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Department of Civil and Industrial Engineering
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Master of Science in Building and Structural Engineering

Master's Degree Thesis

Linear Analyses Options for the Seismic Assessment of
Automated Multi-Depth Warehouse

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Academic Year 2018/2019

Abstract

Automated Rack Supported Warehouses (ARSWs) represent the future of storage technology. They offer some advantages compared to non-automated conventional Steel Racks built and employed thus far in the field. However, the seismic behaviour of Automated Rack Supported Warehouses is not well understood, owing to the lack of relevant research and the structural complexity.

Past ARSWs collapses, due to earthquakes, evidenced fragile collapse mechanisms of ARSWs. In addition, studies about ARSWs' seismic behaviour proved low levels of ductility and overstrength of ARSWs. These observations suggest investigating the seismic behaviour of these structures through linear analyses. Whereas, ARSWs non-linear analyses may involve extreme computational commitment and provide incoherent results. To better understand the behaviour of these complex structures a single Multi-Depth ARSW, designed for moderate seismicity, is modelled in detail and assessed. The seismic behaviour of the structure is investigated through 2D Modal Response Spectrum Analysis and 2D Time History Dynamic Linear Analysis.

However, as expected, both sets of results show that brittle failures dominate the structure response under seismic loads. In addition, an unsuitable strength of some base plates makes the structure inadequate to withstand to seismic action. Therefore, a new structural solution is proposed, by selectively strengthening base plates, in order to provide enough strength to withstand to seismic action and then, to enhance the seismic performances of the Multi-Depth ARSW.

Table of Contents

1.	Introduction.....	5
2.	Steel Racks and Automated Supported Rack Warehouses Features	10
2.1.	Automated Double Depth Cranes Warehouses	16
2.2.	Automated Multi Depth Shuttle Warehouses	17
3.	Open Problems and Research	20
3.1.	Previous Research.....	20
3.2.	Topics Related to ARSWs' Structural Design.....	21
4.	Objectives and Methodologies.....	24
4.1.	Thesis Targets	24
4.2.	Purposes of Analyses	25
4.2.1.	Incremental Dynamic Analysis.....	26
4.2.2.	Fragility Curves	29
4.3.	Thesis Arrangement.....	29
5.	Test Case.....	31
5.1.	Design Phase.....	31
5.2.	Structure Description	39
5.2.1.	Cross-Aisle Frame	42
5.2.2.	Down-Aisle Frame.....	43
6.	Structural Analyses and Results	44
6.1.	Loads Analysis and Combinations	47
6.2.	Response Spectrum Modal Analysis	49
6.2.1.	Behaviour Factor.....	52
6.2.2.	Structural Model Description.....	54
6.2.3.	Analyses and Results	59
6.2.4.	Safety Verifications	65
6.2.1.	Comments	68
6.3.	Time History Dynamic Linear Analysis.....	69
6.3.1.	Time Histories Description.....	69
6.3.2.	Structural Model Description.....	73

6.3.3.	Analyses and Results	74
6.3.4.	Comments	74
7.	New Structural Solution Proposed.....	75
7.1.	Amendments Proposed	75
7.2.	Analyses and Results	75
7.3.	Comparison Results	75
7.4.	Comments	75
8.	Conclusions.....	76