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Mandatory Versus Voluntary Seismic Retrofits: Not All Improvements Are the Same

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INTRODUCTION

This paper is the first in a series of white papers that looks at the improved performance of structures through seismic retrofitting. This paper serves to introduce the topic of seismic retrofitting by focusing on the differences between mandatory and voluntary retrofitting and discusses some of the many reasons for performing seismic retrofits on existing structures.

Subsequent papers will build on these basics by examining and evaluating the differences between the types and degree of improvements' values in terms of building performance and financial impacts.

WHAT IS THE PURPOSE OF SEISMIC IMPROVEMENTS?

Improvement of the lateral force-resisting system ("LFRS") (a.k.a. Seismic Improvements) of a structure serves one or more different purposes. At its basic level, improving the LFRS is meant to improve the structure's ability to protect the safety of its occupants and reduce the likelihood of building collapse. Improvement of the LFRS at the basic level will inherently improve the structure's ability to sustain lesser damage, and thus potentially reduce the exposure to financial losses. At subsequent higher levels of improvement, the focus is to prevent partial or full building collapse and further increase the structure's ability to remain operational after an event and minimize business interruption. The highest level of improvements of the LFRS are such that the structure will sustain essentially no structural damage from a seismic event.

Seismic retrofit of existing buildings is a means of improving a structure's ability to resist seismically induced horizontal forces due to ground shaking. In many cases, seismic retrofitting is in response to mandates from an Authority Having Jurisdiction ("AHJ"). In other cases, seismic improvements are made on a voluntary basis at the desire of building Ownership. It is important to remember that not all seismic improvements are the same.

WHAT ARE MANDATORY SEISMIC IMPROVEMENTS?

Mandatory seismic improvements can be triggered by one or more of the following conditions occurring at the structure's location:

1. **Local Government Imposed:** A local or state-mandated ordinance requiring the investigation of the structure's LFRS through analysis by a licensed structural engineer. If the structural engineer determines that deficiencies exist, the ordinance requires a seismic upgrade to be made to the structure in order for the structure to remain in service. If seismic upgrades using retrofit measures are not implemented, demolition may be required. Ordinances can be included in the local building codes or are often a separate mandate included as a part of a local ordinance or State Bill. One such recent example is the 2015 City of Los Angeles Ordinance No. 183893 that amends Divisions 93 and 95 of Article I of Chapter IX of the Los Angeles Municipal Code. This ordinance requires mandatory measures be investigated and implemented to Non-Ductile Concrete Structures as well as those structures with a condition known as soft or weak stories created due to "tuck under" parking. If a structure does not meet specific standards, the building shall be structurally altered (retrofitted) to conform to the standards within a designated timeframe or shall be demolished.

   The performance of Non-Ductile Concrete ("NDC") structures was first identified as inadequate during the San Fernando earthquake (M6.6) of February 1971. NDC structures demonstrated that they were highly susceptible to excessive damage or even building collapse. More stringent measures were included in subsequent local building codes; however, there were no specific mandates for seismic retrofit of these structures. There are over 1,300 such NDC buildings that have been identified as potentially being subject to the conditions of this ordinance in the city of Los Angeles. Structures with tuck-under parking (primarily apartment buildings) were identified in the Northridge earthquake (M6.7) of January 17, 1994 as having a condition than

can cause building collapse. There are over 13,000 buildings in the city of Los Angeles that have been identified as having this condition.

2. **Building Improvements Triggered:** Changing the occupancy group or use of the structure, making alterations that include the addition of mass to the structure in excess of 10% of its current mass, or alterations that reduce the lateral force-resisting capacity by 10% or more. These conditions will require seismic improvements as called for in the current building codes. In some instances, only portions of the structure are required to comply, namely those that are affected by the alterations.

It is worth noting that while these events will trigger mandatory seismic improvements, AHJs and the building codes only focus on the most basic level of protecting the building occupants from death or injury; they do not focus on financial losses or disruption in building services after a seismic event. There are higher performance levels than those of life safety and collapse prevention that are sought through meeting the requirements of the building codes. Retention of service or immediate occupancy are examples of increased levels of performance that may be desired by Ownership or a tenant.

VOLUNTARY SEISMIC IMPROVEMENTS & EXAMPLE SCENARIOS

A voluntary seismic retrofit is one that is undertaken by a property owner on strictly a voluntary basis and can include partial or full measures to improve the LFRS of the structure. Property owners may have one or more motives to implement these improvements that can be attributed to some or multiple reasons outlined below:

1. It may be that the Owner feels a moral obligation to make improvements that will lead to improved building performance in the event of an earthquake. These improvements will not only yield greater safety to the occupants in an earthquake but will inherently lead to a reduction in the financial risk from a seismic event.

2. Lenders who wish to reduce the exposure to financial losses will often require seismic retrofit of the structure prior to agreeing to provide debt service (lend) on the property. These mandates often become a condition of the close of escrow, and in some cases a hold-back of funds is required until the improvements are completed.

3. Real estate investors that buy and sell real estate will often seek remedies to the exposure to financial risk in the event of an earthquake. Buyers of real estate see seismic retrofit as a means of reducing their exposure to financial loss and will often look to a seller to participate in the cost of these improvements when negotiating the final sale price of the asset.

4. A similar scenario applies to a seller of investment property. If they do not wish to be subject to a renegotiated selling price, current owners can elect to perform the seismic improvements themselves before putting the property on the market. Many times, the asking cost for the proposed seismic improvements by a buyer will be more than what it would cost the seller to make the improvements themselves prior to the sale.

5. A real estate owner may choose to make seismic improvements to make their property more attractive to a certain marketplace (e.g., a government tenant). Government leases or property acquisitions may require seismic improvements to meet particular criteria surrounding the expectations of the performance of the structure e.g. that protection of the life safety of the building occupants be implemented as a part of the agreement to move forward with the lease or purchase. These requirements are typically outlined in Government prepared documents on either the Local, State, or Federal level and include specific criteria that must be met and verified by an engineer licensed in the jurisdiction. Universities, schools, courthouse facilities, medical facilities, police and fire, and prisons are additional examples of users that may have employees or representatives of the organizations occupying privately-owned facilities.

6. Sometimes the operations within a structure require a higher performance level than those required by meeting the building code. Retention of service or immediate occupancy are examples of increased levels of performance that may be desired by Ownership or a tenant.

7. Entities that are self-insured may seek ways to reduce their exposure to financial losses. This often includes a program of seismic retrofit and/or additional insurance by outside sources.

CONCLUSION

Demonstrated in this paper are the many reasons for performing seismic retrofits on existing structures, both voluntary and mandatory. These measures can be readily (or with some difficulty) achieved depending on the structure type and occupancy conditions within the structure. They can also be costly or relatively inexpensive to achieve when considering the benefit gained by the improvements. These factors should be considered before embarking on a seismic retrofit plan or evaluating the seismic improvements made to an existing structure because not all seismic improvements are the same.

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