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INTRODUCTION

Isolation Systems at the Getty Museum
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At the Mountmaking Forum
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Getty Villa- Malibu, CA

Our presentation will be a brief overview of the evolution of isolation systems used at the Getty Museum.

Over the past twenty years, The Getty Museum has gone to great efforts to define its seismic threat and to design seismic mounts that will provide an increased level of protection for its collections.

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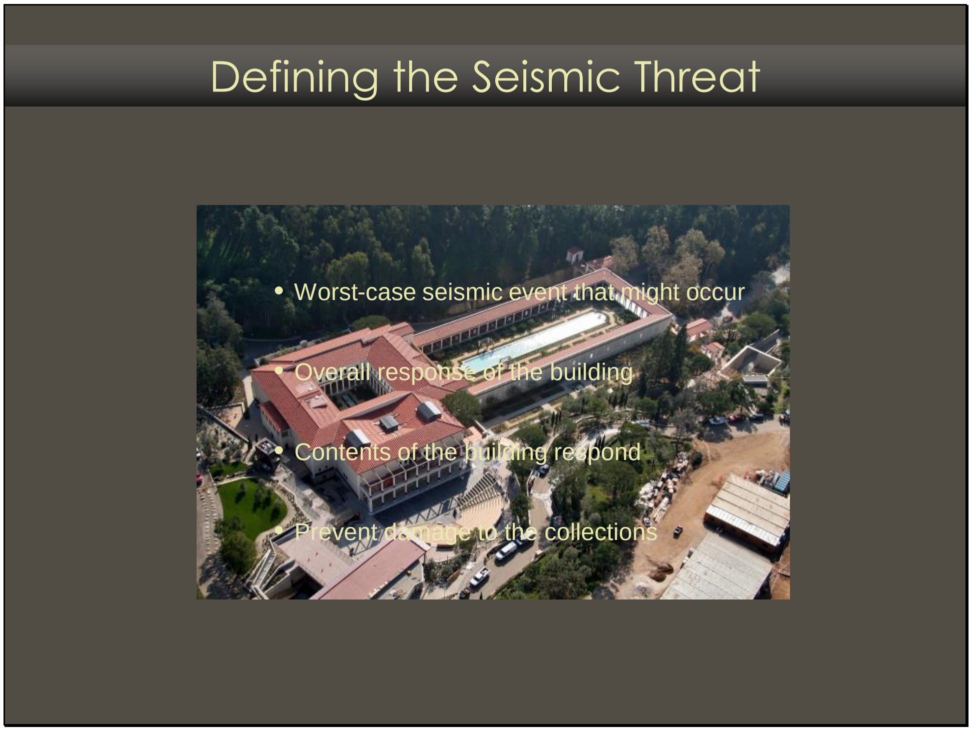

In 1983, the Getty Museum began its efforts to identify measures the staff could take to mitigate the effects of an earthquake- and to protect its collections by addressing the following questions:

What is the worst-case seismic event that might occur within a reasonable risk level and time frame?

What would the overall response of the building be to that event and would any specific part of the building respond differently than any other part?

How would the contents of the building respond to the earthquake forces?

And how any of these effects could be minimized to prevent damage to the collections?

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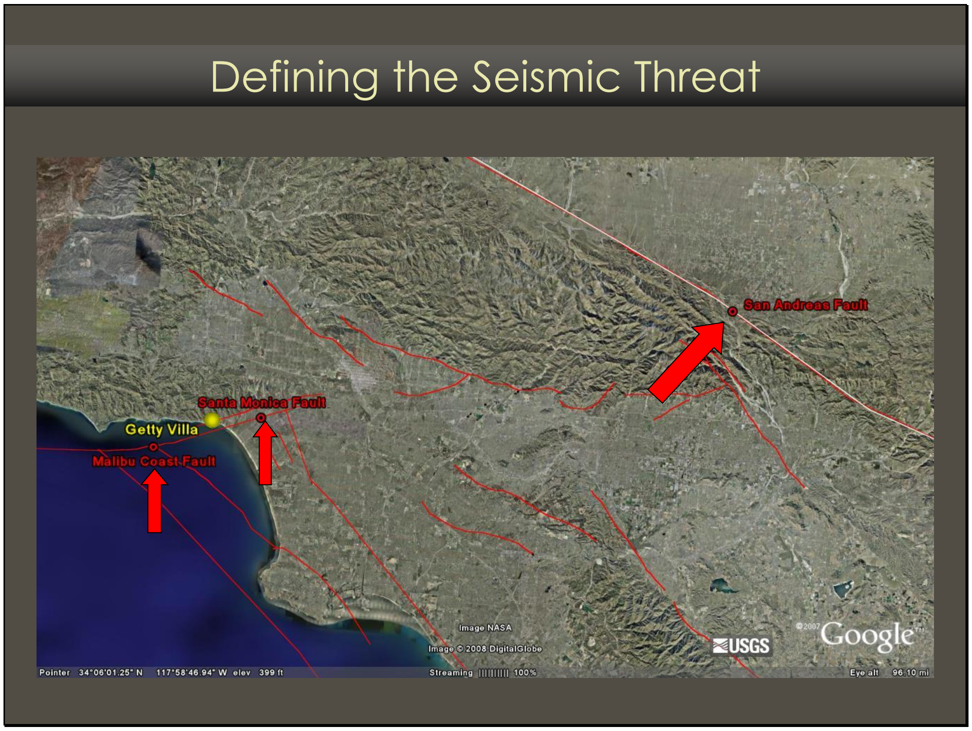

In 1984, the Getty commissioned Lindvall, Richter and Associates to prepare a study of the Malibu site and the Villa museum building. Based on this study, the museum established an acceptable risk level- defined as an event with an 80% probability of not being exceeded in a 50-year period. Reoccurrence of such an event was estimated to be about every 225 years. The study identified two events that would have the most impact upon the museum:

A large scale earthquake on the San Andreas Fault, some 40 miles away to the east, could result in a horizontal ground acceleration of 0.2 g at the museum site-

And a smaller, but possibly more destructive earthquake, on the Malibu Coast/Santa Monica fault system, located only 1 mile from the museum that could potentially produce a maximum 0.7g horizontal ground acceleration.

Because of these concerns, the museum's collections were considered to be at great risk unless some sort of mitigation effort was implemented.

The study also revealed that the Villa museum building proved to be an impressively stiff structure, with a natural period of 0.1 second. Because of this, it was assumed that the earthquake forces would be directly transmitted to the objects in the collection.

But, the positive aspect of the stiff structure being that both gallery floors of the museum are predicted to respond in a similar way, thus eliminating the need to treat the floors differently, which can be an issue in multi-story structures.

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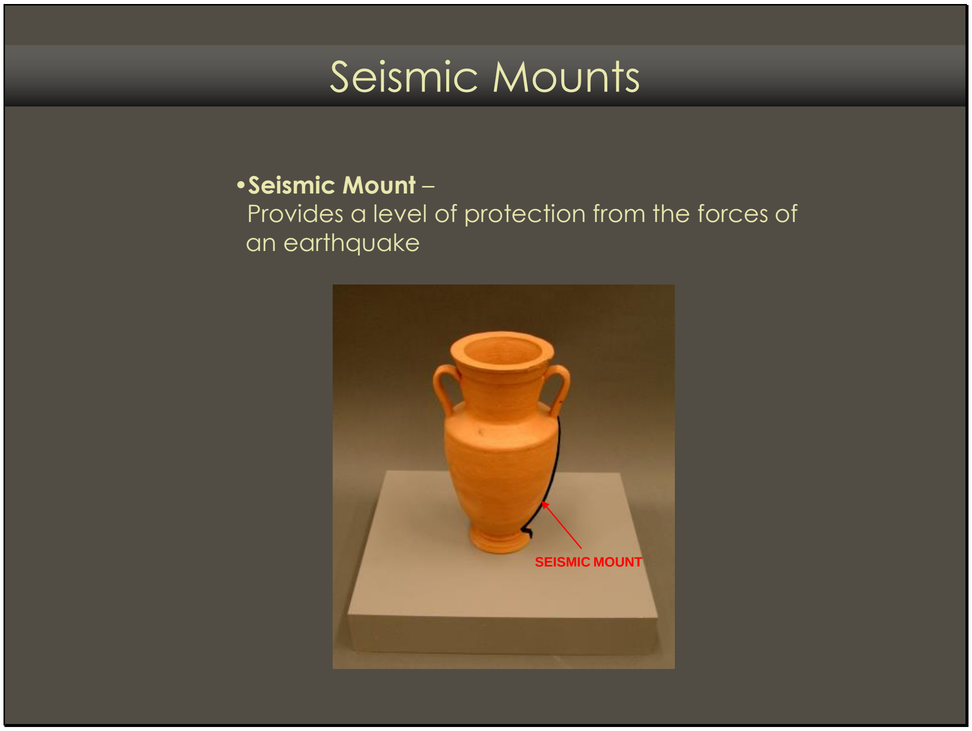

Prior to the seismic study, most of the mounts at the Getty Villa were considered to standard display mounts. But by addressing the seismic considerations of the site, the parameters of the mount designs changed.

By designing a seismic mount, it not only fulfills the basic display requirements for an object, but also provides an increased level of protection from the forces of an earthquake.

Based on this principal, every object that goes on display at the Getty is evaluated for some degree of seismic protection.

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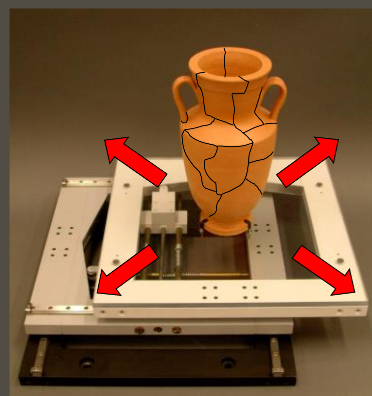
Seismic Mounts

- **Decoupling Mount** –
  Allows the object to move within a defined parameter with a predefined degree of ease



In some situations, the object is too fragile and not capable of fully withstanding the forces that are transmitted to it-

Or where a visible mount will interfere with the desired display.

In these situations, an alternative approach is pursued.

A decoupling mount allows the object to move within a defined parameter.

It is more accurate however, to think of this situation not as the object being allowed to move, but rather envisioning the ground moving without dramatically affecting the object.

We refer to our decoupling mounts as isolators.

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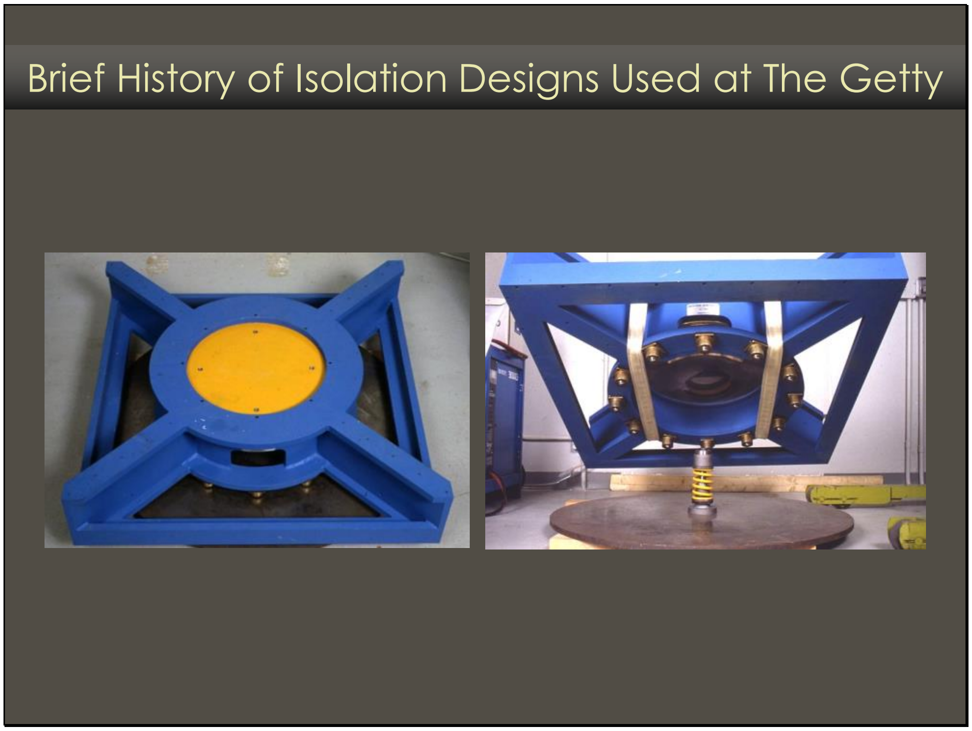

Relatively speaking, the isolation of structures has developed rapidly, but the isolation of contents such as works of art, has lagged behind the trend.

In 1985, the Getty pursued it first isolator. Jack Yaghoubian of Quantec Systems, proposed an isolation mechanism based on an inverted dish system for a large marble Kouros sculpture in the museum’s collection.

Shake table tests of the isolator’s performance proved promising, and when the museum’s design earthquake spectra was applied the isolator, it proved to significantly reduce the risk to the object.

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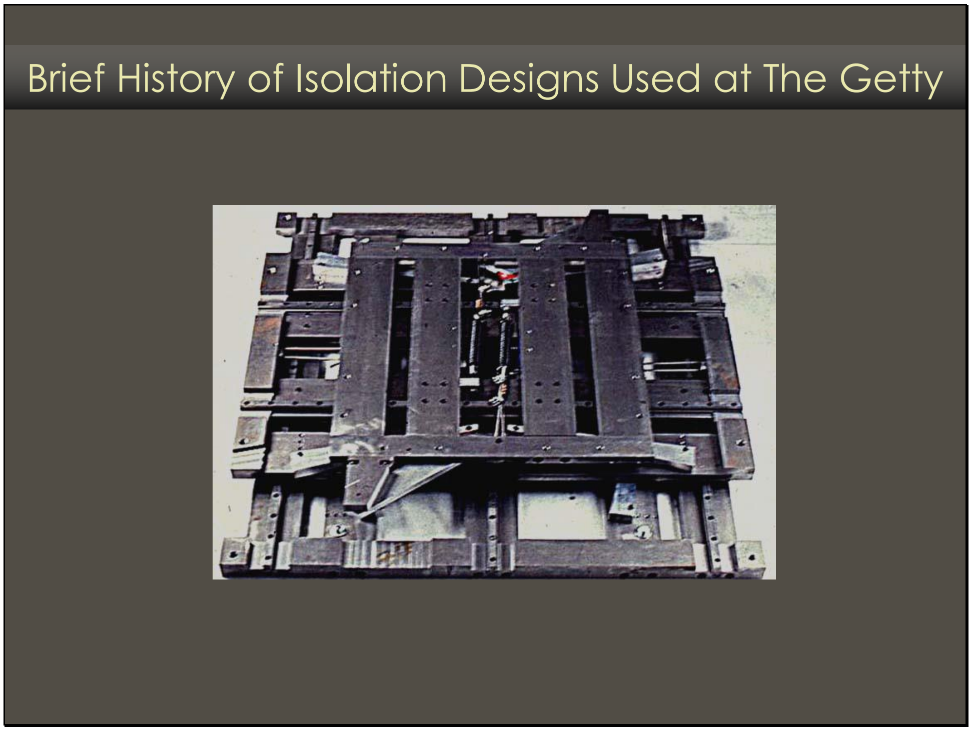

In the subsequent years, the museum pursued other isolator designs that could provide a secure vertical connection between the object and the ground, while still allowing horizontal movement.

In 1990, a design originating in the museum's Antiquities Conservation department fulfilled those requirements.

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Brief History of Isolation Designs Used at The Getty

The new isolator design, intended for a large statue in the museum’s collection, was tested on tri-axial shake table.

During the testing, a full-scale model of the object was attached to the isolator. The weight distribution of the model accurately mimicked that of the original sculpture as did the assembly of the objects fragments and attachment to the display base and isolator.

The tests indicated that the isolator had a natural period of 3 seconds, which when combined with an 18 inch displacement, confirmed the predicted 70% reduction of the seismic forces at the top of the isolator.

This provided an acceptable compromise between displacement demands and size of the transmitted earthquake force.
This isolator design is essentially the same as the design we’re using today.

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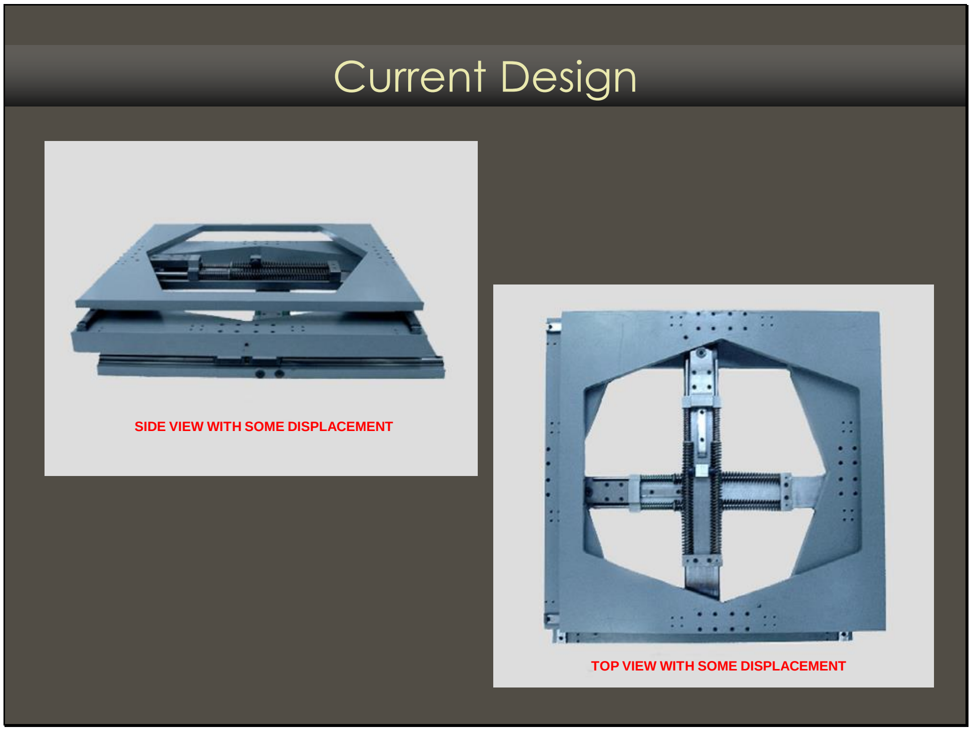

The current isolator design is comprised of three layers, with independent travel in two axes, allowing for 360 degrees of movement.

The bottom layer, which is secured to the ground, and has a pair of mounted linear guide blocks and rails. The blocks and rails provide easy horizontal movement, and since the blocks are captured to the rails, they provide a secure vertical connection. These guide blocks are attached to the middle layer.

The middle layer has another set a linear guide blocks and rails, which run in the opposite axis and attach to the top layer.

The top layer then attaches to the display and object.
Movement in each axis is regulated independently by a series of springs, roller mechanisms and ramps.

As the isolator displaces, the centrally mounted roller mechanism travel along one of the ramps. As this happens, the roller mechanism compresses the springs providing a predetermined resistance and returning force.

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Over the years, our ongoing collaborations with seismic engineers and continued testing has yielded many improvements to the original three layer isolator design such as:

- Stiffer isolator frames, which have been redesigned to handle more weight with minimal deflection.

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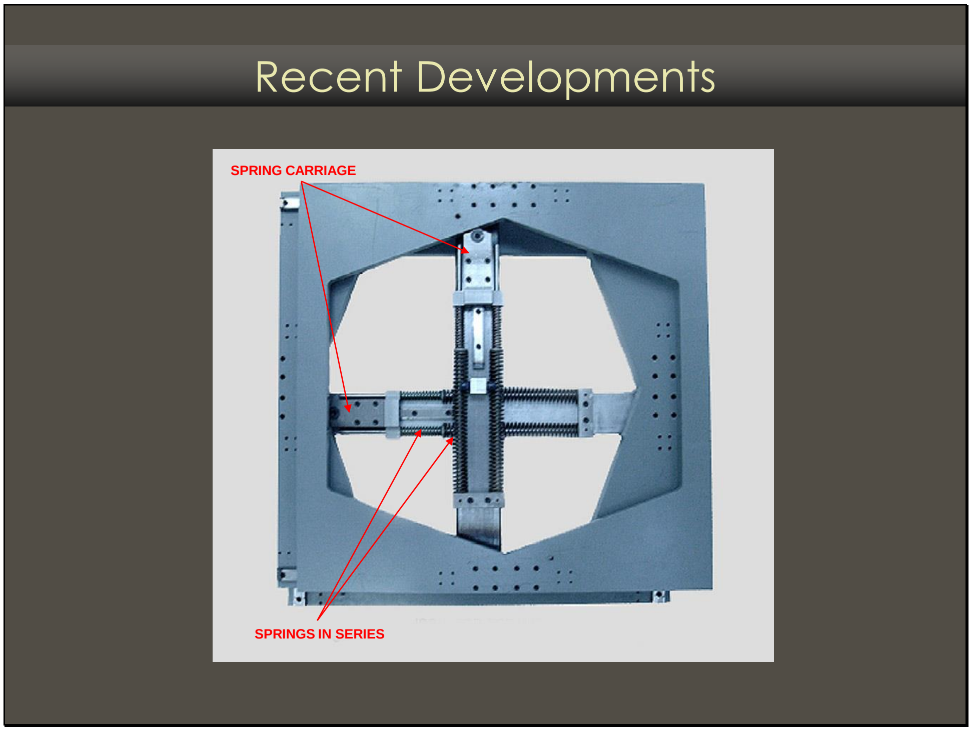

- A spring-return mechanism that has been modified to better withstand the torsional forces imparted during displacement.

- And springs that can be easily changed to increase versatility with different displays.

In an effort to provide a greater response range for our isolators, a springs-in-series design was recently conceived to provide two specific ranges of resistance to the lateral motion.

A combination of softer springs, with a set of stiffer springs, provides less resistance initially, but offers greater resistance at fuller displacements. This allows the isolator move freely, but is still able to accommodate larger earthquake forces and to avoid sudden a stop as the maximum displacement is reached.

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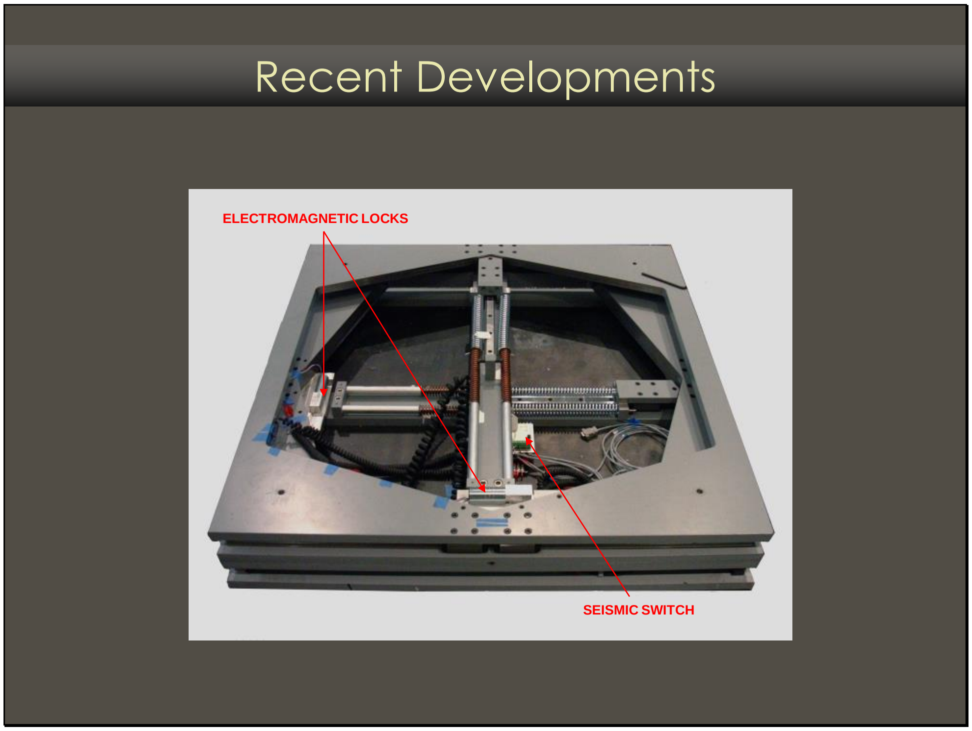

Recently, a new design was developed to address the problem of an isolator being accidentally displaced by the public. In the past, the only way to prevent this was to incorporate barriers into the display to keep the viewer at a distance.

The design locks the isolator in each axes, preventing movement.

A programmable, seismic-micro switch, located within the base of the isolator, is set to a predetermined force limit.

Should the threshold be reached, the seismic switch releases electromagnetic locks and the isolator is free to move.

All of this happens in a fraction of a second.

Experiments with the seismic switch found a setting that allowed for an acceptable amount of contact by the public without triggering the switch, while still being sensitive enough to activate with minor vibrations felt through the building.

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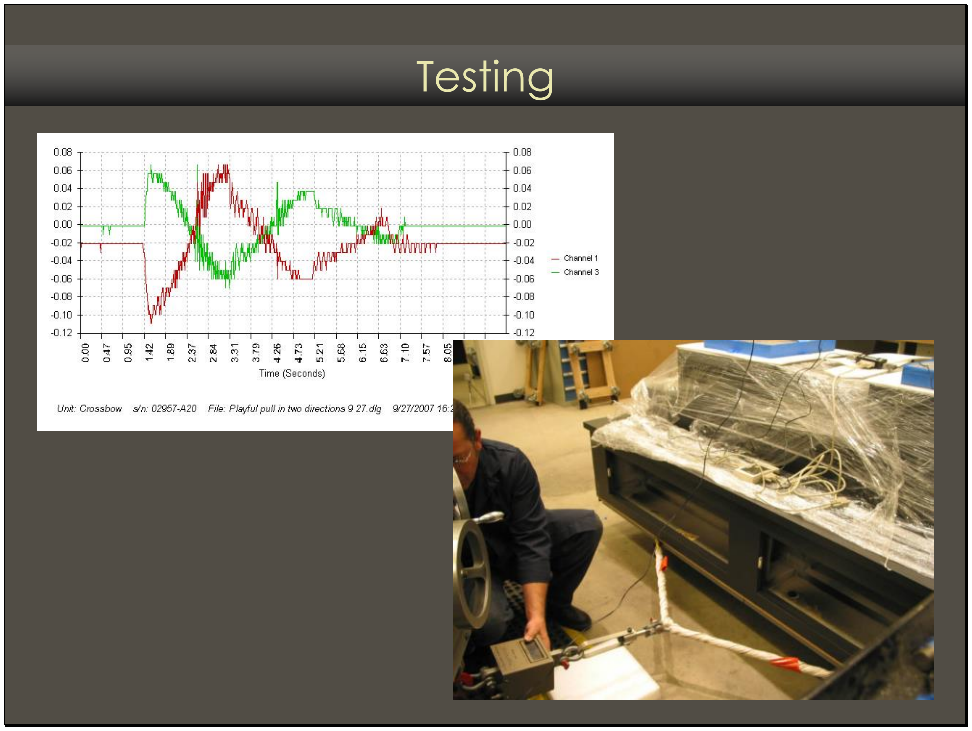

Of these improvements, one of the most significant has been the understanding of keeping current with our information.

Seismology has evolved over the years, and new perspectives based on recent seismic events, has provided new insights into how our site and building could react to an earthquake.

This has led to an updating of the Villa site study and design earthquake, which was over twenty years old.

The importance of our ongoing collaboration with seismic engineers cannot be understated. It is with their guidance that we are able to have a better understanding of our isolators- and ultimately, continue to improve on their designs.

Continued testing has been the key to this progress- and at this point, we are now able to perform some of these tests ourselves, having the data evaluated by the engineers.

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In conclusion, it is our belief, that providing suitable seismic mounts, is one of the most important preventive actions that museums, in seismically active areas, can undertake in the long-term preservation of their collections.

It should be understood, that while isolators absorb a given percentage of the seismic forces, they can never eliminate the need for seismic mounts and structurally robust exhibition furniture.

Presently (2008), there are ten permanent collection objects on display at the Villa with isolators, as well as an additional five that are being incorporated with temporary loans. There are also two objects on display at the Getty Center that use isolators as well. As a result of the changing exhibitions, we're slowly we're building an attic-stock of isolators that can be easily retrofitted for a variety of configurations to suit our changing exhibits.

Thank you.