AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
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Study the Structural Behavior of Turbo Generator Foundation Connected with Passive Supplemental Devices

A Thesis submitted in partial fulfillment of the requirements of the degree of

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(Structural Engineering)

By

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ABSTRACT

The study of the dynamic properties of Turbo-Generator foundation with and without using isolators and supplemental damping devices are considered in this thesis using both basic principles calculation method and finite element method. The high vibrations of machines especially Turbo-Generators machines leads to use massive masses of foundations to absorb the dynamic loads generated by machines. The work in this thesis investigates the effect of using isolators and passive supplemental damping devices in accommodate these big amount of dynamic loads, also investigates how it could lead to change the dynamic responses of Turbo-Generator foundations to be in the safe frequency range.

First the basic principles computation method is performed to accurately determine how isolators could lead to decrease the dynamic loads generated by machines and how it could lead to control the transmitted dynamic loads to the foundation, and the results shows that isolators could resist up to 90% of dynamic loads generated by T.G machines, which ensure that isolators have a significant effect in decreasing the amount of dynamic loads. And this basic principle computation is validated by using the finite element analysis method to compare the results which shows a similar results.

This is followed by study the dynamic response of Turbo-Generator foundation with two approaches: (1) by applying the dynamic forces at the Turbo-Generator machine foundation without using damping devices to evaluate the dynamic response of the foundation. (2) by applying the dynamic forces at the Turbo-Generator machine foundation with using damping devices inserted under the top deck of machine foundation and above the columns to study its effect on the critical dynamic response of the structure to machine dynamic loads.

A detailed finite element analysis model of the Turbo generator foundation is constructed by using SAP2000 program to perform a detailed comparison study between using supplemental damping devices and without using supplemental damping devices, and the damping device used in this study is lead rubber bearing (LRB) according to its high effect in dissipating the dynamic loads. And a large study of the mechanism of lead rubber bearing dampers is presented in this thesis.

The results shows the significant effect of using passive supplemental damping devices in T.G foundation not only in the dynamic properties of foundation but also it could lead to decrease the masses of top deck of the machine foundation by 20% or more with acceptable dynamic responses compared with foundations without damping devices. Which is a proof of the high significant of damping devices specially lead rubber bearings in decreasing the construction cost for Turbo-generator machine foundations with good dynamic behavior and reasonable masses compared with foundations without supplemental damping devices.

Keywords: Structural Dynamic Analysis, Concrete structure, Machine Foundations, Turbo Generators foundations, Passive supplemental damping devices, Lead Rubber Bearings, Isolators, Finite Element Modelling, dynamic response.

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