



# Studying the Influence of Prestressing and Pounding Loads on Quasi-Isolated PC Cable Stayed Bridges with Rigid Pylon Deck Connection Using Experimentally Verified Model

By

### Mohamed Abdel-Shakour Hasan Hassanoun

A thesis submitted to the Faculty of Engineering at Cairo University in Partial Fulfillment of the Requirements for the Degree of

**DOCTOR OF PHILOSOPHY** 

In

STUCTURAL ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY GIZA, EGYPT 2015

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Under the Supervision of

Prof. Dr. Akram Mohamed A.Torkey

Professor of Reinforced Concrete Structures
Structural Engineering Department
Faculty of Engineering, Cairo University

Prof. Dr. Walid Abdel-Latif Attia

Professor of Structural Analysis and Mechanics Structural Engineering Department Faculty of Engineering, Cairo University

### Prof. Dr. Eehab Ahmed Badrel-Din Khalil

Professor of Structural Engineering Construction Research Institute National Water Research Center

FACULTY OF ENGINEERING, CAIRO UNIVERSITY GIZA, EGYPT 2015

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Mohamed AbdEl-Shakour Hasan

### **DEDICATION**

This work is dedicated to my dear parents for their love, support, and scarifies that guided me in all my pursuits in life, with a special dedication to my sincere wife and beloved son for their patience since the beginning of this study.

Mohamed AbdEl-Shakour Hasan

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# LIST OF SYMBOLS

E	Flastic modulus taking into consideration segging effect
$egin{array}{c} E_{ m eff} \ E_{ m o} \end{array}$	Elastic modulus taking into consideration sagging effect Elastic modulus of cable material
-	Specific weight of cable material
γ σ	Axial stress in cable
$\mathcal{L}_{\mathrm{h}}$	Projected length of cable in plan
$t_{\rm e}$	Elastomer single layer thickness
t	Total elastomer thickness
μ	Coefficient of friction
K <sub>r</sub>	Unloading stiffness
G	Shear modulus
S	Shape factor
$K_{H}$	Horizontal stiffness of bearings
$K_V$	Vertical stiffness of bearings
$K_{\Theta}$	Rotational stiffness of bearings
В	Bulk modulus
$K_p$	Nonlinear impact spring stiffness
$g_p$	Expansion joint gap length
$\mathbf{u}_1$	Displacement of bridge end 1
$\mathbf{u}_2$	Displacement of bridge end 2
$C_p$	Impact damping coefficient (energy dissipated during impact)
ζ	Impact damping ratio
e	Coefficient of restitution (represents the degree of rebound)
$m_i$	Mass of span
F	Cable tension
V	Vertical component of cable tension (equivalent to total vertical loads of deck)
$V_{\mathrm{w}}$	The portion of deck loads carried by the web
$V_b$	The portion of deck loads carried by the central beam
Ø	Load distribution ratio
P C	Tendon jacking force The generated compression force in the strut
T	The generated compression force in the strut  The effective prestressing tension in inverted V-tendons
Θ	Cable vertical angle of inclination
	Strut/Tendon vertical angle of inclination
γ ξ	Web vertical angle of inclination
$\Delta P$	Total losses in jacking force (short term + long term)
α	Percentage of total loss in jacking force
η	Percentage of minimum jacking force to cable tension
γ	Specific weight of cable material
σ	Axial stress in cable
$L_{\rm h}$	Projected length of cable in plan
$t_{\rm e}$	Elastomer single layer thickness
$S_d(t)$	Design response spectrum
·- u(-)	