



UNIVERSITI PUTRA MALAYSIA

***DESIGN AND FABRICATION OF LAMINATED VENEER LUMBER
CLASSROOM CHAIR***

NIK AIZAN BIN NIK ABDULLAH

FK 2010 96

DEDICATION

This thesis is dedicated to

my parents and my family,

*my wife Rozita Ismail, my sons and daughters, Nik Muhammad Mu'izzuddin,
Nik Afeef Zharfan, Nik Nur Farhana and Nik Nur Fatin*



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment
of the requirement for degree of Master of Science

**DESIGN AND FABRICATION OF LAMINATED VENEER LUMBER
CLASSROOM CHAIR**

By

NIK AIZAN BIN NIK ABDULLAH

January 2010

Chairman : Tang Sai Hong, PhD

Faculty : Engineering

There were 2,916,841 secondary students registered in Malaysia for 2000/2001 session, with an estimated increase of about two percent annually. The most essential item required by any school is furniture especially chairs and desks as the number of students increase each year. The increase in demand is also due to frequent damage caused by various reasons. The Ministry of Education spent 33 million ringgit for school furniture in 2008. Given the urgency of the above problem, this research has been undertaken to develop a new classroom chair which is more durable than the current chairs. The study emphasizes on design, material and jointing system used in developing process of the classroom chair. From the interviews and physical observation, it was demonstrated that the current classroom chair is fragile, vulnerable to various types of defect, short life cycle and not repairable. The above problems occurred due to failure in design, as well as the material and jointing used in this current classroom chair. Therefore a new design of classroom chair made of LVL has been developed to overcome the above problems. LVL has been chosen as material for the new design classroom chair as it can be curved to desired shape through a moulding process, allows manufacturing of the chair frame using

a single bent blank, hence the new chair design has fewer components to be assembled. According to DfA principles, less components of the chair will result in less risk of defect and easy to assemble. Bolt and nut are used as jointing systems. The design of the chair also has reduced the risk of defect by aborting the front joint of the chair. According to FRIM standard test, this joint is the most vulnerable part of the current classroom chair. In this study, the current and proposed classroom chair have undergone the FRIM test for strength and stability, the both chairs failed the drop test. However, the damage occurred to the current classroom chair are more critical compared to the proposed LVL classroom chair. The damages are major crack and gapping of the joint between the seat and rear leg. On the other hand, the proposed LVL classroom chair had only a minor crack. In conclusion, this study has proposed a school chair which can be used to replace the current school chair for secondary schools. The proposed LVL classroom chair is not only high in strength and durability, but also has aesthetic and economic values. The findings of this study are useful for further research of LVL classroom chair and also for other LVL products.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

REKA BENTUK DAN FABRIKASI KERUSI BILIK DARJAH PAPAN VENIR BERLAMINASI

Oleh

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Pada tahun 2000/2001, terdapat 2,916,841 jumlah pelajar sekolah menengah yang mendaftar bagi sesi persekolahan. Bilangan tersebut dijangkakan akan meningkat sebanyak dua peratus bagi setiap tahun. Bilangan pelajar yang meningkat setiap tahun memerlukan pertambahan perabot sekolah terutamanya kerusi dan meja. Pertambahan keperluan ini juga disebabkan oleh perabot yang sering mengalami kerosakan atas sebab-sebab tertentu. Pada tahun 2008 Kementerian Pelajaran Malaysia membelanjakan sebanyak RM 33 juta untuk perabot sekolah. Berdasarkan permasalahan yang berlaku penyelidik telah mengambil inisiatif untuk menjalankan kajian di mana tujuan kajian ini adalah untuk menghasilkan kerusi bilik darjah yang lebih kukuh dan tahan lama. Kajian ini menekankan rekabentuk, bahan dan sistem penyambungan yang digunakan dalam proses pembuatan kerusi. Temuramah dan pemerhatian fizikal dalam kajian ini menunjukkan kerusi bilik darjah yang ada sekarang mempunyai jangka hayat yang pendek dan mudah mengalami kerosakan yang tidak boleh dibaikpulih. Masalah ini terjadi kerana kegagalan dari segi reka bentuk, bahan dan juga sistem penyambungan yang telah digunakan dalam proses pembikinan kerusi tersebut. Oleh itu, sebuah kerusi bilik darjah yang diperbuat daripada papan venir berlaminasi telah direka untuk

mengatasi masalah di atas. Papan venir berlaminasi dipilih berdasarkan sifat fizikalnya yang boleh dibengkokkan mengikut kehendak rekaan melalui proses pengacuan. Kaedah ini membolehkan proses membuat bingkai dari sekeping papan venir berlaminasi, menjadi sebuah kerusi yang mempunyai komponen yang sedikit dan mudah dipasang. Merujuk kepada prinsip dan garis panduan Reka bentuk untuk Pemasangan (*DfA*), komponen yang sedikit akan mengurangkan risiko kerosakan dan mudah untuk dipasang. Bol dan nat digunakan bagi sistem penyambungan. Reka bentuk kerusi ini yang tidak mempunyai sendi di bahagian struktur kaki hadapan dapat mengurangkan risiko kerosakan. Menurut kajian dari Institut Penyelidikan Perhutanan Malaysia (*FRIM*), bahagian penyambungan sesebuah kerusi bilik darjah adalah bahagian yang paling mudah rosak. Dalam kajian ini, kerusi yang sedia ada dan kerusi yang baharu telah melalui ujian ketahanan dan kestabilan yang telah dijalankan oleh pihak *FRIM*. Hasil ujian ini menunjukkan kedua-dua kerusi gagal dalam ujian di peringkat ujian hempasan. Walau bagaimanapun, kerosakan yang berlaku pada kerusi yang ada sekarang adalah lebih kritikal berbanding dengan kerusi papan venir berlaminasi yang baharu. Kerosakan dengan retakan yang besar dan jarak penyambungan yang tercabut di antara bahagian tempat duduk dan kaki belakang kerusi. Tetapi bagi kerusi bilik darjah papan venir berlaminasi hanya mengalami keretakan yang sedikit. Di akhir kajian, penyelidik akan menghasilkan kerusi bilik darjah yang dapat menggantikan kerusi bilik darjah sekolah menengah yang sedia ada. Kerusi papan venir berlaminasi ini bukan sahaja mempunyai kekuatan dan ketahanan tetapi ia juga mempunyai nilai estetik dan ekonomi. Keputusan dari kajian ini akan mendapat membantu untuk penyelidikan kerusi sekolah papan venir berlaminasi dan juga penyelidikan produk papan venir berlaminasi pada masa akan datang.

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I certify that an Examination Committee has met on 22 Jan 2010 to conduct the final examination of Nik Aizan b Nik Abdullah on his Master of Science thesis entitled “Design and Fabrication of Laminated Veneer Lumber (LVL) Classroom Chair” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Member of the Examination Committee are as follow:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotation and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Putra Malaysia or other institutions.



NIK AIZAN B NIK ABDULLAH

Date: 01 January 2010

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