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COMPARATIVE STUDY OF CONVENTIONAL AND OUTRIGGER STRUCTURE FOR P-DELTA ANALYSIS

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Abstract

A brief overview There is a growing need for residential and commercial multi-story structures as people relocate from rural to urban areas. These colossal buildings have considerably reduced the problem of shelter.So far, designers have been unable to come up with solutions that provide enough stability and strength to endure lateral loads, despite their growing significance. Consequently, tall structures should be analysed using dynamic methods.These days, people want taller, more elongated structures.This article's principal objective is to compare and contrast conventional and high-rise outrigger structures with respect to their seismic resistance, architectural soundness, and P-delta resistance.

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Keywords: would Outrigger Structure, P-delta, Concept of outrigger, Conventional outrigger, Virtual outrigger

1 Introduction

Over the previous few decades, the skyscraper industry has seen a great deal of development. A large number of individuals are relocating from rural areas to urban centres. This is leading to a dramatic increase in the population density of urban regions. As the population grows, land becomes more valuable and scarce. Consequently, building multi-story buildings is the most direct and efficient approach of evading these problems. A tall building is any construction with a height more than 35 metres, albeit there is no precise description. A building's categorization is based on more than simply its height; for example, a 12-story building may be considered tall in a less developed city than in a highly developed metropolis like Hong Kong or Singapore. Building skyscrapers involves a number of complex factors, including:

1. Land scarcity in densely populated regions.
2. The need for commercial and residential real estate is on the rise.
3.Thirdly, improvement in technology.
4. Innovations in structural systems.
5. A rise in the economy.
6. Idea of a metropolitan skyline. 16.
7. Prestige and cultural significance.

Eighth, the universal human desire to rise to greater heights.

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1.1 Introduction to the Outrigger System and Its Evolution

A Polynesian ocean-going boat's mast is the horizontal beam that joins the outer stabilising floats to the main canoe-shaped hull. Although the principles of architecture stretch back millennia, the use of outriggers in tall buildings is a relatively new phenomenon that has only been around for about fifty years. This rustic-modern vessel design demonstrates the use of an outrigger mechanism. • A narrow boat's hull may be forced over by sudden waves and capsize or overturn with little "amas floatation" (upward resistance) from outrigger leverage. Is sufficient to keep the building from falling over; similarly, building outriggers fastened to perimeter columns that can endure both upward and downward forces greatly enhance the building's ability to resist falling over.Boats that have been ballasted to avoid overturning may have unconformable long period roll. However, you may greatly reduce this behaviour and the construction period by attaching the 'amas' to the outriggers.
Based on this concept, we may deduce:

1. The outriggers' job is to reduce the core's inherent instability, which would happen in a completely cantilever structure. By using the increased moment arm between these columns, tension compression coupling transfers the decreased moment to columns beyond the core.

2. Reducing the strength of the stepped mast's connection to the keel beam is the second critical purpose.

3. In tall structures, the same benefits may be achieved by lowering the base core over-turning moments and, by extension, the potential core uplift pressures.

The Idea of the Outrigger System (1.2)

The usage of outriggers is a time-honored practice that has been around for centuries and is known to reduce the impact of wind on sails. If we were to compare this towering building to a ship, its centre core would be the mast, its outriggers the spreaders, and its exterior columns the stays.

The outrigger system offers 1.3 advantages.

• All outer columns, not only those of the outriggers, are engaged in resisting the overturning moment. • To reduce the core overturning moment, provide a reverse moment to the core at each outrigger link.

• The overall cost may be reduced by using simple beam and column framing for the outer framing instead of rigid-frame type connections.

Uplift and net tension loads may be mitigated or avoided if the column and foundation construction weren't there.

• There are no trusses in the space between the building's interior and outside.

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Anomalies with the Outrigger Mechanism 1.4 Because of many problems associated with its use, the concept of outriggers has limited practical application: The outrigger's diagonal design makes the floor it's on an unsuitable surface for use. Architectural and practical limitations may prevent the placement of large outrigger columns in a way that would allow an outrigger beam extending from the core to readily touch them.

• The outrigger trusses' connections to the core could be difficult when a concrete shear-wall core is used.

• The core and outrigger columns will compress uniformly under a gravity force, although to different degrees. The very rigid outrigger trusses may undergo a number of stresses as they endeavour to restrict the differential shortening between the core and the outrigger columns.

RESULTS

From the models prepared in etab software for G+60,G+70,G+80 the output results graph are prepared for storey drift and storey displacement.

STOREY DISPLACEMENT

STOREY DISPLACEMENT G+60 X

ISSN: 1832-5505
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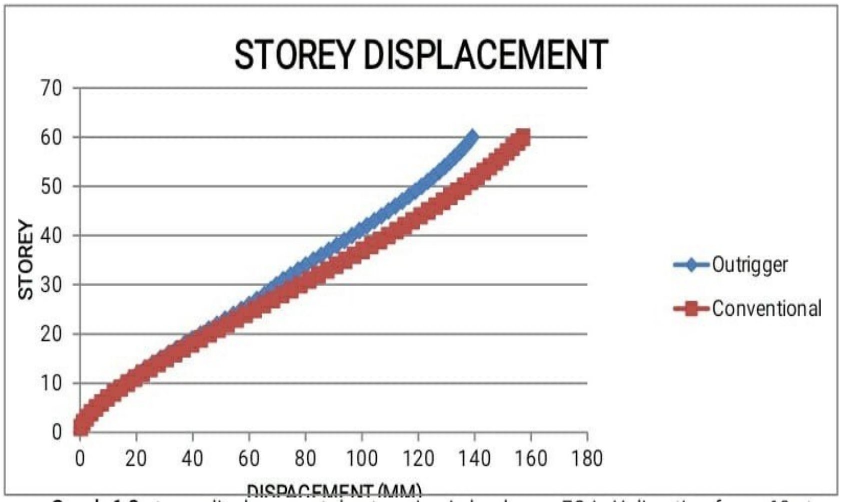


STOREY DISPLACEMENT G+60 Y

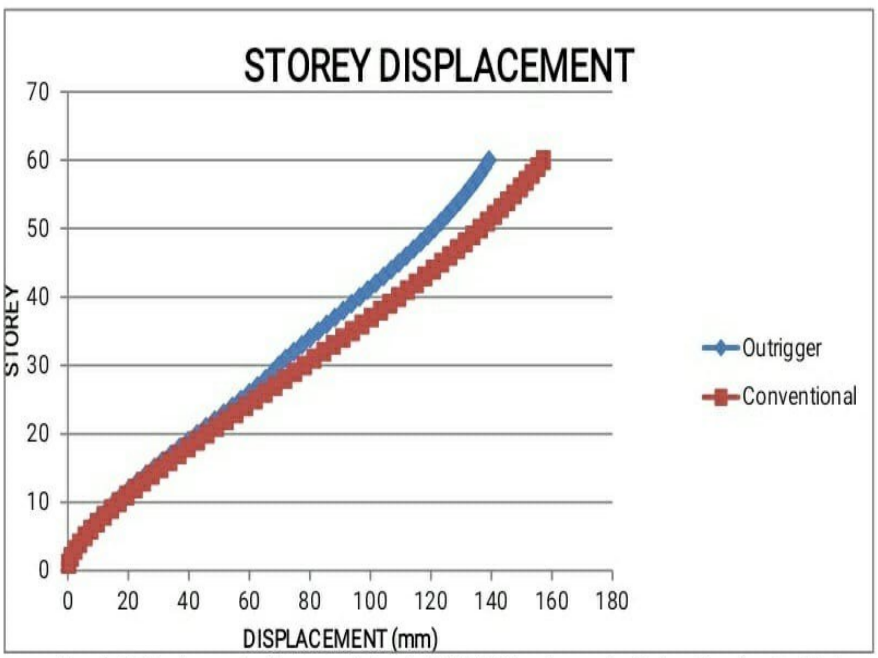
ISSN: 1832-5505
Vol-10, Issue-01, 2022

STOREY DISPLACEMENT G+70 x

STOREY DISPLACEMENT G+70 Y

ISSN: 1832-5505
Vol-10, Issue-01, 2022

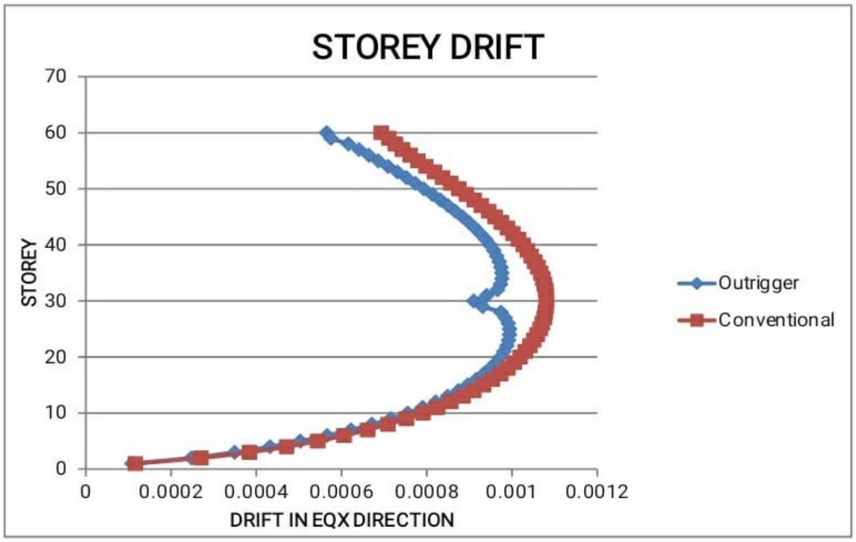
STOREY DISPLACEMENT G+80 X



STOREY DISPLACEMENT G+80 Y

ISSN: 1832-5505
Vol-10, Issue-01, 2022

STOREY DRIFT RESULTS



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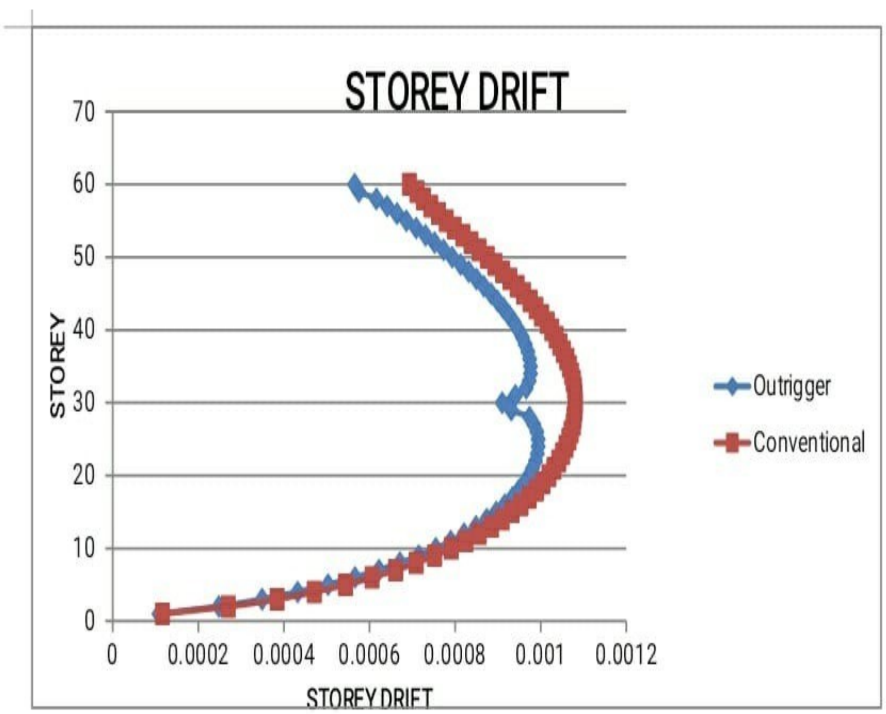

STOREY DRIFT G+60 Y

ISSN: 1832-5505
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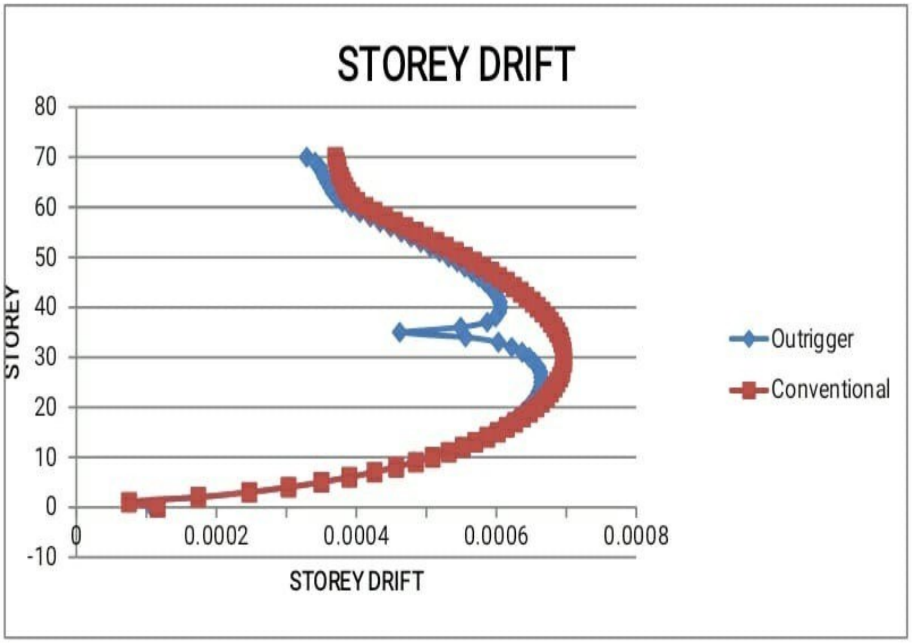

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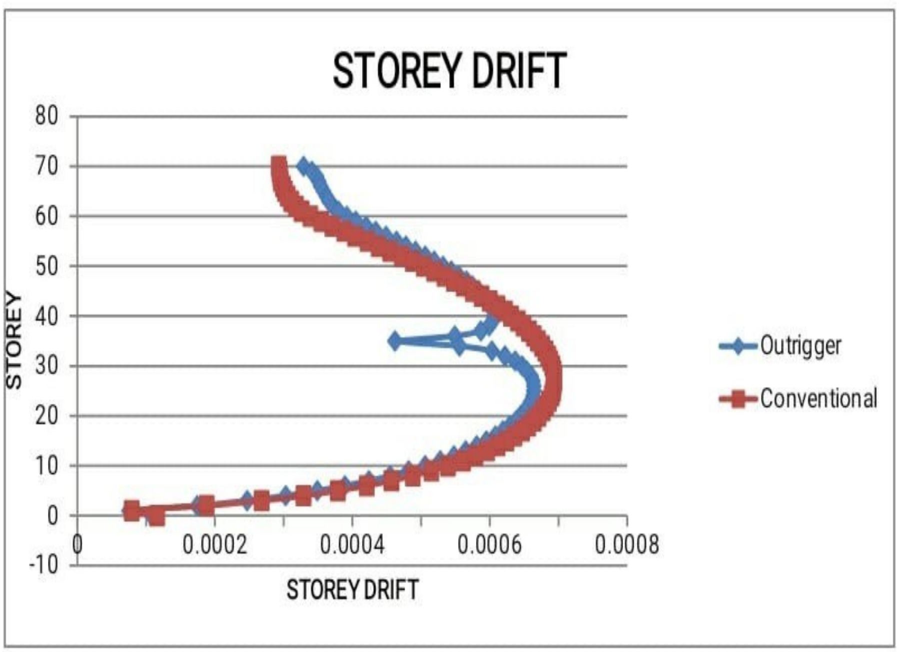

STOREY DRIFT G+70 Y

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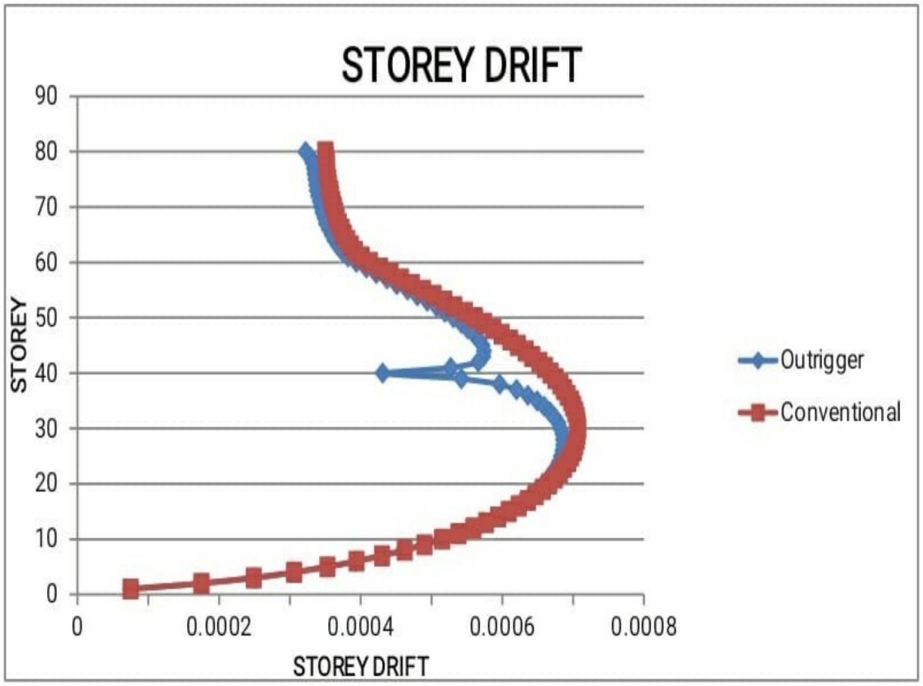

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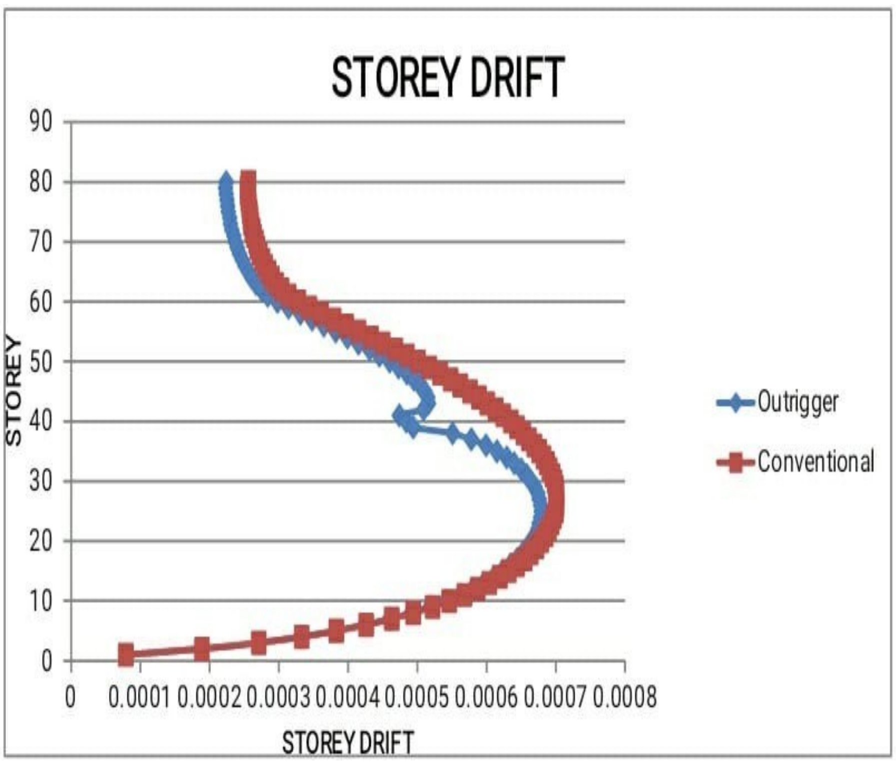

STOREY DRIFT G+80

2.RESULTS

The data analysis leads to the following conclusions :-

1. Using outrigger systems makes tall constructions more efficient when exposed to seismic and wind load. As a result, the structure becomes more sturdy.

2. Compared to traditional constructions, outriggers have a reduced displacement at the top story.There is less displacement with the outrigger structure compared to the conventional construction.

3. There is less storey drift in outrigger constructions as compared to conventional ones.

4. It is evident from the storey drift graph that the outrigger structure serves as a high drift controller in wind analysis, reaction spectrum analysis, comparative static analysis, and overall stability.The outrigger effect becomes most apparent at the outrigger levels of a storey drift graph, when the graphs display a significant bend.

5. Compared to the conventional building method, the outrigger structure clearly has a less p-delta effect when considering the two primary metrics, displacement and drift.

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