UNIVERSITAS ATMA JAYA YOGYAKARTA LIBRARY'S STRUCTURAL RESPONSE TO EXTERNAL BLAST LOADING

Final Project Report

as a requirement to obtain Bachelor degree from

Universitas Atma Jaya Yogyakarta

by:

EDGART PRAHARJA MASGAWAN PONGSITANAN

Student ID Number: 121314320

INTERNATIONAL CIVIL ENGINEERING PROGRAM

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITAS ATMA JAYA YOGYAKARTA

YOGYAKARTA

DECEMBER 2016

STATEMENT

I signed below stating that the final project with the title:

"UNIVERSITAS ATMA JAYA YOGYAKARTA LIBRARY'S STRUCTURAL RESPONSE TO EXTERNAL BLAST LOADING"

It is the result of my own work and not a result of plagiarism of other people's work. Ideas, research data, and quotes directly or directly derived from the writings or ideas of others expressly provided in this Final Project. If it is proven later that this Final Project is the result of plagiarism, the graduation certificate that I received will be canceled and returned to Universitas Atma Jaya Yogyakarta.

Yogyakarta,

Who made the remarks,

Edgart P.M. Pongsitanan

APPROVAL

Final Project Report

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Student ID Number: 121314320

Has been approved by Supervisor
Yogyakarta, December 15th, 2016

Supervisor,

(Prof. Ir. Yoyong Arfiadi, M.Eng., Ph.D)

Department of Civil Engineering
Chairman,

(Ir. Alannas Sudjan, S.T., M.T)

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Has been examined and approved by the examination committee:

	Name	Signature	Date
Chairman	: Prof. Ir. Yoyong Arfiadi, M.Eng., Ph.D		15/12/16
Secretary	: Dr. Ir. AM. Ade Lisantono, M.Eng		16/12/2016
Member	: Dinar Gumilang Jati, S.T., M.Eng		16/12 2016

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4. All the lecturers in the civil engineering program, especially the International program.
5. My Parents and all relatives for their constant support in moral and material.
6. My comrades 2012 batch, seniors and juniors in the International Civil Engineering Program.
7. The XVII Gen of SMA Kr. Barana', IKASKIBAR Yogyakarta.

I realize, this report may be flawed. Therefore, I accept any form of suggestion for further improvement. Thank you.

Yogyakarta, November 2015

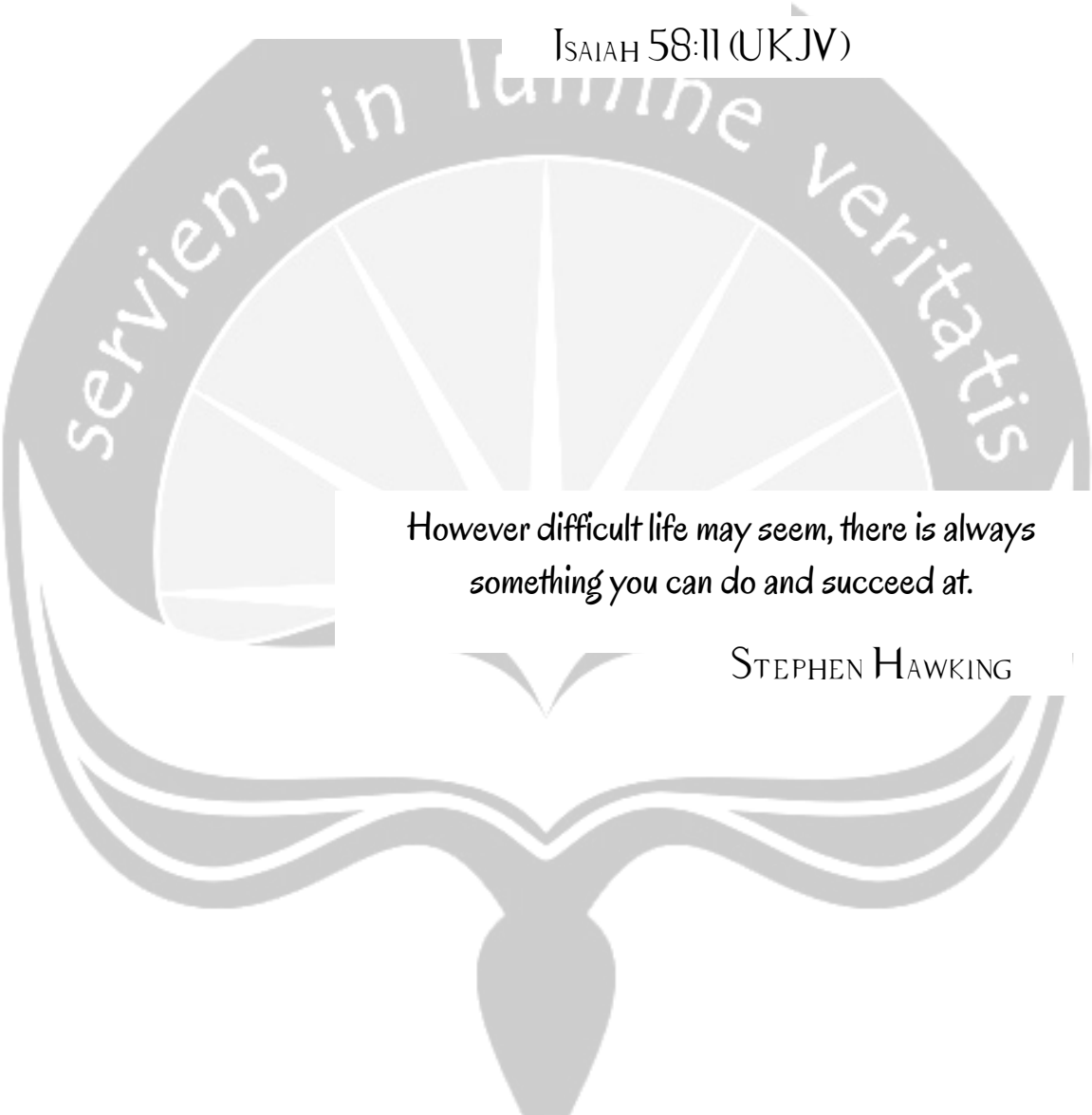
Author

Edgart P.M. Pongsitanan

121314320

"And the LORD shall guide you continually, and satisfy your soul in drought, and make fat your bones: and you shall be like a watered garden, and like a spring of water, whose waters fail not."

Isaiah 58:11 (UKJV)



However difficult life may seem, there is always something you can do and succeed at.

Stephen Hawking

For Jesus Christ, my father in heaven, my beloved mother, my brothers & sisters and all of comrades.

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Z_G	:	Scaled charge distance
R_G	:	Charge ground distance
W	:	Charge Weight
P_{so}	:	Peak positive incident pressure
U	:	Shock front velocity
$i_s/W^{1/3}$	:	Scaled unit positive incident impulse
i_s	:	Incident impulse
$t_o/ W^{1/3}$	:	Scaled positive phase duration
t_o	:	Positive phase duration
$t_A/ W^{1/3}$	:	Scaled arrival time
t_A	:	Arrival time
$P_{r\alpha}$	:	Peak positive refracted pressure
$C_{r\alpha}$	:	Reflected pressure coefficients
$i_{r\alpha}/ W^{1/3}$	:	Scaled positive refracted impulse
$i_{r\alpha}$	:	Positive refracted impulse
C_r	:	Sound Velocity in reflected overpressure
t_c	:	Clearing time
t_{of}	:	Fictitious length of positive phase
q_0	:	Dynamic Pressure
C_D	:	Drag Coefficients
t_{rf}	:	Duration of negative refracted pressure.
$P_{r\alpha}^-$	:	Negative refracted pressure
$i_{r\alpha}^-/ W^{1/3}$	:	Scaled negative refracted impulse
$i_{r\alpha}^-$	:	Negative refracted impulse
t_{rf}^-	:	Duration of negative refracted pressure.

ABSTRACT

UNIVERSITAS ATMA JAYA YOGYAKARTA LIBRARY'S STRUCTURAL RESPONSE TO EXTERNAL BLAST LOADING, Edgart Praharja Masgawan Pongsitanan, Student Number 121314320, year of 2016, Structural Engineering, International Civil Engineering Program, Department of Civil Engineering, Universitas Atma Jaya Yogyakarta.

Over 10 years the terrorist activities and threats have become the growing problem in Indonesia. Following the September 9th, 2004, vehicle bombing of the Australian Embassy in Kuningan, Jakarta, July 17th, 2009, bombing at the JW Marriott hotel and Ritz-Carlton hotel, Jakarta, until the most recent terrorist activities January 14th, 2016, explosions and gun fire near Plaza Sarinah, Jl. MH Thamrin, Jakarta Pusat. As we already aware that terrorists were targeting the government buildings, embassies, hotels, but after a decade and a half of rolling waves of terrorist act across the world, these buildings are now harder to hit, so they've changed their target, over the last 13 months there has been a series of extremely bloody attacks on school, colleges and universities.

This final project attempts to analyze the UAJY's library structure subjected to the blast loading especially from vehicle bombing. The blast loading obtains by using software called AT Blast and compared with the procedure proposed by UFC 3-340-02. The blast load was analytically determined as a pressure-time history and numerical model of the structure was created using ETABS 2015 (v.15.2.0), the conventional software for the static/dynamic analysis of structures, as a full 3D model with Beam elements for girders and columns and Shell elements for slabs. The blast pressure is depending on the stand-off distance. Peak refracted overpressure Pr was increasing when the stand-off distance decreasing. Resulted in the reflected overpressure is more at the bottom floors and low at the top floors. Blast has a characteristic of high amplitude, the explosion near the structure can cause catastrophic damage to the structure, from the story drift ratio result it was observed that the story drift exceeds the story drift limitation as per SNI 1726: 2012 Section 7.12.1 the story drift ratio shall not exceed 0.015. From the graphical representation of joint displacement and maximum story displacement the maximum response on the concrete frame structure under the action of blast loading is occur at the top. From the maximum story drift ratio figure, the maximum ratio was occurred at the first level of the building in the y direction is about 0.055. Therefore, the Universitas Atma Jaya Yogyakarta's Library current design cannot resist blast loading come from vehicle with 227 kg charge weight.

Key Words: ETABS, Blast Loading, Vehicle Bomb, Pressure-Time History, Story Drift, Peak Refracted Overpressure.