AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
AUTOMOTIVE ENGINEERING DEPARTMENT

INVESTIGATION OF PASSENGER CAR IMPACT ABSORBERS APPLYING ENERGY ABSORBING CONCEPT

A thesis submitted in partial fulfillment of the requirements for the Master of Science degree in Automotive Engineering

by

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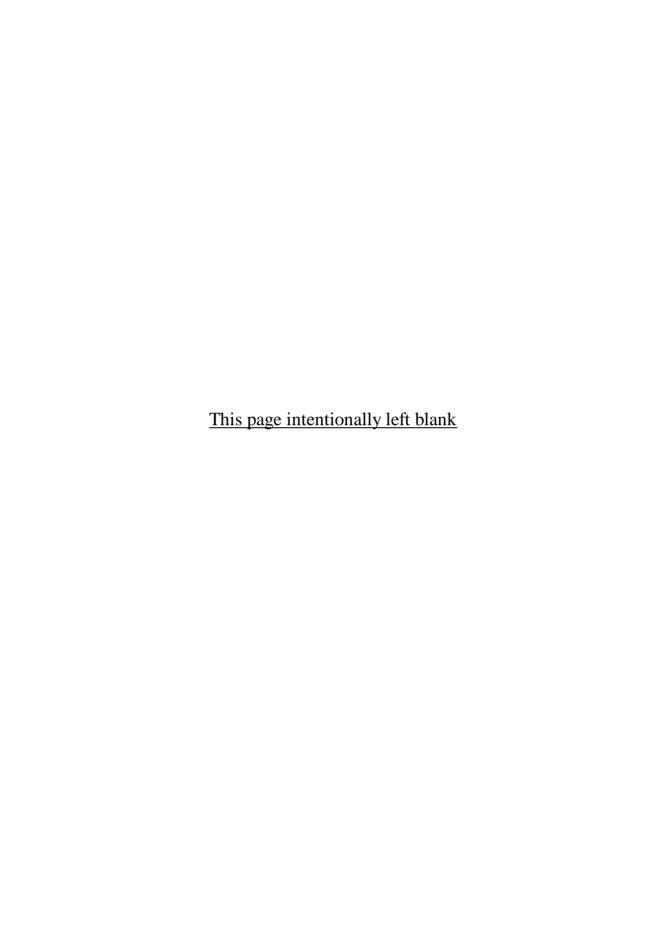
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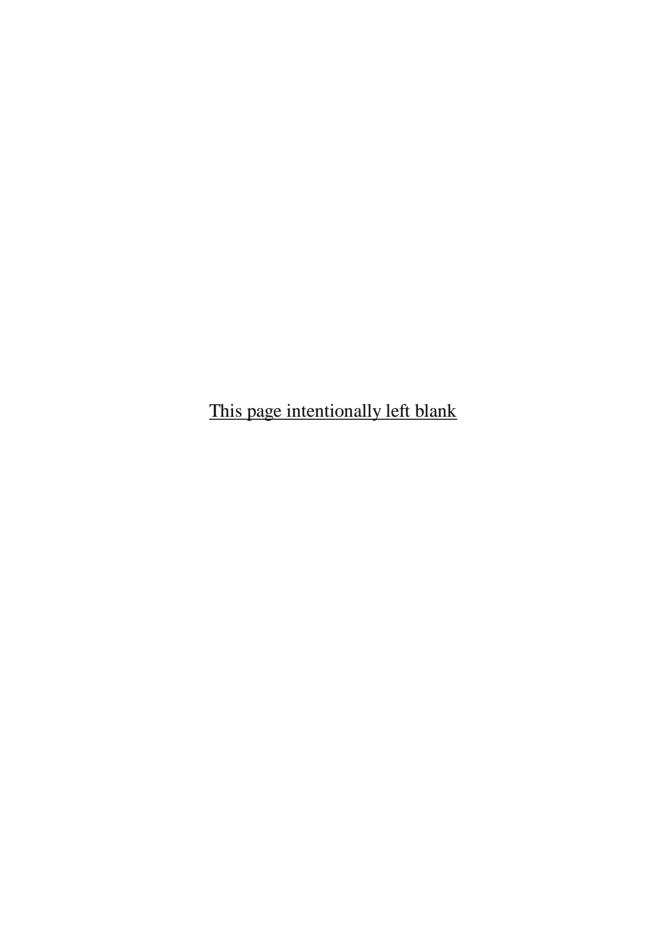| Name and Affiliation	Signature
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STATEMENT

This thesis is submitted as partial fulfillment of Master of Science degree in Automotive Engineering, Faculty of Engineering, Ain Shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or qualification at any other scientific entity.

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List of Publications

The following publications have been published while in conduct of this study:

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http://www.erpublications.com/uploaded_files/download/download_22_05_2016_16_43_12.pdf

THESIS SUMMARY

This research is dedicated to the study of the effects of the passenger cars frontal energy absorbers design on its ability to absorb and dissipate impact energy. Energy absorbers (Crashworthiness) are used to dissipate collision energy upon plastic deformation to prevent critical parts damaging of the vehicle structure. In this work, experimental approach is used to determine the energy absorption and the mechanical behavior of thin-walled aluminum structures with various shapes of different 100 cold-formed aluminum specimens under quasi-static axial compression testing showing the effect of shape (Triangle, Square, and Hexagonal), construction (Simple-cell or Multi-cells), Filling (Empty, Foam or Styropor), and adhesive material (clear Epoxy or clear duct tape) used to connect each sample. This research also summarizes the history of thin-walled structures testing from 60's to present. An experimental testing machine (*WDW-10 Computer Control Electromechanical Universal Testing Machine*) was used to carry out the laboratory experiments, where load-deflection properties for Simple and Multi cell thin-walled tubes specimens that utilized in passenger cars chassis construction were measured. There was good consistency between the testing data. The results showed that the energy absorption capacity of simple hexagonal sections is greater than that of other simple sections by **147.7%.** As well as, simple hexagonal sections absorbed the greatest amounts of energy per unit of mass with **95.4%** more than other simple shapes. For multi-cell specimens, square section with blades connected to middle of each side has the maximum energy absorption capacity with **208.1%** and the higher SAE with **224.3%** than other multi-cell specimens. And for hybrid