SEISMIC CAPACITY ASSESSMENT OF EXISTING RC BUILDINGS IN THE SUDAN BY USING PUSHOVER ANALYSIS

By

MOHAMMED AHMED IBRAHIM ISMAEIL

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

STRUCTURAL ENGINEERING

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Title of Thesis : **Seismic Capacity Assessment of Existing RC Buildings in The Sudan by Using Pushover Analysis**

Key Words: Pushover, Seismic capacity, Existing buildings, The Sudan.

Summary:

The Sudan has low-to-moderate seismic activity; most of existing buildings in The Sudan were designed only for gravity load. The aim of this thesis is to evaluate seismic performance of existing low-to-mid-rise Reinforced Concrete (RC) buildings in The Sudan. The buildings, which consist of 4, 6,8, and 10 stories, are designed according to British standard code (BSI) and American code (ACI). Pushover analysis has been performed. Results showed that the buildings designed using the (ESEE using BSI) has a greater capability to resist seismic loads than the (IBC2012 using ACI) design.

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Nomenclature

IBC	International Building Code
ESEE	Egyptian Society for Earthquake Engineering
PGA	Peak Ground Acceleration
ATC	Applied Technology Council
SAP	Structural Analysis Program
SBC	Saudi Building Code
IO	Immediate Occupancy
STAAD	Structural Analysis and Design
ASCE	American Society of Civil Engineering
RC	Reinforced Concrete
FEMA	Federal Emergency Management Agency
LS	Life safety level
CP	Collapse prevention
CM	Coefficient Method
CSM	Capacity-Spectrum Method
V-Δ	Base Shear – Roof Displacement
MDOF	Multi-Degree of Freedom
SDOF	Single-Degree of Freedom
N2	Nonlinear for SDOF and MDOF
AD	Acceleration–Displacement
S_a	Spectral pseudo-Acceleration
S_d	Spectral Displacement.
POA	Pushover Analysis
V_b	Base Shear
2D	Two Dimensions
C_s	Seismic Coefficient

W_t	Total Weight
p	Incidence factor
DL	Dead Load
LL	Live Load.
h_i	Height over the base to the level of the (i^{th}) floor.
W_i	Total load on the (i^{th}) floor
V	Total horizontal seismic force.
F_i	Part of the total horizontal seismic force assigned to the (i^{th}) floor.
F_t	Additional concentrated force at top story
H/d	Height to width ratio of the building)
R	Response modification factor
I	Occupancy importance factor
N	Number of stories
T	Fundamental period of the structure (sec)
F_a	Acceleration-based site coefficient
F_v	Velocity-based site coefficient
SM_s	The maximum spectral response acceleration at short periods adjusted for site class
SM_1	The maximum spectral response acceleration at a period of 1 sec adjusted for site class
SD_s	The design spectral response acceleration at short periods
SD_1	The design spectral response acceleration at a period of 1 sec
S_1	The mapped spectral accelerations for a 1- second period
S_s	SS The mapped spectral accelerations for short period.
F_x	Applied lateral force at level ‘x’
h	Story height
k	An exponent related to the structure period as follows:
MATLAB	Matrix Laboratory
ISACOL	Information Systems Application on Reinforced Concrete Columns