VERIFICATION

"I verify that, I have read this report and from my opinion this thesis have fulfill the scope and quality requirement for Bachelor Mechanical Engineering (Structure and Material)"

Signature : ……

Supervisor Name : MR. RAZALI BIN MOHD TIHTH

Date : ……

R66 BUS SUPERSTRUCTURE CONCEPT DESIGN DEVELOPMENT

LAW SOO HAR

This report is submitted as partial requirement for the completion of the Bachelor of Mechanical Engineering (Structure and Material) Degree Program

Faculty of Mechanical Engineering
Universiti Teknikal Malaysia Melaka

APRIL 2009

DECLARATION

"I hereby, declare this thesis is result of my own research except as cited in the references"

Signature : …….

Author Name : Law Soo Har

Date : …….

DEDICATION

To

My Beloved Family

My Parent

Yin Teng

ACKNOWLEDGEMENTS

Final year project is requisite to fulfill the Bachelor of mechanical engineering. This report was written in order to fulfill the requirement of Bachelor of mechanical engineering for Final Year Project. I was thankful to manage this report writing on time.

In order to finish my project and make it successful, I owe a debt of thanks to all those time, concern and efforts were given during the process of this project. Thus, my heartfelt gratitude is extended to my beloved advisor; Mr. Razali Bin Mohd Tihth who gives me advises and guides me in the project of "R66 Bus Superstructure Concept Design Development". He is always pushes me and giving many of criticism, and always checking the progress.

Thanks to all my coursemates because they are always gave me some opinion and comments on this project. Thanks also to my parents that understand my situation, giving extra money for go somewhere, doing research and print it as a report.

I would like to pray for you all with good health, and always happy.

ABSTRAK

Masa sekarang, bas merupakan bahagian integral dari sistem pengangkutan kebangsaan. Meskipun bas adalah salah satu sarana yang paling dalam angkutan umum, tapi penghuninya kecederaan dan kematian di bas crash akan terjadi. Tingkat kecederaan serius dan kematian ahli dalam kemalangan “rollover” lebih tinggi bila dibandingkan dengan semua jenis kemalangan. Dengan selalu meningkatkan kesedaran untuk keselamatan penumpang, lebih diinginkan untuk mengembangkan struktur bas hanya mempunyai kekuatan untuk memenuhi keselamatan penumpang. Oleh kerana itu, kekuatan “rollover” telah menjadi isu penting bagi pengeluar bas dan jurulatih. Parti kerja (UNECE) telah membiarkan PADU R66 peraturan yang berkaitan dengan perlindungan dan kekuatan bas struktur dalam kemalangan.

Objektif dari projek "Pembinaan reka concept Bas R66 Suprastruktur" adalah reka “data digital” untuk reka konsep bas chassis yang sesuai dengan R66 dan mengembangkan reka konsep struktur bas akhir yang sedang dipertimbangkan aplikasi yang optimum dalam hal berat badan, bahan, dan proses pembuatan. Projek ini dibahas perkembangan terhadap struktur bas dari teori impak analisis atapnya menghancurkan dan “rollover” di ADAMS-View. ADAMS-View perisian ini digunakan untuk mensimulasikan “rollover” bas. Tenaga pergerakkan, kelajuan, daya impak apabila impak di atas lantai dan sudut bas dengan lantai sebelum impak diukur dalam ADAMS-View dan kemudian digunakan sebagai masukan untuk analisis teori impak. Analisis kelengkungan struktur bas dengan menggunakan perisian MSC. Patran dan MSC. Nastran untuk membandingkan keputusan dengan keputusan daripada cara pengiraan teori impak. Menurut regulasi ECE-R66, seorang penumpang ruangan kelangsungan hidup ditakrifkan dalam model bas untuk memeriksa sama ada kerosakkan ke dalam ruangan kelangsungan hidup selama atau setelah “rollover”. Hal ini memastikan bahawa struktur bas mempunyai cukup kekuatan untuk menghindari kerosakkan ke ruangan kelangsungan hidup.

ABSTRACT

Nowadays, buses are an integral part of the national transportation system. Although buses are one of the safest means of public transportation, but the occupant cause in injuries and fatalities in bus crashes still occurred. The rate of serious injuries and fatalities of occupants in rollover accidents is higher compared with all other types of accidents. With the ever-increasing awareness for the occupant's safety, it is much desired to develop the bus structure which has enough strength to meet the safety norms. Therefore, rollover strength has become an important issue for buses and coaches manufacturers. The working party of the United Nations Economic Commission for Europe (UNECE) had allowed the relevant regulation ECE R66 deals with occupant protection and strength of bus superstructure during accident which involved rollover.

The purpose of this project, "R66 Bus Superstructure Concept Design Development" is to design a digital data for bus chassis concept which comply with R66 regulation and develop the final bus structure concept which being considered the optimum application in term of weight, material, compliances, and manufacturing process. This project is discussed the development of bus structure from theoretical impact analysis of its roof crush in rollover analysis using ADAMS-View. ADAMS-View software was used to simulate the rollover of the bus. Bus kinetic energies, velocities, impact force of bus structure on the ground and its angle with the ground just before impact was measured in ADAMS-View. By using these inputs for the calculation structure deformation and energy absorb by bus structure using theoretical impact calculation is execute. On the other hand, bus structure deformation analysis by using MSC. Patran and MSC. Nastran is used for the comparison purpose to the gain from theoretical impact calculation method. According to the ECE-R66 regulation, a passenger's survival space is defined in the bus model to check whether, there is any intrusion into the survival space during or after the rollover. This is to ensure the bus structure has sufficient strength to avoid intrusions into the survival space.

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LIST OF SYMBOLS

a	=	Acceleration of object
d	=	Crumpling distance or travel distance
F_{avg}	=	Impact force
g	=	Gravity force
h	=	Height
J	=	Joule
m	=	Mass of object
N	=	Newton
t	=	Time
s	=	Second
u	=	Initial velocity of object
v	=	Final velocity of object
W	=	Work done

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CHAPTER 1

INTRODUCTION

In this report, the discussion on study of "R66 Bus Superstructure Concept Design Development" will be called out.

In today's competitive environment, one of the most powerful business competencies is a fast product design and development process. Almost all of the industries are keen to leverage advancements in CAE (Computer Aided Engineering) to shorten development cycle time. It is very much required to meet the stringent government norms before delivering product to the market and it is one of the primary concerns for every manufacturer. With the increasing awareness for occupant's safety and crashworthiness in automotive industries, buses are also receiving more attention for occupant's safety. Mainly during rollover accident, it has been observed that the deforming body structure of bus seriously threatens the lives of passenger and driver. Therefore, the strength of bus structure has become main concern of bus and coach manufacturers.

In Europe, the working party of the United Nations Economic Commission for Europe (UNECE) had allowed the relevant regulation ECE R66 deals with occupant protection and strength of bus superstructure during rollover accident. According to ECE R66, the regulations calls for quasi-static rollover of the full scale vehicle with un-laden kerb mass.

1.5 Background

Nowadays, many automotive manufacturers are investing large capital in crashworthiness and automobile safety research. As a result, according to Traffic Safety Facts (2004), the fatality rate dropped to a new historic low of 1.44 fatalities per 100 million of vehicles traveling in 2004. Currently, automotive industries are more concentrating or focusing on vehicle rollover, as rollover accidents have only decreased a little more than a half percent in the last decade. It can be showed that vehicle rollover is one of the serious highway accidents. The risk of fatal injuries is more in a rollover accident than any other type of accident.

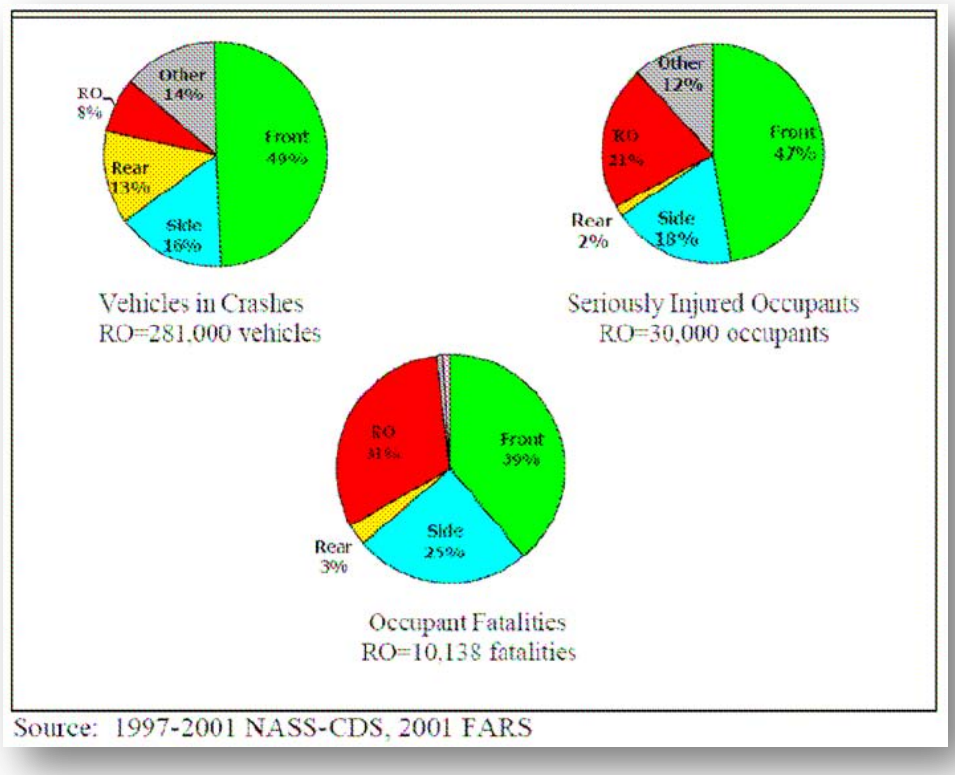

Figure 1.1: The percentage of rollover accident compared with the others type of accidents. (Source: NASS-CDS, (2001))

Figure 1.1 shows the data from the 1997-2001 National Automotive Sampling System (NASS) and Crashworthiness Data System (CDS).