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DATE :.....

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NAME OF SUPERVISOR 2 :.....

DATE :.....

**DESIGN AND FABRICATION OF BOLLARD LIGHT USING MODERN  
PRODUCT DEVELOPMENT PROCESS**

**FARHANI BT MOHAMAD**

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

**FACULTY OF MECHINCAL ENGINEERING  
UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**MAY 2008**

“I verify that, I have read this report and from my opinion this thesis have fulfill  
the scoop and quality requirement for Bachelor Mechanical Engineering  
(Design and Innovation)”

Signature : .....

Name of Supervisor : .....

Date : .....

To my beloved parents, Mr. Mohamad b. Hj Aziz and Mdm Mariyati bt Yaman, to  
my supervisor Mr. Hambali Boejang, and friends.

Thank you very much for the motivation and full support

## ACKNOWLEDGEMENT

ALHAMDULILLAH, thanks to God for giving me a chance to finish up my final project 'Projek Sarjana Muda' report from the first word until this end of point. First of all I would like to say thank you to the Faculty of Mechanical Engineering that had managed me during my project. Thanks a lot to my supervisor En. Hambali b. Boejang who always gave me the guidance and full commitment along the 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 give me this valuables moments I ever go through in my lives that had develop me as a student and also as a person.

At last, I also wish to thank both my parent who always encouraging me, giving support to complete my project. All of this had shown me why I should carry out the project. I've realized all of this is only to teach me how to face the future environment, for preparing myself to communicate and show my ability in the future. Once again, I wish to thank all who involved in my project, giving me support and encouragement to complete this project in an organized and professional manner.

## ABSTRACT

This project is to develop new design and fabricate the bollard light prototype by using Product Development Process approach. This project uses the principles of concurrent engineering and rapid prototyping as a tool to produce a prototype. To realize this project, the new design of bollard will be developed through product development approach from sketching until prototype fabrication. The entire elements in the product development have to be considered during the execution of this project. Computer Aided Design CAD is used to design the product into solid modeling or surface modeling. The data from CAD will be using during rapid prototyping process. RP process is to build the master pattern by using fused deposition modeling machine. Computer Aided Engineering (CAE) is use to identify the performance of the bollard and at the same time try to get the best material for the concept bollard through the analysis and optimization of CAE. Finally, the gathered data from market research, identifying customer needs, interview and survey have been use to produce the concept for the bollard. The bollard concept that had been chosen was Urban Style.

## ABSTRAK

Projek ini adalah berkenaan pembangunan rekabentuk dan fabrikasi prototaip lampu taman dengan menggunakan pendekatan proses pembangunan produk. Projek ini juga menggunakan prinsip dari strategi kejuruteraan selaras dan *rapid prototyping* sebagai alat untuk menghasilkan prototaip. Untuk merealisasikan projek ini, rekabentuk lampu taman terbaru akan dibangunkan melalui pendekatan proses pembangunan product dari lukisan lakaran sehingga fabrikasi prototaip. Keseluruhan aspek dalam pembangunan produk haruslah dititik beratkan semasa pelaksanaan projek ini. *Computer Aided Design CAD* digunakan untuk merekabentuk produk kepada model pepejal atau pun model permukaan. Maklumat data dari CAD akan digunakan semasa proses *rapid prototyping*. Proses RP adalah untuk membentuk *master pattern* dengan menggunakan mesin *fused deposition modeling*. *Computer Aided Engineering (CAE)* digunakan bagi mengenalpasti kemampuan struktur lampu taman ini dan pada masa yang sama dapat memilih bahan yang terbaik bagi konsep lampu taman ini melalui proses analisis dan optimisasi melalui CAE. Akhirnya, data yang dikumpul daripada kajian pasaran, mengenal pasti kehendak pelanggan, temuduga dan *survey* digunakan untuk menghasilkan konsep untuk lampu taman. Konsep lampu taman yang telah dipilah adalah *Urban Style*.

## TABLE OF CONTENTS

| NO       | CONTENTS                 | PAGE     |
|----------|--------------------------|----------|
|          | <b>DECLARATION</b>       | ii       |
|          | <b>DEDICATION</b>        | iii      |
|          | <b>ACKNOWLEDGEMENTS</b>  | iv       |
|          | <b>ABSTRACT</b>          | v        |
|          | <b><i>ABSTRAK</i></b>    | vi       |
|          | <b>TABLE OF CONTENTS</b> | vii      |
|          | <b>LIST OF TABLES</b>    | xi       |
|          | <b>LIST OF FIGURES</b>   | xiii     |
|          | <b>LIST OF APPENDIX</b>  | xvii     |
| <br>     |                          |          |
| <b>1</b> | <b>INTRODUCTION</b>      | <b>1</b> |
|          | 1.1 Project Background   | 1        |
|          | 1.2 Objective of Study   | 2        |
|          | 1.3 Problem Statement    | 2        |
|          | 1.4 Scope                | 4        |
|          | 1.5 Benefit of Study     | 4        |
|          | 1.6 Report Outline       | 5        |
| <br>     |                          |          |
| <b>2</b> | <b>LITERATURE REVIEW</b> |          |
|          | 2.1 Bollard Light        | 6        |
|          | 2.1.1 Function           | 6        |
|          | 2.1.2 Specification      | 8        |
|          | 2.1.3 Features           | 9        |



|          |                                   |    |
|----------|-----------------------------------|----|
| 2.1.4    | Power Supply                      | 11 |
| 2.1.5    | Performance                       | 13 |
| 2.1.6    | Luminaire Consideration           | 14 |
| 2.1.7    | Thermal Consideration             | 16 |
| 2.2      | Product Development Process       | 16 |
| 2.2.1    | Product Planning Process          | 16 |
| 2.2.2    | Identifying Customer Needs        | 17 |
| 2.2.3    | Product Specification             | 19 |
| 2.2.4    | Concept Generation                | 21 |
| 2.2.5    | Concept Selection                 | 23 |
| 2.2.6    | Preliminary Design                | 26 |
| 2.3      | Concurrent Engineering            | 27 |
| 2.3.1    | Concurrent Engineering Method     | 29 |
| 2.3.2    | Concurrent Engineering Technology | 29 |
| 2.3.3    | Sequential Engineering Process    | 30 |
| 2.3.4    | Concurrent Engineering Benefits   | 31 |
| 2.4      | Computer Aided Design             | 32 |
| 2.4.1    | Basic Principles in CAD           | 33 |
| 2.4.2    | Application of CAD                | 35 |
| 2.5      | Computer Aided Engineering        | 36 |
| 2.6      | Rapid Prototyping                 | 36 |
| 2.6.1    | Rapid Prototyping Process         | 37 |
| 2.6.2    | Rapid Prototyping Benefits        | 41 |
| 2.7      | Summary                           | 42 |
| <b>3</b> | <b>EXPERIMENTAL WORK</b>          |    |
| 3.1      | Project Planning                  | 43 |
| 3.2      | Product Planning                  | 44 |
| 3.3      | Identifying Customer Needs        | 46 |
| 3.4      | Product Specification             | 47 |
| 3.5      | Conceptual Design                 | 49 |
| 3.5.1    | Concept Generation                | 50 |
| 3.5.2    | Concept Selection                 | 51 |
| 3.5.3    | Final Design Concept              | 52 |

|          |  |     |
|----------|--|-----|
| 3.6      | Final Product Specification                          | 53  |
| 3.7      | Detail Design  | 53  |
|          | 3.7.1 Sketching                                      | 54  |
|          | 3.7.2 CAD Drawing                                    | 54  |
| 3.8      | Prototype Fabrication                                | 57  |
|          | 3.8.1 Prototype Pre-Processing                       | 58  |
|          | 3.8.2 Prototype Processing                           | 65  |
|          | 3.8.3 Prototype Post-Processing                      | 66  |
| 3.9      | Analysis and Optimization                            | 69  |
|          | 3.9.1 Material Selection                             | 70  |
|          | 3.9.2 Finite Element Analysis                        | 72  |
|          | 3.9.3 Analysis Pre-Processing                        | 72  |
|          | 3.9.4 Analysis Processing                            | 76  |
|          | 3.9.5 Analysis Post-Processing                       | 76  |
| 3.10     | Summary  | 77  |
| <b>4</b> | <b>RESULT AND DISCUSSION</b>                         |     |
| 4.1      | Product Development Process of Bollard               | 78  |
|          | 4.1.1 Product Planning                               | 79  |
|          | 4.1.2 Identifying Customer Needs                     | 82  |
|          | 4.1.3 Target Product Specification                   | 83  |
|          | 4.1.4 Conceptual Design                              | 84  |
|          | 4.1.5 Final Product Concept                          | 88  |
|          | 4.1.6 Final Product Specification                    | 89  |
|          | 4.1.7 Detail Drawing                                 | 92  |
|          | 4.1.8 Prototype Fabrication                          | 94  |
|          | 4.1.9 Analysis and Optimization                      | 97  |
|          | 4.1.10 Material and Structure Analysis               | 98  |
| 4.2      | Sequential Engineering versus Concurrent Engineering | 106 |
| 4.3      | Lead Time  | 108 |
|          | 4.3.1 Design Process Duration                        | 108 |
|          | 4.3.2 Fabrication Process Duration                   | 109 |
|          | 4.3.3 Analysis Process Duration                      | 111 |
|          | 4.3.4 Product Development Process Duration           | 112 |

|          |   |     |
|----------|---|-----|
| 4.3.5    | Time Efficient of Concurrent Engineering Approach | 114 |
| 4.4      | Cost Effectiveness                                | 114 |
| 4.4.1    | Cost Implementation within Sequential Approach    | 114 |
| 4.4.2    | Cost Implementation within Concurrent Approach    | 115 |
| 4.5      | Quality   | 116 |
| 4.5.1    | Low Quality within Sequential Approach            | 116 |
| 4.5.2    | High Quality within Concurrent Approach           | 117 |
| <b>5</b> | <b>DISCUSSION</b>                                 |     |
| 5.1      | Discussion  | 119 |
| 5.2      | Limitation  | 122 |
| 5.3      | Summary   | 123 |
| <b>6</b> | <b>CONCLUSION AND RECOMMENDATION</b>              |     |
| 6.1      | Conclusion  | 124 |
| 6.2      | Recommendation                                    | 125 |
|          | <b>REFERENCE</b>                                  | 126 |
|          | <b>BIBLIOGRPHY</b>                                | 130 |
|          | <b>APPENDIX A TO D</b>                            |     |

**LIST OF TABLES**

| <b>NO</b> | <b>TITLE</b>   | <b>PAGE</b> |
|-----------|--|-------------|
| 3.1       | Standard specification of existing bollard in Malaysia             | 47          |
| 3.2       | Quality function deployment table for product specification        | 49          |
| 3.3       | Concepts bollard   | 51          |
| 3.4       | Decision metrics of the generation concepts                        | 52          |
| 4.1       | Statistic data and rank of target market                           | 81          |
| 4.2       | Statistic data from concept selection survey                       | 87          |
| 4.3       | Final product specification  | 91          |
| 4.4       | Standard bollard specification                                     | 92          |
| 4.5       | The advantages and disadvantages the prototype fabrication process | 96          |
| 4.6       | CAE advantage and disadvantage                                     | 97          |
| 4.7       | Result of steel performance  | 100         |
| 4.8       | Result of aluminum performance                                     | 101         |

|      |   |     |
|------|---|-----|
| 4.9  | Result of fiberglass performance                      | 103 |
| 4.10 | Comparison characteristics of three types of material | 103 |
| 4.11 | Sequential Engineering versus Concurrent Engineering  | 107 |
| 4.12 | Design process duration                               | 109 |
| 4.13 | Prototype fabrication process                         | 110 |
| 4.14 | Analysis process duration                             | 111 |
| 4.15 | Product development process duration                  | 112 |

## LIST OF FIGURES

| NO   | TITLE  | PAGE |
|------|--|------|
| 2.1  | Residential bollard                                      | 7    |
| 2.2  | Garden Bollard   | 7    |
| 2.3  | Pathway Bollard  | 7    |
| 2.4  | Bollard's height range                                   | 8    |
| 2.5  | Bollard design option                                    | 9    |
| 2.6  | Result of impact strength on bollard                     | 14   |
| 2.7  | Basic style of lighting                                  | 15   |
| 2.8  | Example of bollard's photometrics                        | 16   |
| 2.9  | The product planning process                             | 17   |
| 2.10 | The customer needs process                               | 18   |
| 2.11 | The five steps concept generation method                 | 23   |
| 2.12 | Concept selection process                                | 25   |
| 2.13 | Overview of Concurrent Engineering Methodology           | 28   |
| 2.14 | The redundancies of the phase of CE principles to reduce | 30   |
| 2.15 | Flow diagram of a Sequential Engineering process         | 31   |
| 2.16 | Freeform Surface Modeling in CAD                         | 34   |
| 2.17 | Solid Modeling in CAD                                    | 35   |
| 2.18 | Specific processes of Rapid Prototyping method           | 37   |
| 2.19 | Stereolithography process                                | 38   |
| 2.20 | Selective layer sintering process                        | 38   |
| 2.21 | Fused deposition modeling mechanism                      | 39   |
| 2.22 | Fused deposition modeling process                        | 40   |
| 2.23 | Three dimensional printing process                       | 41   |
| 2.24 | Rapid prototyping as the manufacturing middle            | 41   |

|      |  |    |
|------|--|----|
| 3.1  | PSM process flow   | 44 |
| 3.2  | Bollards in Malacca city                                       | 45 |
| 3.3  | Three selected concepts from decision metrics                  | 53 |
| 3.4  | Bollard's sketching with dimensioning                          | 54 |
| 3.5  | 2D drawing of bollard with dimensioning                        | 55 |
| 3.6  | 3D drawing of cap part of bollard                              | 56 |
| 3.7  | Template drawing of bollard's cap.                             | 56 |
| 3.8  | Bollard's assembly   | 57 |
| 3.9  | Schematic diagram of RP process sequence                       | 58 |
| 3.10 | Transferring CAD data to STL file                              | 58 |
| 3.11 | Sequence process of Magics RP software                         | 59 |
| 3.12 | Check the part properties                                      | 60 |
| 3.13 | Rescale part to 0.25   | 60 |
| 3.14 | Bollard's part nested into a platform                          | 61 |
| 3.15 | Sequences process of Insight software                          | 62 |
| 3.16 | Insight Software environment                                   | 62 |
| 3.17 | Plane checking   | 62 |
| 3.18 | Model processing   | 63 |
| 3.19 | Building job   | 63 |
| 3.20 | Pack and Download  | 64 |
| 3.21 | Prodigy Plus and building status                               | 64 |
| 3.22 | Prodigy Plus Machine   | 65 |
| 3.23 | Process and status of prototype operation in the Prodigy Plus. | 65 |
| 3.24 | Bollard's parts with support                                   | 66 |
| 3.25 | Removing support from parts.                                   | 67 |
| 3.26 | Parts dissolve into the WaterWorks Solution                    | 67 |
| 3.27 | Stratasys WaterWorks Solution                                  | 67 |
| 3.28 | Parts removed from the solution                                | 68 |
| 3.29 | Washing the parts  | 68 |
| 3.30 | Sanding the part surface                                       | 68 |
| 3.31 | Painting the parts with spray paint                            | 69 |
| 3.32 | Oven to dry the wet painted parts                              | 69 |
| 3.33 | Idealization the geometry (simplify geometry)                  | 73 |
| 3.34 | Identify as mixed mesh part                                    | 73 |

|      |   |     |
|------|---|-----|
| 3.35 | Identify the material properties of parts                                 | 74  |
| 3.36 | Select the restraint part   | 74  |
| 3.37 | Apply force on the top (buckling consideration)                           | 75  |
| 3.38 | Apply force at the body (crashing consideration)                          | 75  |
| 3.39 | Part meshing process  | 75  |
| 3.40 | Run the analysis part   | 76  |
| 3.41 | Result of the analysis in term of contour colour<br>(need interpretation) | 77  |
| 4.1  | Product development process   | 78  |
| 4.2  | Survey questionnaire  | 80  |
| 4.3  | Bar chart of the target market  | 80  |
| 4.4  | Gantt chart; target timing of bollard project                             | 82  |
| 4.5  | Customer data template  | 83  |
| 4.6  | Quality function deployment   | 84  |
| 4.7  | Conceptual design flow process  | 85  |
| 4.8  | Decision matrix for bollard's concepts                                    | 86  |
| 4.9  | Questionnaire; survey on customer selection                               | 87  |
| 4.10 | Pie chart; result from customer selection survey                          | 87  |
| 4.11 | Sketching of the concept bollard with dimension                           | 92  |
| 4.12 | Bollard concept in CAD drawing  | 93  |
| 4.13 | Template 2D and 3D of bollard drawing                                     | 93  |
| 4.14 | The result on stress analysis for the steel material                      | 98  |
| 4.15 | Graph stress versus load for steel  | 98  |
| 4.16 | The result on displacement analysis for the steel                         | 99  |
| 4.17 | Graph displacement versus load of the steel material.                     | 99  |
| 4.18 | The result on stress analysis for the aluminum material                   | 101 |
| 4.19 | Graph stress versus load of the aluminum material.                        | 101 |
| 4.20 | The result on displacement analysis for the aluminum material             | 101 |
| 4.21 | Graph displacement versus load of the aluminum material.                  | 101 |
| 4.22 | The result on stress analysis for the fiberglass material                 | 102 |
| 4.23 | Graph stress versus load of the fiberglass material.                      | 102 |
| 4.24 | The result on displacement analysis for the fiberglass material           | 103 |
| 4.25 | Graph displacement versus load of the fiberglass material.                | 103 |
| 4.26 | Bar chart for comparison of maximum load                                  | 104 |



|      |  |     |
|------|--|-----|
| 4.27 | Bar chart for price comparison                                     | 104 |
| 4.28 | Concurrent flow of bollard development process                     | 113 |
| 4.29 | Sequential flow of light development process from Muarlite Sdn Bhd | 113 |
| 4.30 | Cost Implementation within Sequential Process                      | 114 |
| 4.31 | Cost Implementation within Concurrent Process                      | 115 |
| 4.32 | Quality of product within Sequential Approach                      | 116 |
| 4.33 | Quality of product within Concurrent Approach                      | 117 |
| 5.1  | Bollard prototype  | 120 |

## **LIST OF APPENDIX**

- A            Product Development Process**
- B            Detail Drawing**
- C            Bollard Specification**
- D            Form and Letter**

## **CHAPTER 1**

### **INTRODUCTION**

This chapter is to provide the reader with an introduction to the research conducted for this project. This chapter discussed on the background, scopes, objective and problem statement of this project.

#### **1.1 Project Background**

This project is to develop a new design and fabricate the bollard light prototype using rapid prototyping machine which is Fused Deposition Modeling (FDM) machine. The process is started by product planning development and proceeds by design process development from sketching until prototype fabrication. The analysis and optimization of this product are by using modern approach which is Computer Aided Engineering (CAE) to get the best product.

Bollard light is one of the outdoor lighting. This project is to develop new design of bollard through modern product development approach. The references for this information are gathered from Majlis Bandaraya Meleka Bersejarah (MBMB), journal, reference books, and related websites. Rapid prototyping is the process to fabricate bollard prototype. Rapid prototyping (RP) is the process to develop the master pattern. The product development process can lead to superior design through the design by

analysis. The bollard prototype test is by using finite element analysis (FEA) to optimizing the structure and thermal of the bollard. For design optimization, FEA is need to check the structure and thermal issue of the design

## **1.2 Objective of Study**

The main objective of this project is to carry out feasibility study of modern product development process.

## **1.3 Problem Statement**

Traditionally, the product development process has relied on a combination of past experience, basic calculation, prototype fabrication manually and prototype testing. The traditional model of the product development process and organization is based upon a sequential and functional approach to development (Wheelwright and Clark, 1992; Zaccai, 1991). Initially in this process, a design concept was chosen, often heavily influenced by what worked in the past. In the traditional approach, the drawing of the concept design is done manually drawing which using drawing tools like ruler, protector and more. Next, calculations were made to get some assurance that the design would meet the requirements like structure, material selection and other characteristic. Typically, the analysis is by using the formula from theory and calculates it by manually part by part of the drawing. Prototype part was then obtained to obtain a representation of the product under development. The prototype fabrication was made by manually by using man power. A review of the methods traditionally used in the product development process development process would be helpful but it can be defined as the waste process where the traditional process extend cycle times or incur additional

resources use, thereby increasing costs. Traditionally, the development process has relied on classical structural mechanics and experimental based methods.

This project is to solve the traditional engineering process approach. This project has chosen the bollard light as the product to show the mechanism of the modern product development process and concurrent engineering approach. The modern product development process is started with the product planning where here the strategies and assessment of technology developments and market objectives have been developed. The process conceptual design is done by collecting data from customer need. The design is developed by using modern approach which using computer aided design (CAD). Then the data of the product from CAD will be transferred to the analysis software and prototype machine concurrently. Furthermore, all process in the modern product development process can be concurrently works; it can be identified as the concurrent engineering (CE) approach. Those bring a lot of benefits compared to the traditional approach.

This project will focus on the bollard because the problem of bollard where the current bollard in Malaysia are having weakness concept design and the fail of target market of this product where, from the observation bollard are becoming extinct in Malaysia's landscape due to the weakness of product planning and product development approach. The design of the bollard will be improved by implementing modern product development process through product planning, identifying customer need, target concept, design through computer aided design (CAD), analyzing using computer aided engineering (CAE), and testing product through rapid prototyping. This implementing process is using concurrent engineering (CE) approach.

## 1.4 Scope

The scopes of this project are:

- i. To study on concurrent engineering and product and design development process.
- ii. To study on bollard existing market, computer aided design (SolidWork), computer aided engineering (CosmosWork), and rapid prototyping (Fused Deposition Modelling).
- iii. To study on the drawing tool which is SolidWork as the computer aided design (CAD) approach, analysis tool which is CosmosWork as the computer aided engineering (CAE) approach.
- iv. To design, analyze and fabricate the final concept design of bollard.

## 1.5 Benefit of Study

For the last few years a product development process is becoming more important. This project implementing modern product development process which conducting from the product planning phase until prototype fabrication phase.

Furthermore, this project is focusing on the concurrent engineering within product development process. It means this project is focusing more on the important of lead time and cost. The most efficient project is the project that reduces cost, compressed lead time and produce high profit. This project has trained on working base on concurrently approach and arranged all process in efficiently to obtain the target of this project.

This project also has introduced the modern technology tools such as rapid prototyping machine, CAD and CAE software. This technology is very important in concurrent engineering implementation. By using these modern technology tools the

product development process is more effective where these tools provide easier and faster result.

## 1.6 Report Outline

*Chapter 2* is discussed the literature search more on bollard lighting, product development process, concurrent engineering approach, computer aided design, and computer aided engineering, rapid prototyping and rapid tooling technologies.

*Chapter 3* is discussed base on the experimental work that have been conduct during this project. The experimental works are base on project which implements modern product development process within concurrent engineering in developing new concept bollard. The process starts from product planning until prototype fabrication and analysis bollard's structure.

*Chapter 4* is showed the result and the finding from this project. The result is more on the effectiveness of the implementation of the modern product development within concurrent engineering.

*Chapter 5* is discussed on the result and interpreted the results that have been found through this project. Furthermore this chapter discussed on the limitation of this project that barrier to get the accurate result.

*Chapter 6* is the conclusion for this project. This chapter has concluded the overall of this project in positive and negative side. Furthermore, the recommendation for future research also has been attached in this chapter.

## CHAPTER 2

### LITERATURE REVIEW

This chapter has provide an overview of bollard lighting, modern product development process, concurrent engineering approach, computer aided design, computer aided engineering, rapid prototyping and rapid tooling technology.

#### 2.1 Bollard Light

Bollard light is a stand which provides illumination as a defining element to mark pathway, direct pedestrian and vehicular traffic. Furthermore, the bollard can brighten the dark yards and make the home stand out in the neighbourhood or improve safety and security.

##### 2.1.1 Function

Bollards light are an aesthetic lighting steel barrier used to illuminate and brighten the walkway or path way of the landscape for residential used. Bollard also offers a unique way to dress up the exterior of home, commercial space or any landscape through soft lighting without detracting from the architectural element of the building's outlook.