

**DESIGN AND PRODUCT DEVELOPMENT OF MULTI- PURPOSE RIHAL  
THROUGH CONCURRENT ENGINEERING TOOLS AND TECHNOLOGY**

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**This report is submitted to the Faculty Mechanical Engineering in partial to fulfill the  
requirement for Bachelor Mechanical Engineering  
(Design and Innovation)**

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**APRIL 2009**

“I hereby declared that this report is a result of my own work except for the  
works that have been cited clearly in the references.”

Signature : .....

Name of author : .....

Date : .....

To my dearest parents, sister and brother

## ACKNOWLEDGEMENTS

First of all, I would like to thank Allah for His blessing that help me finally completed my final year project. I also would like to express my sincerest thanks to my supervisor, Mr. Hambali Boejang who has guided and supported me, sharing ideas and knowledge throughout the whole project. To my beloved family, thank you very much for their love, encouragement and support in order to help me succeed in completing this final year project.

Further, I would like to express my gratitude to Tuan Hj Abdullah who had sharing ideas and knowledge throughout my project. I also take this opportunity to say thanks to all of every single person that helps me in any kind of help in my way to finish up my project.

Last but not least, thanks to all of my friends who stood by me no matter what and gave me full support upon completion of this project. Without the assistance to support from individual and institution I am sure that I cannot finish this project in allocated time given.

Finally, I owe greatest debts to everyone that constantly gives support and cooperation during the project's period. Thank you very much.

## ABSTRACT

The title of the project is “design and product development of multi-purpose rehal through concurrent engineering tools and technology”. This project uses the principles of concurrent engineering and rapid prototyping as a tool to produce a product. To realize this project, the new design of “papan rehal” will be developed through concurrent product development approach from sketching until prototyping. The first step is to sketch the concept design, after chosen the final concept; a model will be design by using computer aided software. The next step is to determine its capabilities using finite element analysis. As for modeling, used SolidWorks 2009 while for the analysis used COSMOSWorks 2009. Rapid Prototyping process is used to build the product by using fused deposition modeling machine.

## ABSTRAK

Tajuk projek ialah “Merekabentuk dan menghasilkan papan rehal serbaguna dengan menggunakan pendekatan teknologi yang terkini”. Projek ini menggunakan prinsip-prinsip teknologi yang terkini, merekabentuk dengan menggunakan *SOLIDWorks2009*, menganalisis dengan menggunakan *COSMOSWorks2009* dan *Rapid prototyping* sebagai salah satu alat untuk menghasilkan produk. Untuk menghasilkan projek ini, rekaan baru papan rehal akan dihasilkan dengan menggunakan pendekatan teknologi yang terkini dari proses melakar sehingga ke proses penghasilan produk. Langkah pertama adalah melukis konsep-konsep rekabentuk, selepas memilih konsep akhir; model akan dilukis dengan menggunakan perisian bantuan komputer. Langkah seterusnya adalah menentukan kebolehannya dengan menggunakan *finite element analysis*. Proses *Rapid Prototyping* dilakukan dengan menggunakan *fused deposition modeling machine* untuk penghasilan produk.

**TABLE OF CONTENT**

<b>DECLARATION</b>	<b>ii</b>
<b>DEDICATION</b>	<b>iii</b>
<b>ACKNOWLEDGEMENT</b>	<b>iv</b>
<b>ABSTRAK</b>	<b>v</b>
<b>ABSTRACT</b>	<b>vi</b>
<b>TABLE OF CONTENT</b>	<b>vii</b>
<b>LIST OF TABLE</b>	<b>xiii</b>
<b>LIST OF FIGURE</b>	<b>xiv</b>
<b>ABBREVIATION</b>	<b>xvi</b>
<b>LIST OF APPENDIX</b>	
<b>CHAPTER 1: INTRODUCTION</b>	
<b>1.1 Background</b>	<b>1</b>
<b>1.2 Aim</b>	<b>2</b>
<b>1.3 Objective</b>	<b>2</b>

<b>1.4</b>	<b>Scope</b>	<b>3</b>
<b>1.5</b>	<b>Problem Statement</b>	<b>3</b>
<b>1.6</b>	<b>Report Outline</b>	<b>4</b>
 <b>CHAPTER 2: CONCURRENT PRODUCT DEVELOPMENT</b>		
<b>2.1</b>	<b>Existing Product</b>	<b>5</b>
<b>2.1.1</b>	<b>Folding Quran Stand</b>	<b>5</b>
<b>2.1.2</b>	<b>Modern Quran stand</b>	<b>6</b>
<b>2.2</b>	<b>Product Development</b>	<b>7</b>
	<b>2.2.1 Customer needs</b>	<b>7</b>
	<b>2.2.2 Product specification</b>	<b>10</b>
	<b>2.2.3 Concept generation</b>	<b>11</b>
	<b>2.2.4 Concept selection</b>	<b>15</b>
	<b>2.2.4.1 Method for choosing a concept</b>	<b>16</b>
	<b>2.2.4.2 Benefit</b>	<b>16</b>
	<b>2.2.4.3 Methodology</b>	<b>17</b>
<b>2.3</b>	<b>What Is Concurrent Engineering</b>	<b>17</b>
	<b>2.3.1 Definition</b>	<b>17</b>
	<b>2.3.2 Need for concurrent engineering</b>	<b>18</b>
<b>2.4</b>	<b>How to Apply Concurrent Engineering</b>	<b>19</b>
	<b>2.4.1 Commitment, planning and leadership</b>	<b>19</b>
	<b>2.4.2 Continuous Improvement Process</b>	<b>20</b>
<b>2.5</b>	<b>Basic Principle of Concurrent Engineering</b>	<b>20</b>
<b>2.6</b>	<b>Technologies in Concurrent Engineering (CE)</b>	<b>21</b>
	<b>2.6.1 Concurrent Process</b>	<b>21</b>



<b>2.7</b>	<b>Why Used Concurrent Engineering</b>	<b>22</b>
	<b>2.7.1 Advantage</b>	<b>22</b>
	<b>2.7.1.1 Potential Advantage of Using Concurrent Engineering</b>	<b>22</b>
	<b>2.7.1.2 Concurrent Engineering Benefits</b>	<b>23</b>
<b>2.8</b>	<b>Comparison between SE and CE</b>	<b>24</b>
<b>2.9</b>	<b>Failure factor</b>	<b>25</b>

### **CHAPTER 3: COMPUTER AIDED DESIGN /FEA**

<b>3.1</b>	<b>CAD</b>	<b>26</b>
	<b>3.1.1 Introduction to CAD</b>	<b>26</b>
	<b>3.1.2 Fundamental and Basic Principle of CAD</b>	<b>28</b>
	<b>3.1.3 Benefits of CAD</b>	<b>29</b>
	<b>3.1.4 Application of CAD</b>	<b>30</b>
	<b>3.1.5 Solid Works</b>	<b>30</b>
<b>3.2</b>	<b>CAE</b>	<b>31</b>
	<b>3.2.1 Introduction to CAE</b>	<b>31</b>
	<b>3.2.2 Type of CAE</b>	<b>31</b>
	<b>3.2.3 Introduction to FEA</b>	<b>32</b>
	<b>3.2.4 COSMOS Works</b>	<b>32</b>

### **CHAPTER 4: RAPID PROTOTYPING**

<b>4.1</b>	<b>Introduction to Rapid Prototyping</b>	<b>33</b>
	<b>4.1.1 Overview of RP Process Chain from CAD to Prototype.</b>	<b>34</b>
<b>4.2</b>	<b>The Main Types of Rapid Prototyping</b>	<b>35</b>
	<b>4.2.1 Stereolithography (SLA)</b>	<b>35</b>
	<b>4.2.2 Fused Deposition Modeling (FDM)</b>	<b>36</b>
	<b>4.2.3 Selective Laser Sintering (SLS)</b>	<b>37</b>
<b>4.3</b>	<b>Pros and Cons of RP</b>	<b>39</b>

4.3.1	SLS or SLA rapid prototyping	39
4.4	Benefits and Applications	39
4.4.1	The benefits of RP	
4.4.2	RP applications within product development process	40
<b>CHAPTER 5: METHODOLOGY</b>		
5.1	Introduction to Methodology	41
5.2	Flow Chart	42
5.2.1	Title selection, confirmation and product selection	44
5.2.2	Literature review	44
5.2.3	Methodology base on Concurrent product development	45
5.2.3.1	Conceptual design	45
5.2.3.1.1	Sketching by using free hand.	46
5.2.3.1.2	Drawing via Rhino 3.0 SE (E)	47
5.2.3.2	Survey	49
5.2.3.3	Sketches and detail design	54
5.2.3.4	Part design	54
5.2.3.5	Assembly design	59
5.2.3.6	Analysis the design	61
5.2.3.7	Prototyping pre-processing	63
5.2.3.8	Prototyping process	67
5.2.3.9	Finishing	68
5.2.4	Preparation of technical report and submission	72
5.3	GANTT CHART	73
5.3.1	Gantt chart PSM I	73
5.3.2	Gantt chart PSM II	75

**CHAPTER 6: RESULT AND DISSCUSION**

<b>6.1</b>	<b>Introduction to Result and Discussion</b>	<b>77</b>
<b>6.2</b>	<b>Part drawing data</b>	<b>77</b>
<b>6.2.1</b>	<b>Multi-purpose rehal's bag</b>	<b>77</b>
<b>6.2.2</b>	<b>Multi-purpose rehal</b>	<b>78</b>
<b>6.3</b>	<b>Analysis data</b>	<b>80</b>
<b>6.3.1</b>	<b>Acrylonitrile butadiene styrene (ABS) material</b>	<b>80</b>
<b>6.3.1.1</b>	<b>Properties and advantages of ABS material</b>	<b>80</b>
<b>6.3.1.2</b>	<b>COSMOSWork data result and discussion for ABS material</b>	<b>81</b>
<b>6.3.2</b>	<b>Polypropylene (PP Copolymer) material</b>	<b>85</b>
<b>6.3.2.1</b>	<b>Properties and advantages of PP material</b>	<b>85</b>
<b>6.3.2.2</b>	<b>COSMOSWork data result and discussion for PP material</b>	<b>86</b>
<b>6.3.3</b>	<b>Polybutylene terephthalate (PBT General Purpose) material</b>	<b>90</b>
<b>6.3.3.1</b>	<b>Properties and advantages of PBT material</b>	<b>90</b>
<b>6.3.3.2</b>	<b>COSMOSWork data result and discussion for PBT material</b>	<b>90</b>
<b>6.4</b>	<b>Discussion</b>	<b>94</b>

**CHAPTER 7: CONCLUSION AND RECOMMENDATION**

<b>7.1</b>	<b>Conclusion</b>	<b>96</b>
<b>7.2</b>	<b>Recommendations</b>	<b>97</b>
	<b>REFERENCE</b>	<b>98</b>
	<b>APPENDIX</b>	<b>100</b>

**LIST OF TABLE**

<b>NO</b>	<b>TITLE</b>	<b>PAGE</b>
Table 2.1	Comparison between CE and SE	24
Table 5.1	Decision metrics of the generation concepts	53
Table 5.2	Gantt chart PSM I	74
Table 5.2	Gantt chart PSM II	76
Table 6.1	Study 1 property	83
Table 6.2	Result of ABS multi-purpose rehal analysis	84
Table 6.3	Properties for ABS	84
Table 6.4	Study 2 property	88
Table 6.5	Result of PP multi-purpose rehal analysis	89
Table 6.6	Properties for PP Copolymer	89
Table 6.7	Study 3 property	93
Table 6.8	Result of PBT multi-purpose rehal analysis	93
Table 6.9	Properties for PBT General Purpose	93
Table 6.10	Comparisons between ABS, PP and PBT	94

## LIST OF FIGURES

NO	TITLE	PAGE
Figure 2.1	Wooden traditional Quran stand	5
Figure 2.2	Wood and Aluminum book's stand	6
Figure 2.3	Wooden modern Quran stand	6
Figure 2.4	Inlaid book case and stand	7
Figure 2.5	Customer needs process	8
Figure 2.6	The five steps concept generation method	12
Figure 2.7	Concept Selection Process	15
Figure 2.8	Concurrent engineering process	20
Figure 2.9	Concurrent product development process	21
Figure 2.10	Sequential Development Method vs. Iterative Development Method	24
Figure 3.1	CAD modified design process	27
Figure 4.1	Schematic diagram of overall RP process chain	34
Figure 4.2	Schematic diagram of Stereolithography	36
Figure 4.3	Schematic diagram of fused Deposition Modeling (FDM)	37
Figure 4.4	Schematic diagram of laser Sintering (LS)	38
Figure 5.1	Flow chart for PSM 1 and PSM 2	42

<b>Figure 5.2</b>	<b>Flow chart for project methodology</b>	<b>43</b>
<b>Figure 5.3</b>	<b>Methodology project based on Concurrent Product Development</b>	<b>45</b>
<b>Figure 5.4</b>	<b>1<sup>st</sup> concept</b>	<b>46</b>
<b>Figure 5.5</b>	<b>2<sup>nd</sup> concept</b>	<b>46</b>
<b>Figure 5.6</b>	<b>3<sup>rd</sup> concept</b>	<b>46</b>
<b>Figure 5.7</b>	<b>4<sup>th</sup> concept</b>	<b>46</b>
<b>Figure 5.8</b>	<b>5<sup>th</sup> concept</b>	<b>46</b>
<b>Figure 5.9</b>	<b>1<sup>st</sup> concept</b>	<b>47</b>
<b>Figure 5.10</b>	<b>2<sup>nd</sup> concept</b>	<b>47</b>
<b>Figure 5.11</b>	<b>3<sup>rd</sup> concept</b>	<b>48</b>
<b>Figure 5.12</b>	<b>4<sup>th</sup> concept</b>	<b>48</b>
<b>Figure 5.13</b>	<b>5<sup>th</sup> concept</b>	<b>49</b>
<b>Figure 5.14</b>	<b>Survey question 1</b>	<b>50</b>
<b>Figure 5.15</b>	<b>Survey question 2</b>	<b>51</b>
<b>Figure 5.16</b>	<b>Survey's result</b>	<b>52</b>
<b>Figure 5.17</b>	<b>Sketches for final concept with dimensioning</b>	<b>54</b>
<b>Figure 5.18</b>	<b>Table part 1</b>	<b>55</b>
<b>Figure 5.19</b>	<b>Table part 2</b>	<b>55</b>
<b>Figure 5.20</b>	<b>Table part 3</b>	<b>56</b>
<b>Figure 5.21</b>	<b>Table part 4</b>	<b>56</b>
<b>Figure 5.22</b>	<b>Table part 5</b>	<b>57</b>
<b>Figure 5.23</b>	<b>Table part 6</b>	<b>57</b>
<b>Figure 5.24</b>	<b>Clip</b>	<b>58</b>
<b>Figure 5.25</b>	<b>Bag</b>	<b>58</b>

<b>Figure 5.26</b>	<b>Assembly drawing for multi-purpose rehal's bag</b>	<b>59</b>
<b>Figure 5.27</b>	<b>Assembly drawing for multi-purpose rehal</b>	<b>60</b>
<b>Figure 5.28</b>	<b>Template drawing of multi-purpose rehal</b>	<b>60</b>
<b>Figure 5.29</b>	<b>Process flow for analysis via COSMOSWorks 2007</b>	<b>61</b>
<b>Figure 5.30</b>	<b>Force 30N and restrain applied</b>	<b>62</b>
<b>Figure 5.31</b>	<b>Mesh applied</b>	<b>62</b>
<b>Figure 5.32</b>	<b>Analysis by using COSMOSWork2007</b>	<b>63</b>
<b>Figure 5.33</b>	<b>Schematic diagram of overall RP process chain</b>	<b>64</b>
<b>Figure 5.34</b>	<b>Base plat 8inch x 8inch</b>	<b>64</b>
<b>Figure 5.35</b>	<b>Separated drawing of table part 1</b>	<b>65</b>
<b>Figure 5.36</b>	<b>Separated drawing of bag</b>	<b>65</b>
<b>Figure 5.37</b>	<b>Example of part orientation by using Magics 9.0 software</b>	<b>66</b>
<b>Figure 5.38</b>	<b>Example of part orientation in Insight software</b>	<b>66</b>
<b>Figure 5.39</b>	<b>FDM machine model prodigy Stratasys</b>	<b>67</b>
<b>Figure 5.40</b>	<b>Plastic filament supply coil</b>	<b>67</b>
<b>Figure 5.41</b>	<b>Multi-purpose rehal's bag with support</b>	<b>68</b>
<b>Figure 5.42</b>	<b>Removing support from parts.</b>	<b>68</b>
<b>Figure 5.43</b>	<b>Sanding parts with sand paper</b>	<b>69</b>
<b>Figure 5.44</b>	<b>Spray with clear colour spray</b>	<b>69</b>
<b>Figure 5.45</b>	<b>Spray with selected colour</b>	<b>70</b>
<b>Figure 5.46</b>	<b>Red, Clear and Black paint</b>	<b>70</b>
<b>Figure 5.47</b>	<b>Some of assembly process for Multi-purpose rehal</b>	<b>71</b>
<b>Figure 5.48</b>	<b>Multi-purpose rehal</b>	<b>71</b>
<b>Figure 5.49</b>	<b>Some of assembly process for Multi-purpose rehal's bag</b>	<b>72</b>



<b>Figure 6.1</b>	<b>Bag</b>	<b>77</b>
<b>Figure 6.2</b>	<b>Clip</b>	<b>78</b>
<b>Figure 6.3</b>	<b>Table part 1</b>	<b>78</b>
<b>Figure 6.4</b>	<b>Table part 2</b>	<b>78</b>
<b>Figure 6.5</b>	<b>Table part 3</b>	<b>78</b>
<b>Figure 6.6</b>	<b>Table part 4</b>	<b>79</b>
<b>Figure 6.7</b>	<b>Table part 5</b>	<b>79</b>
<b>Figure 6.8</b>	<b>Table part 6</b>	<b>79</b>
<b>Figure 6.9</b>	<b>Study 1-strain</b>	<b>81</b>
<b>Figure 6.10</b>	<b>Study1-displacement</b>	<b>81</b>
<b>Figure 6.11</b>	<b>Study 1 – Principle stress</b>	<b>82</b>
<b>Figure 6.12</b>	<b>Study 1 - Von-Mises stress</b>	<b>82</b>
<b>Figure 6.13</b>	<b>FOS for study 1</b>	<b>83</b>
<b>Figure 6.14</b>	<b>Study 2-strain</b>	<b>86</b>
<b>Figure 6.15</b>	<b>Study 2-Displacement</b>	<b>86</b>
<b>Figure 6.16</b>	<b>Study 2- Principle stress</b>	<b>87</b>
<b>Figure 6.17</b>	<b>Study 2 - Von-Mises stress</b>	<b>87</b>
<b>Figure 6.18</b>	<b>FOS of study 2</b>	<b>88</b>
<b>Figure 6.19</b>	<b>Study 3-strain</b>	<b>90</b>
<b>Figure 6.20</b>	<b>Study 3-Displacement</b>	<b>91</b>
<b>Figure 6.21</b>	<b>Study 3 – Principle stress</b>	<b>91</b>

<b>Figure 6.22</b>	<b>Study 3 - Von-Mises stress</b>	<b>92</b>
<b>Figure 6.23</b>	<b>FOS of study 3</b>	<b>92</b>

**ABBREVIATION**

<b>CE</b>	<b>Concurrent engineering</b>
<b>SE</b>	<b>Sequential Engineering</b>
<b>FDM</b>	<b>Fused Deposition Machine</b>
<b>FEA</b>	<b>Finite Element Analysis</b>
<b>UTeM</b>	<b>Universiti Teknikal Malaysia Melaka</b>
<b>SLA</b>	<b>Stereolithography</b>
<b>SLS</b>	<b>Selective Laser Sintering</b>
<b>3D</b>	<b>Three-dimension</b>
<b>2D</b>	<b>Two-dimension</b>
<b>CAD</b>	<b>Computer Aid Design</b>
<b>CAE</b>	<b>Computer Aided Engineering</b>
<b>RP</b>	<b>Rapid prototyping</b>
<b>PDS</b>	<b>Product Design Specification</b>
<b>CSG</b>	<b>Constructive Solid Modeling</b>
<b>PCB</b>	<b>Printed Circuit Design</b>

<b>CFD</b>	<b>Computer Fluid Dynamic</b>
<b>CNC</b>	<b>Computer Numerically Controlled</b>
<b>PSM</b>	<b>Projek Sarjana Muda</b>
<b>FKM</b>	<b>Fakulti Kejuruteraan Mekanikal</b>
<b>PP</b>	<b>Polypropylene</b>
<b>PBT</b>	<b>Polybutylene terephthalate</b>
<b>ABS</b>	<b>Acrylonitrile butadiene styrene</b>
<b>STL</b>	<b>Standard Triangulation Language</b>
<b>FOS</b>	<b>Factor of Safety</b>

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background**

This purpose of this project is to develop a new design of “Papan rehal” using modern product development approach through Concurrent Engineering process regarding to Product Design and Development concept.

This project used rapid prototyping machine which is Fused Deposition Modeling (FDM) machine. The process is starts with the study of Concurrent Engineering (CE), Computer Aided Design (CAD), Finite Element Analysis (FEA), and Rapid Prototyping. Then, it proceeds with product planning development and design process development from sketching until product fabrication. The analysis and optimization of the product are by using modern approach which is Computer Aided Engineering (CAE) to get the best product.

“Papan rehal” is used to be one of our important items in childhood life. It is used as Al-Quran stands to keep it in higher position apart from our feet. Unfortunately, it is now one of the things that have faded through time in life. In order to keep it in the same level with other technology, this project was made to develop and improved the usage of “Papan rehal” to make it multi-purpose.

## **1.2 Aim**

The aim of this project is to improve the product and makes something more agreeable of “Papan Rehal” by using technology approach consist of Solid Work, Finite Element Analysis (FEA) and develop prototype using Fused Deposition Modelling (FDM) machine of rapid prototyping technologies and Concurrent Engineering Process. This “Papan Rehal” will be expected to be multi-purpose, light and easily handled. It must also be easily cleaned.

## **1.3 Objective**

The objective of this project is:

- 1.3.1 To design and fabricate a new “Papan Rehal” using Concurrent Engineering technology.

## **1.4 Scope**

The scopes of this project are:

- 1.4.1 To literature search on potential product, CAD, RP, design and product development method, concurrent engineering etc
- 1.4.2 To carry out design task
- 1.4.3 To fabricate the prototype of the product via RP
- 1.4.4 To do Finite Element Analysis

## **1.5 Problem Statement**

“Papan Rehal” is used to be one of our important items in our childhood life. It is used as Al-Quran stands to keep it in higher position apart from our feet. Unfortunately, it is now one of the things that have faded through time in our life. In order to keep it in the same level with other technology, this project was made to develop and improved the usage of “Papan rehal” to make it multi-purpose by using technology approach of Concurrent Engineering, Rapid Prototype, and Computer Aided Design.

## 1.6 Report Outline

This report is consisting of six chapters. First chapter is the introduction of the project which is contains the background of the project, aim, objective, scope, problem statement on designing the modern “papan rehal” which have multi –purpose and the report outline.

Chapter 2 will discuss about literature review. This chapter will cover about product and Concurrent product development. For product design and development will cover about existing product, customer need, product specification, concept generation and concept selection. Concurrent Engineering which is reveal about the definition of Concurrent Engineering, need, strategic plan, commitment, planning and leadership, basic principle of concurrent engineering , when to used it, why we used it and the comparison between SE and CE.

Chapter 3 is about literature review on CAD. Basically, this chapter will cover on computer aided design (CAD) and finite element analysis (FEA) only. Some of the contents are basic principle of CAD, benefits of CAD, application of CAD, Solid Works, introduction to CAE, type of CAE, introduction of FEA and COSMOS Works.

Chapter 4 is discussed about literature search on rapid prototype (RP). Some of these chapters contains of the introduction to RP, the main types of RP, the pros and cons of RP, the benefits and applications of RP.

Chapter 5 is about methodology that covers the method that will be used to prepare the product and all the process involved in the production.

Chapter 6 will discussed about the result and discussion of the project. Finally, chapter 7 will conclude about this report.