NORTHERN ARIZONA UNIVERSITY

Alternative Concrete Masonry Unit

30% Design Report

CENE 476

February 15, 2018

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Tables & Figures

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Acknowledgements

The team would like to express their appreciation to all of those who were involved during our research and development efforts.We are particularly grateful for the assistance given by Dr. Robin Tuchscherer, Mr. Robert Morgan and Dr. Dianne McDonnell who gave us guidance and advice throughout the course of the project. Additionally a special thanks to the company Block-Lite for providing our team with materials required for our baseline mix.

1.0 Project Introduction

1.1 Alternative Concrete Masonry Unit

The purpose for this research project is to create an alternative building block. The alternative building product will be a dry stacked, insulated, load bearing modular block that is composed from local materials such as cinders and cement as well as local waste products such as small diameter timber. This new alternative building product is to be constructed in order that it reaches a minimum insulation value of R-10 in addition to meeting all of the necessary strength requirements.

1.2 Project Justification

In the current market insulated modular blocks made with wood fiber aggregate are limited. The blocks that are available are not structural and simply act as formwork intended to support the hydraulic pressure of grout. Additionally due to costs the availability of current blocks relies heavily on regional availability of the necessary materials. The environmental impacts of using concrete can be reduced by using a greener alternative option within its mix. The world's yearly cement production of 1.6 billion tons accounts for about 7% of the global loading of carbon dioxide into the atmosphere [1].

1.3 Constraints & Limitations

The constraints of the research project is that the concrete masonry unit (CMU) must obtain an insulation value of at least R-10, a compressive strength of 1900 psi as well as meeting all demands of modern building construction. Additionally the CMU will be constructed strictly out of materials that have been gathered from the Flagstaff area.

1.4 Objectives

The objective of the research is to develop an alternative to the markets dry stacked modular block by developing a mix that is made out of materials local to flagstaff such as small diameter timber that is left from logging companies as well as the cinders that are present within the Flagstaff area. Another objective is to assure that the designed modular block meets the minimum strength requirement and can be mass produced within a local factory.

2.0 Technical Research

2.1 Field Work

2.1.1 Material Collection

2.2 Predominate Analysis

2.2.1 Material Study

2.2.1.1 Small Diameter Timber Analysis

2.2.2 Create Baseline

[Insert baseline data]

2.3 Alternatives Pursued

2.3.1 Concrete Mix Design

2.3.1.1 Baseline Mix

[Insert baseline mix data]

2.3.1.2 Design Mix 1

[Insert design mix 1 data]

2.3.1.3 Design Mix 2

[Insert design mix 2 data]

2.3.1.4 Design Mix 3

[Insert design mix 3 data]

2.4 Final Design Recommendations

2.4.1 Product Testing

2.4.1.1 Compressive Strength

[Insert compressive strength data]

2.4.1.2 Tensile Strength

[Insert tensile strength data]

2.4.1.3 Freeze Thaw

[Insert freeze thaw data]

2.4.1.4 Thermal Resistance

[Insert thermal resistance data]

2.4.2 Feasibility Study

2.4.2.1 Block Lite Tour
[Insert tour data]

2.4.2.2 Current Available Options
[Insert available options data]

2.5 Statistical Analysis
[Insert statistical analysis data]

3.0 Summary of Engineering Work

3.1 Discussion of Engineering Work
[Insert discussion of work]

3.2 Original Gantt Chart
[Insert original gantt chart]

3.3 New Gantt Chart
[Insert new gantt chart]

4.0 Summary of Engineering Costs

4.1 Discussion of Engineering Costs
[Insert discussion of costs]

4.2 Original Staffing
[Insert original staffing table]

4.3 New Staffing
[Insert new staffing table]

4.4 Original Engineering Costs
[Insert original costs]

4.5 New Engineering Costs
[Insert new costs]

5.0 Conclusion

[Insert conclusion discussion]

6.0 References

[1] K. Mehta, "Reducing the Environmental Impact of Concrete", 2017. [Online]. Available: http://maquinamole.net/EcoSmartconcrete.com/docs/trmehta01.pdf. [Accessed: 14- Feb- 2018].

7.0 Appendices

[Insert appendices]