شبكة المعلومات الجامعية

بسم اللّه الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم باللّه العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

شبكة المعلومات الجامعية

بعض الوثائق الأصلية تالفة

بالرسالة صفحات
لم ترد بالأصل

Ain Shams University
Faculty of Engineering

SEISMIC BEHAVIOR OF SKY STEEL BRIDGES CONNECTING ADJACENT BUILDINGS

Thesis Submitted to the Faculty of Engineering at Ain Shams University
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Structural Engineering

MINA REFAAT FARAH ESKANDER

SUPERVISED BY

Prof. Dr. Ahmed Hassan Youssef Professor of Steel Structuresand Bridges Faculty of Engineering Ain Shams University	**Prof. Dr. Osman Mohamed Osman Ramadan** Professor of Structural Analysis Faculty of Engineering Cairo University

Cairo
2020

Ain Shams University
Faculty of Engineering

SEISMIC BEHAVIOR OF SKY STEEL BRIDGES CONNECTING ADJACENT BUILDINGS

Thesis Submitted to the Faculty of Engineering at Ain Shams University
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Structural Engineering

MINA REFAAT FARAH ESKANDER

SUPERVISED BY

Prof. Dr. Ahmed Hassan Youssef Professor of Steel Structures and Bridges Faculty of Engineering Ain Shams University	**Prof. Dr. Osman Mohamed Osman Ramadan** Professor of Structural Analysis Faculty of Engineering Cairo University

Cairo
2020

Ain Shams University
Faculty of Engineering

SEISMIC BEHAVIOR OF SKY STEEL BRIDGES CONNECTING ADJACENT BUILDINGS

Thesis Submitted to the Faculty of Engineering at Ain Shams University
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Structural Engineering

MINA REFAAT FARAH ESKANDER

Approved by the Examining Committee

Name and Affiliation	Signature
1. Prof. Dr. Sherif Ahmed Mourad Professor of Steel Structures Faculty of Engineering, Cairo University	
2. Prof. Dr. Mohamed Nour Eldin Saad Fayed Professor of Structural Engineering Faculty of Engineering, Ain Shams University	
3. Prof. Dr. Ahmed Hassan Youssef Professor of Steel Structures and Bridges Faculty of Engineering, Ain Shams University	
4. Prof. Dr. Osman Mohamed Osman Ramadan Professor of Structural Analysis Faculty of Engineering, Cairo University	
Date: 23 / 11 / 2020	

Cairo
2020

Engineer's Name: Mina Refaat Farah Eskander
Date of Birth : 25, September 1991
Nationality : Egyptian
E-mail : 13331@eng.asu.edu.eg
Phone : +201022727776
Address : Luxor, Egypt
Registration Date: 7/2015
Awarding Date :
Degree : Master of Science
Department : Structural Engineering

Supervisors : Prof. Dr. Ahmed Hassan Youssef
Prof. Dr. Osman Mohamed Osman Ramadan

Examiners : Prof. Dr. Sherif Ahmed Mourad
Prof. Dr. Mohamed Nour Eldin Saad Fayed
Prof. Dr. Ahmed Hassan Youssef
Prof. Dr. Osman Mohamed Osman Ramadan

Title of Thesis : Seismic behavior of sky steel bridges connecting adjacent buildings

Key Words : Sky-bridge - Adjacent buildings - Seismic excitation - Response spectrum analysis - Parametric study

STATEMENT

This thesis is submitted to Ain Shams University for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author at the Department of Structural Engineering, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

Name: Mina Refaat Farah Eskander

Signature:

Date: 23 / 11 / 2020

ACKNOWLEDGMENT

Gratitude is due to the merciful generous God that guided me throughout this study.

Thanks are due to ***Prof. Dr. Ahmed Hassan Youssef***, Professor of Steel Structures, Faculty of Structural Engineering at Ain Shams University for his constant assistance and valuable advice throughout this study.

Gratitude is also extended to ***Prof. Dr. Osman Mohamed Osman Ramadan***, Professor of Structural Analysis, Faculty of Structural Engineering at Cairo University, for his valuable supervision, continuous encouragement, useful suggestions, and active help during this investigation.

My sincere appreciation and gratitude are due to my family for their help and patience during the preparation of this study. Without their assistance, this investigation would have never ended.

Gratitude is to be extended to the staff members and colleagues who assisted me to accomplish my thesis.

ABSTRACT

Due to the limitation of land in the capitals with the increase of population, buildings are often built close to each other. In most cases, these buildings are separated without any structural connections or are connected only at the ground level. Accordingly, the seismic behavior of sky bridges linking two adjacent steel buildings is theoretically evaluated via numerous three-dimensional analyses. While the study focuses on the earthquake effects on internal forces induced in the bridge itself, the effects of the link presence on the global performance of the two buildings are also briefly addressed. About 300 three-dimensional models of the building and connecting bridge are developed and analysed using the response spectrum method. These models consider various controlling parameters such as bridge span, elevation, and end conditions; relative stiffness of the two buildings; as well as direction of ground motion excitation with respect to bridge axis. Results showed that the connections of the linking bridge have a significant effect on the overall dynamic response of the bridge in both longitudinal and transverse directions. Also, the linking bridge itself was found to be significantly affected, with varying of the buildings stiffness and it is direction of inertia.

Keywords: Sky-bridge - Adjacent buildings - Seismic excitation - Response spectrum analysis - Parametric study

TABLE OF CONTENTS

ABBREVIATIONS AND SYMBOLS

- **F: Force of Inertia**
- **m: Mass of the structure**
- **a: Acceleration due to gravity**
- **S: Soil-factor**
- **γ: Response-factor**
- **T1: Building fundamental-period**
- **Ct: Coefficient related to the structural system and material**
- **Fy: Minimum yield-stress**
- **Fye: Effective yield-stress**
- **Fu: Minimum tensile-stress**
- **Fue: Effective tensile-stress**
- **ν: Poisson-ratio**
- **A: Thermal expansion coefficient**
- **E: Elasticity Modulus**
- **G: Modulus of Shear**
- **A: Building with fixed dimensions**
- **B: Building with variable dimensions**
- **H: Building height above foundation level**
- **h: Sky-bridge level**
- **S: Sky-bridge span**
- **EQx: Earthquake in X-direction**
- **EQy: Earthquake in Y-direction**
- **MAF: Main girder maximum axial load**
- **MSF: Main girder maximum shear load**
- **Case I: Identical buildings**
- **Case II: longitudinal inertia of building B = 3 of building A**
- **Case III: Transverse inertia of building B = 3 of building A**
- **Case IV: Longitudinal inertia of building B = 5 of building A**
- **Case V: Transverse inertia of building B = 5 of building A**
- **Sub-case a: Connection between B and sky-bridge is a hinged**