationship with Density.....	56
4.6.4 Effect of Preservation Treatment.....	58
4.7 Tensile Strength.....	59
4.7.1 Test Results.....	59
4.7.2 Relationship with Diameter .....	61
4.7.3 Relationship with Density.....	61
4.7.4 Effect of Preservation Treatment.....	62
4.8 Comparison of Results .....	64
5. CONCLUSION AND FUTURE WORK .....	67
5.1 Conclusions .....	67
5.2 Future Work .....	69
REFERENCES.....	71
APPENDICES .....	75
APPENDIX A1 .....	75

APPENDIX A2 .....	81
APPENDIX A3 .....	87
APPENDIX A4 .....	97
APPENDIX B1 .....	103

## LIST OF FIGURES

Figure 2.1: Full culm bamboo Bridge in Java, Indonesia (www.archdaily.com, 2017)....	8
Figure 2.2: Bamboo used for a restaurant building, Elle, Sri Lanka (Photo: Kumara, 2019) .....	8
Figure 2.3: Luum Temple, Mexico (bamboo-construction, 2019).....	8
Figure 2.4: Sombra Verde pavilion, Singapore (bamboo-construction, 2019).....	8
Figure 2.5: Engineered bamboo construction (Wei, 2019(b)) .....	9
Figure 2.6: Checking straightness of pole.....	10
Figure 2.7: Horizontal dip diffusion (Stamm, et al. 2014).....	11
Figure 2.8: Vertical sap diffusion (Stamm, et al. 2014).....	11
Figure 2.9: Treatment in trough .....	12
Figure 2.10: Modified Boucherie method (Stamm, et al. 2014) .....	12
Figure 2.11: Relevant European norms and ISO timber standards and their application to bamboo (Gato´o, et al. 2014) .....	15
Figure 3.1: Dimensions of the fabricated V-frames in mm .....	21
Figure 3.2: 3D view of a V-frame in use for culm data measurement.....	22
Figure 3.3: Dimensions of compressive strength testing plates in mm .....	22
Figure 3.4: 3D view of compression testing plates .....	23
Figure 3.5: Dimensions of shear strength testing plates in mm .....	23
Figure 3.6: 3D view of shear test plates .....	24
Figure 3.7: Dimensions of flat ring flexure test plates in mm .....	24
Figure 3.8: 3D view of flat ring flexure plates.....	25
Figure 3.9: Bamboo culms kept slanted on wall.....	25
Figure 3.10: Data measurement setup for a bamboo culm.....	26
Figure 3.11: Detailing of a typical culm cross section.....	27
Figure 3.12: sample legend detail used for culm data measurement .....	28
Figure 3.13: Preservation treatment of poles .....	29
Figure 3.14: Preservation treatment of poles .....	29
Figure 3.15: Samples being marked on a pole prior to cutting .....	30

Figure 3.16: A set of samples prepared for testing .....	30
Figure 3.17: Compressive strength testing with standard compression machine .....	32
Figure 3.18: Shear strength testing with standard compression machine .....	33
Figure 3.19: Flat ring flexure testing with standard compression machine .....	34
Figure 3.20: Four point bending flat ring flexure test geometry (Virgo, et al. 2018) .....	34
Figure 3.21: Tensile testing with Hounsfield Tensometer .....	34
Figure 4.1: A sample checked for moisture content .....	38
Figure 4.2: Failure of 06-B-Top during compression loading .....	44
Figure 4.3: Compressive failure pattern of 06-B-Top .....	44
Figure 4.4: Top view of compressive failure pattern of 06-B-Top .....	44
Figure 4.5: Diameter vs. Compressive strength plot .....	45
Figure 4.6: Average density vs. Compressive strength plot .....	46
Figure 4.7: Shear failure pattern of 58-T-Bottom sample .....	49
Figure 4.8: Shear failure pattern of 07-B-Bottom sample .....	49
Figure 4.9: Diameter vs. Shear strength plot .....	50
Figure 4.10: Average density vs. Shear strength plot .....	51
Figure 4.11: Failure in loading of a flat ring flexure test sample .....	54
Figure 4.12: Failure pattern 58-T-Top sample in flat ring flexure test .....	54
Figure 4.13: Diameter vs. bending strength plot and Diameter vs. MOR plot .....	56
Figure 4.14: Average density vs. Bending strength plot and Average density vs. MOR plot .....	57
Figure 4.15: Tensile failure between grip and node of 58-T-Top sample .....	60
Figure 4.16: Tensile failure at node of 02-B-Top sample .....	60
Figure 4.17: Average diameter vs. Tensile strength plot .....	61
Figure 4.18: Average density vs. Tensile strength plot .....	62

## LIST OF TABLES

Table 2.1: Cultivation locations of bamboo species in Sri Lanka (Kariyawasam, 1998)..5	5
Table 2.2: Known uses of Sri Lankan bamboo species (De Soyza & Vivekanandan, 1991) .....	6
Table 2.3: Uses of parts of Bamboo plant (Wei, 2019(b)).....	7
Table 2.4: Existing structural bamboo standards and codes (Gato’o, et al. 2014).....	13
Table 2.5: Average strengths of dry mature bamboo.....	16
Table 2.6: Characteristic strength and design values for Colombian dry mature bamboo .....	17
Table 2.7: Typical values of modulus of elasticity (Kaminski, et al. 2016) .....	17
Table 2.8: Moisture content correction factor $C_{\text{mois}}$ as a function of the moisture content at time of testing (Kaminski, et al. 2016).....	18
Table 2.9: Laboratory test correction factor $C_{\text{lab}}$ (Kaminski, et al. 2016).....	18
Table 3.1: Legend for culm data measurement.....	27
Table 3.2: Distribution of number of samples per test.....	30
Table 3.3: Distribution of tests based on position of sample .....	31
Table 3.4: Legend for test results and specimen data .....	31
Table 4.1: Provenance of acquired bamboo culms .....	37
Table 4.2: Moisture content check of five random culms.....	38
Table 4.3: Culm data of pole 01-B.....	39
Table 4.4: Culm data along short span of pole 01-B in mm .....	40
Table 4.5: Culm data along long span of pole 01-B in mm .....	41
Table 4.6: Summary of full culm data of pole 01-B in mm.....	42
Table 4.7: Compression test data of 06-B-Top .....	43
Table 4.8: Average compressive strength values in $\text{N/mm}^2$ based on position of sample .....	44
Table 4.9: Comparison of compressive strength in $\text{N/mm}^2$ of treated and untreated samples .....	47
Table 4.10: Shear test data of 07-B-Bottom.....	48

Table 4.11: Average shear strength values in N/mm <sup>2</sup> based on position of sample .....	49
Table 4.12: Comparison of average shear strength in N/mm <sup>2</sup> of treated and untreated samples .....	51
Table 4.13: Flexural test data of 58-T-Top .....	53
Table 4.14: Average bending strength values in N/mm <sup>2</sup> based on position of sample....	55
Table 4.15: Average modulus of rupture values in N/mm <sup>2</sup> based on position of sample	55
Table 4.16 : Comparison of average bending strength in N/mm <sup>2</sup> of treated and untreated samples .....	58
Table 4.17: Comparison of average modulus of rupture values in N/mm <sup>2</sup> of treated and untreated samples .....	58
Table 4.18: Tensile test data of 06-B-Top .....	59
Table 4.19: Average tensile strength values in N/mm <sup>2</sup> based on position of sample .....	60
Table 4.20: Comparison of average tensile strength values in N/mm <sup>2</sup> of treated and untreated samples .....	63
Table 4.21: Comparison of average strengths of different bamboo species from literature in N/mm <sup>2</sup> .....	64
Table 4.22: Calculation of characteristic strengths for Sri Lankan <i>Bambusa Vulgaris</i> ...	65
Table 4.23: Comparison of characteristic strengths of Sri Lankan <i>Bambusa Vulgaris</i> with different bamboo species from literature and reliable softwood classes in N/mm <sup>2</sup> .....	66
Table A1.1: Compressive strength test specimen dimensions .....	75
Table A1.2: Compressive strength test result data .....	78
Table A2.1: Shear strength test specimen dimensions.....	81
Table A2.2: Shear strength test result data.....	84
Table A3.1: Flat ring flexure test specimen dimensions.....	87
Table A3.2: Flat ring flexure test results data part I .....	90
Table A3.3: Flat ring flexure test results data part II .....	93
Table A4.1: Tensile strength test specimen dimensions .....	97
Table A4.2: Tensile strength test result data.....	100