

**PREDICTING THE BEHAVIOUR OF *CANDI PRAMBANAN* UNDER EARTHQUAKE LOAD:
LITERATURE REVIEW**

Final Project Report

As one of the requirements to receive bachelor degree
of Universitas Atma Jaya Yogyakarta

By:

Karina Octavia

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INTERNATIONAL CIVIL ENGINEERING PROGRAM

FACULTY OF ENGINEERING

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Malang, June 2021

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Karina Octavia

PREFACE

This research is one of the requirements of fulfilling bachelor degree of Universitas Atma Jaya Yogyakarta. This research is finished under “3+2 Program” in Taiwan, where **Universitas Atma Jaya Yogyakarta** and **National Cheng Kung University** has an agreement and collaboration. The background of this research is to determine the suitable numerical method for predicting the behaviour of *Candi Prambanan* and joint parameters that govern the strength of the overall strength of the masonry. The research is conducted by literature review by reviewing 15 papers discussing related topic.

Chapter I of the report contains the introduction, research background, research motivation, scope and limitation. Chapter II is the literature review about the previous research conducted by another author about related subject. Chapter III is the basic theory that provide basic knowledge about this research. Chapter IV is the methodology or method conducted for this research. Chapter V is the discussion related to the objective of this research. And Chapter VI contains the conclusion and suggestion of this study. Author realizes that this report is not perfect enough, therefore the author apologized.

Malang, June 20th 2021

Author

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Sincerely authors give the praises and thanks to **Jesus Christ**, with all of His graces and blessings, authors finished the final report in timely manner. Although everything is conducted online due to pandemic, author could finish this final report without any problems. Authors realize that this final report could not be done without the help from others. For that, I would like to thank these people mentioned below:

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Author fully realizes that this report is far beyond the word 'perfect'. Thus, both developing critic and suggestion are expected to make this report better. Finally, author really hopes that this report is really beneficial to all sides and readers.

Yogyakarta, June 2021

Author

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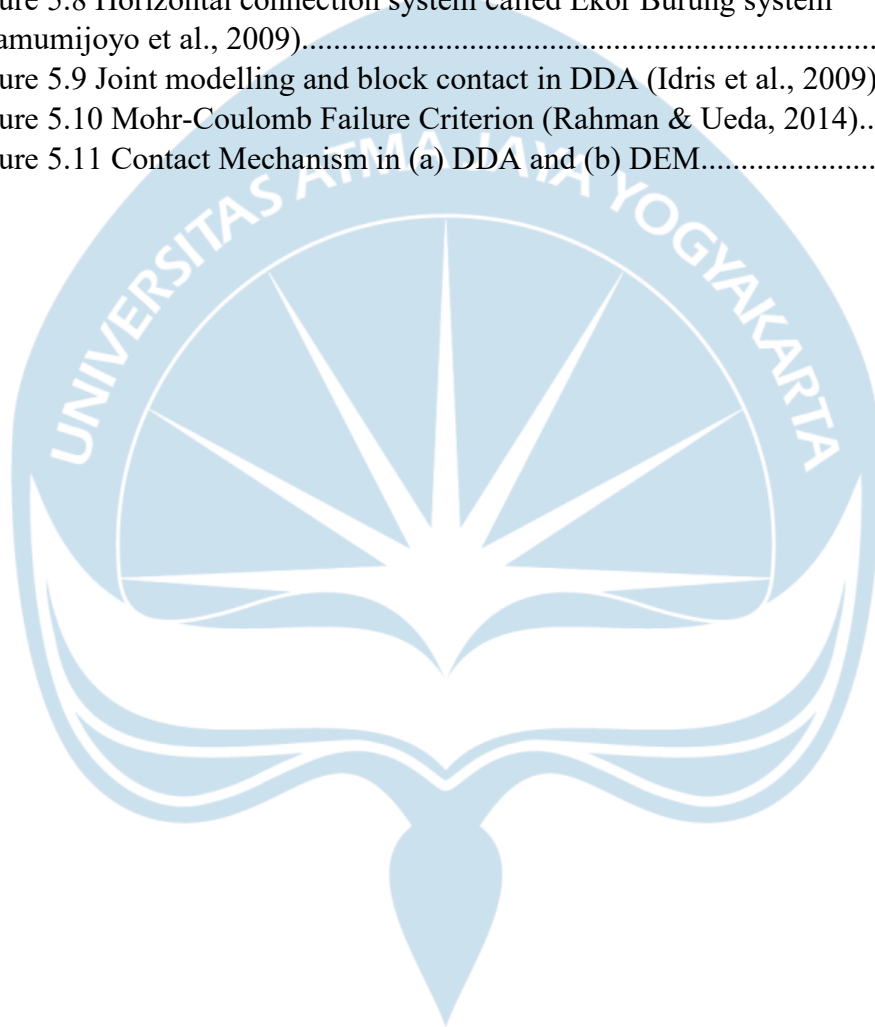
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ABSTRACT

PREDICTING THE BEHAVIOUR OF *CANDI PRAMBANAN* UNDER EARTHQUAKE LOAD: LITERATURE REVIEW, Karina Octavia, Student Number 171316792, the Year 2021, Field of Geotechnical Engineering, International Civil Engineering Program, Faculty of Engineering, Universitas Atma Jaya Yogyakarta.

Candi Prambanan is an example of various historical building available in Indonesia. However, it is threatened by high potency of earthquake in Indonesia. Assessing the stability of *Candi Prambanan* is important to determine if it still able to sustain earthquake load and as a step for preservation and restoration. One way to conduct the analysis by using experimental test, yet it is not feasible, therefore numerical method is chosen for assessing the stability of *Candi Prambanan*. There are various numerical methods with its own basic principles and assumptions. To determine which numerical method is suitable for predicting the behaviour of *Candi Prambanan* under earthquake load, literature study was conducted. This literature study was aiming to obtain basic understanding about various numerical method for assessing the masonry structure under earthquake load based on previous research. *Candi Prambanan* as a masonry structure shows high discontinuity due to its geometry of the component, hence traditional numerical method such as Finite Element Method (FEM) is not able to describe the behaviour of the structure fully since FEM is not allowed fully detachment. Therefore, Discontinuous Deformation Analysis (DDA) is the suitable numerical method for assessing *Candi Prambanan*. The geometry of *Candi Prambanan* can be discretized into blocks and mortar joints, and large displacement until fully detachment is allowed. Implicit time integration adopted by the DDA cause the analysis becomes more stable and accurate. During the research, it was found out that the mortar joint is the weakest part in the masonry structure. The joint properties such as joint cohesion and friction angle are the govern joint properties that control the shear strength of the masonry. Thus, the failure in the joint follows the Mohr-Coulomb failure criterion.

Keywords: Numerical Method, DDA, Joint Properties