

## ELEPHANT FOOT – SEISMIC SHOCK ABSORBER FROM USED TIRES

SECOND PHASE OF SHAKE TABLE TEST SERIES AT INDIAN INSTITUTE OF TECHNOLOGY, GUWAHATI

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After reviewing the results from the first test series Aug 13 - Sep 9, 2015 by Professor Anjan Dutta, IIT, Guwahati, India and Professor JM Kelly at UC Berkeley, USA, the next phase is now taking form.

### Short recapitulation of the test set up in Guwahati:



We configured four tires, one in each corner of the 2.5 x 2.5m shake table and confined them with timber frames. On each tire a precast Elephant Foot was mounted. On top of all this there was a steel plate placed, of the same dimension as the table. The load was increased from 800 kg (by the top plate itself) up to totally 1600 kg.

Hence, 400 kg per tire, or 0.7 kN per running meter, represents the proportional weight of a brick/hollow concrete block wall, including a foundation beam and a roof structure with corrugated sheets, this being the most typical construction in poor urban areas.

This shake table is operating only in the x-axis.

*To better distribute the pressure a second tire on top served as a “collar”. However, this system probably obstructed the Elephant Foot from sliding over the tires, which would have increased the energy dissipation.*

### The main conclusions:



*Professors S.K. Deb and Anjan Dutta inspecting the test set up*

- The IIT shake table simulated two seismic history records, (1) El Centro, California 1940 and (2) Siliguri, India 2015.
- The accelerometer records of the tests can roughly be summarized as:  
El Centro had a low frequency (5-6 Hz) and the *Elephant Foot* provided up to 50% reduction of the Peak Ground Acceleration.  
The higher frequency (10-21 Hz range) of Siliguri resulted in just 4-5% reduction of PGA.

### Question 1:

- It is often assumed that low frequency earth quakes are associated with soft and alluvial soils where normally *the damage on a house is the most severe*. How common are these low

frequency quakes in comparison to all earth quakes? Would the Elephant Foot be worthwhile to launch in regions with unquestionably soft soils?

*Question 2:*

- Given the poorer performance at a high frequency quake, is it likely that steel belted car tires positioned flat in the foundations are *too stiff in the horizontal direction*?



*After a quick market survey we had concluded that the 13" rim steel belted radial tire is the most common size in India and therefore the most likely to find in abundance.*



*Ms Needhi Kotoky, civil engineer at IIT searching tires*



- The shape of the Elephant Foot needs to be redesigned such that the pressure is distributed over the entire tire outer diameter, some 54 cm.



- Bamboo has a compression strength up to 30-50 MPa. In the new concept we will evaluate if bamboo slats could be stapled into the half hardened concrete Elephant Foot, with the hard exterior surface facing the rubber. This could provide a sliding effect and enhance the energy dissipation.

- In addition soapstone powder will be tried as a lubricating agent. As this is a mineral it should not dry out over time.

The second phase at IIT Guwahati is targeted for December 2015

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