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PRELIMINARY OBSERVATIONS ON THE RESPONSE OF ACCELERATOR SHIELDING BLOCKS TO EARTHQUAKE MOTIONS

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DISCLAIMER

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The response to earthquake motions of massive block assemblages presents a fundamentally new type of problem in structural dynamics. The usual analytical methods in seismic design (which depend ultimately on damped-oscillator mathematical models) do not apply to blocks not anchored to the floor. Furthermore, no previous seismic experiments have been made on such block structures partly because testing facilities of the required sophistication heretofore were unavailable.

Dynamic testing is essential for studying response modes, assessing seismic safety of present block systems, and suggesting remedial measures if required. The importance of establishing rational design criteria based on dynamic tests is very great--since collapse of shielding systems during an earthquake could cause loss of life and damage to accelerators to an extent that would effectively shut down a national laboratory for an indefinite period.

Ground motions on radiation shielding blocks were recorded in a movie which was shown at the Accelerator Conference. These motions were induced, in preliminary dynamic tests, by the newly completed 20-ft Shaker Table at the UC Earthquake Engineering Research Center. This table has the unique feature of permitting simultaneous 2-dimensional (vertical and horizontal) excitations with variable Fourier spectrums.

Figures 1 through 11 show some of the slides used to introduce the movie.

Novel remedial measures are suggested by the dynamic testing thus far completed. Further study is needed to permit full utilization of the preliminary observations contained in the movie.

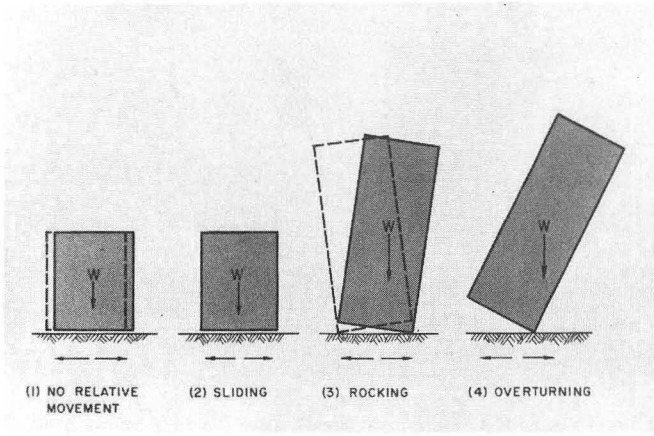

Fig. 1. Block response to ground motions.

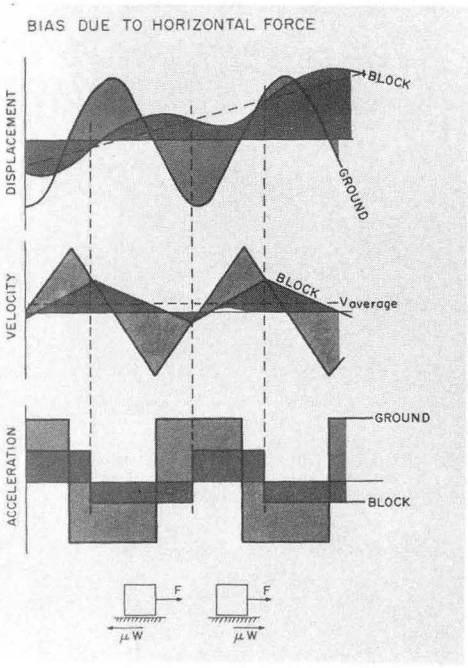

Fig. 2. Bias due to horizontal force.
(Block displacement in upper graph is similar to that for simultaneous vertical and horizontal ground acceleration.)

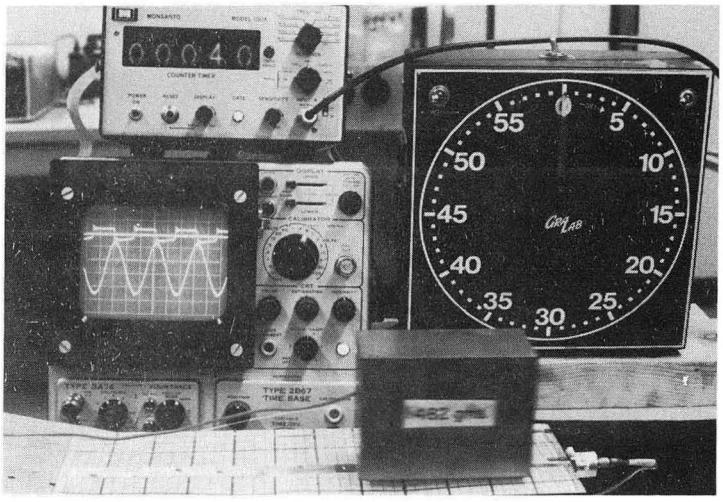

Fig. 3. Block sliding, small scale test.

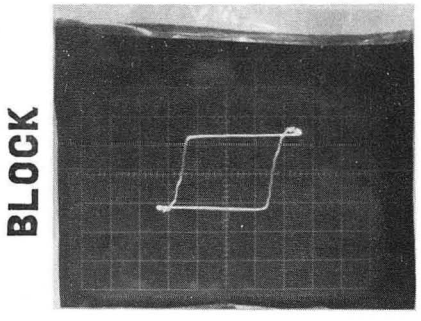

Fig. 4. Block sliding hysteresis.
(Block acceleration vs. ground acceleration for simple harmonic excitat

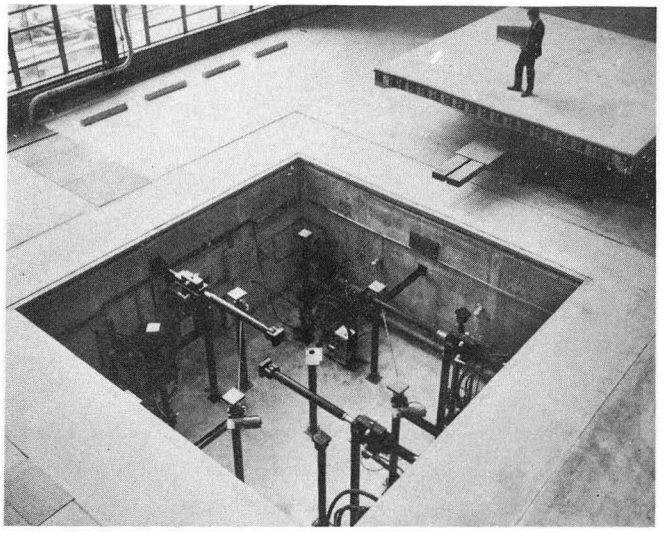

Fig. 5. UC Earthquake Engineering Research Center 20-ft, 2-component Shaker Table-- before installation of table top.

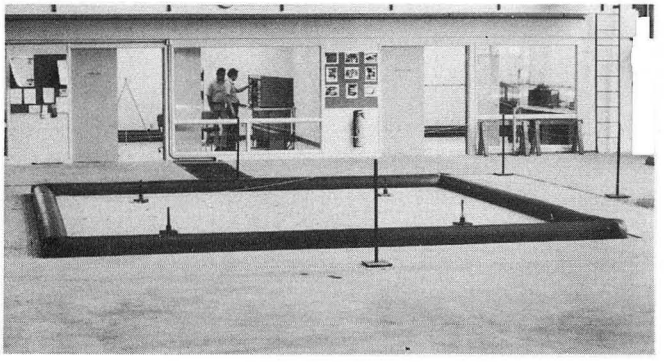

Fig. 6. Same as Fig. 5-- after installation of table top.

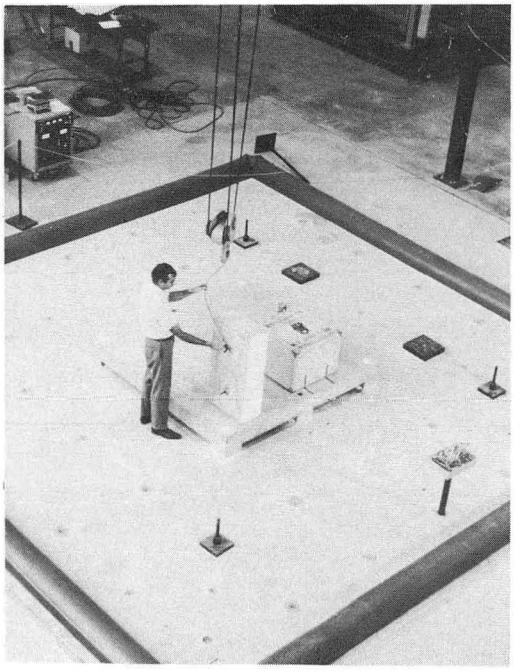

Fig. 7. Experimental setup for measuring effect of aspect ratio of blocks on response mode.

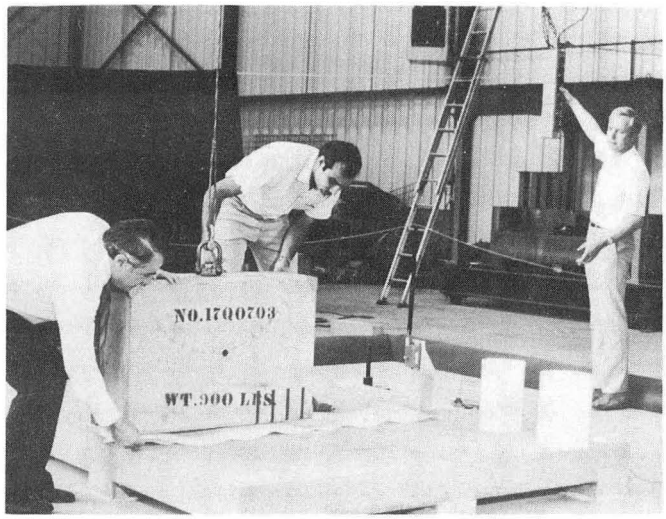

Fig. 8. Experimental setup for measuring effect of friction--teflon on teflon--on residual displacement with simultaneous vertical and horizontal ground excitation.

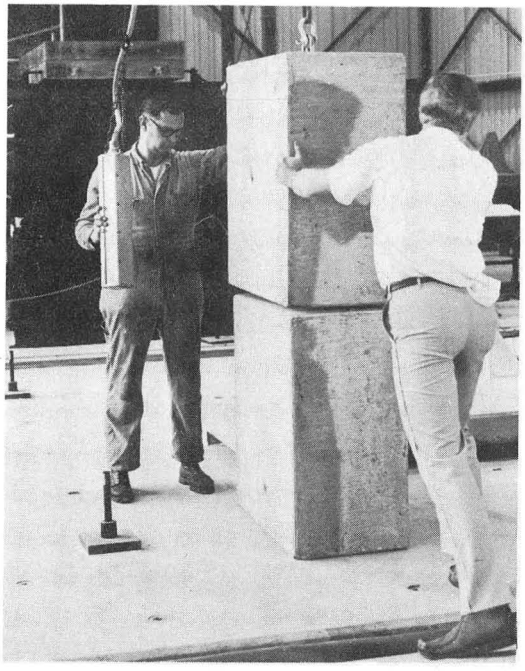

Fig. 10. Response of 2-block stack.

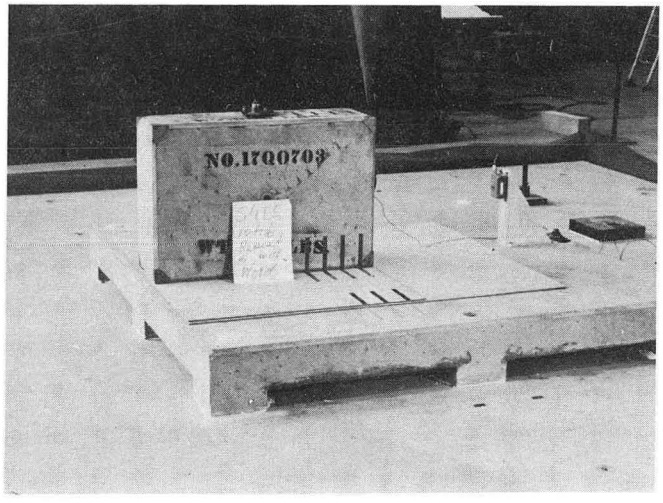

Fig. 9. Same as Fig. 8-- except plywood on plywood.

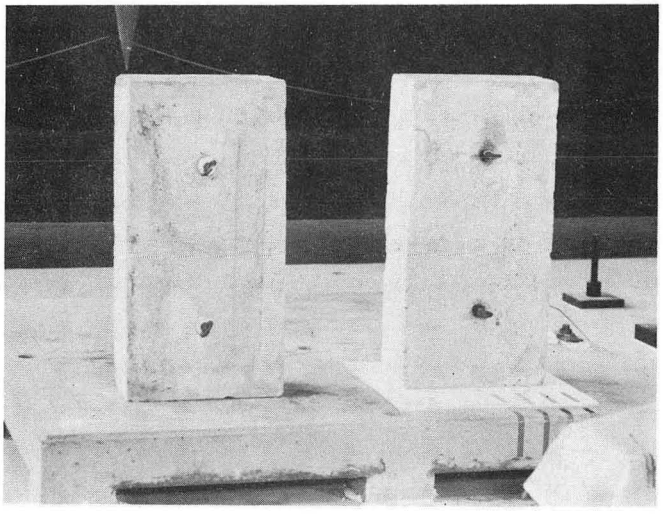

Fig. 11. Effect of friction on response mode. (Left block, concrete on concrete, rocked and was damaged. Right block, teflon on teflon, slid with no damage.)

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