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SAMES : VIBRATION - ISOLATED BUILDING

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Extremely sensitive vibration tolerances were prescribed for a new electronics factory by SAMES, a micro-electronics and computer manufacturer in Pretoria. This building was structurally designed by BPP and constructed during 1991. A particular difficult design constraint was the close proximity of a busy main line railroad adjacent to the physical site. Furthermore, the ground structure consists of 11m deep montmorilonite turf on basalt and granite rock. Such foundation conditions are highly undesirable because continuous train induced ground vibrations are being fed into surrounding buildings. Clay soil tends to reduce the frequency of seismic vibration to critical values which harmonize in a detrimental way with natural building structure vibration response.

Vibration tests confirmed the presence of severe vibration response in the soil and existing factory buildings on the site. These vibrations exceeded by far the sensitive criteria required for micro electronics manufacturing equipment.

The structural solution adopted was based on an articulated, reinforced concrete box-like structure resting on concrete ground piles. Only a portion of the building was subjected to the criteria, therefore this portion was isolated from the rest. The objective of the articulation was a structure of high stiffness and low mass with vibration characteristics having fundamental frequency respone above 10Hz. This was achieved by designing a ribbed floor slab of high stiffness-to-mass-ratio, resting on concrete shear walls and some columns to reduce spans to 2,5m.

Foundations consists of augered concrete piles socketed into the rockbed, with some piles 11m deep. Upper 5,5m of each pile was isolated from the surrounding clay by a 50mm thick vermiculite-chip filled void/jacket.

Figure-1 pictures this concept.

Because the vibration excitation of foundations is akin to earth tremor or quake, a similar analysis technique was applied as a design tool. Powerful computer software (PAFEC) predicted response of the critical vibration "table" or slab. Although the design process is simple in concept, it required considerable iteration, adjustment and judgement of design before all criteria were satisfied simultaneously.

On completion of the building accurate vibration measurements were taken in order to test the adequacy of theoretical design and predictions. Suitable accelerometers and recording instruments were set up at control references over a continuous period of 48 hours. The results confirmed that vibration parameters, for example acceleration peak, was reduced from 1000 micro-g's to 5 micro-g's in the frequency domain 2-10Hz. This was achieved through conventional construction without specialized expensive shock absorbers and bearings.

TYPICAL CROSS SECTION Y-DIRECTION

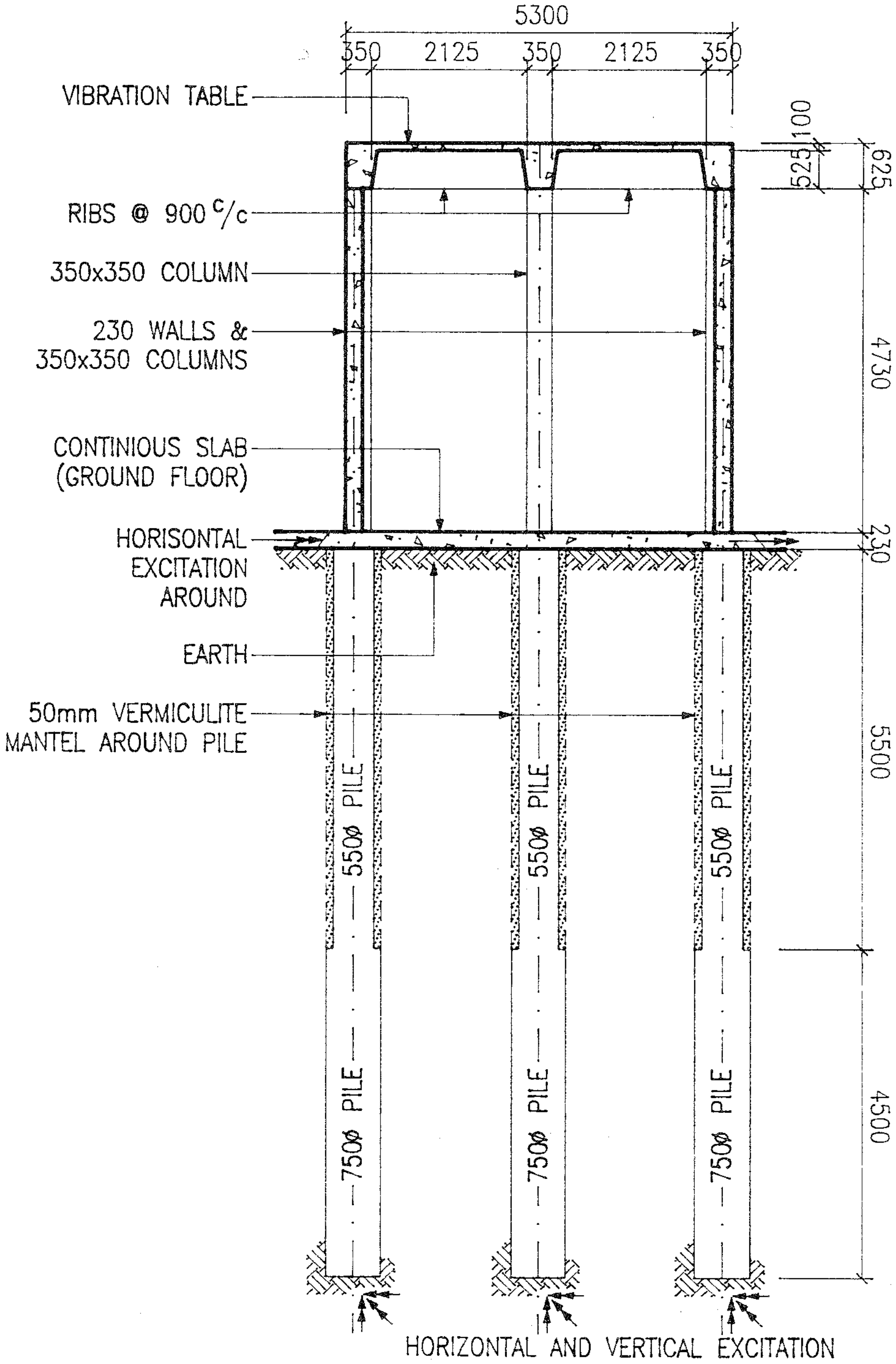
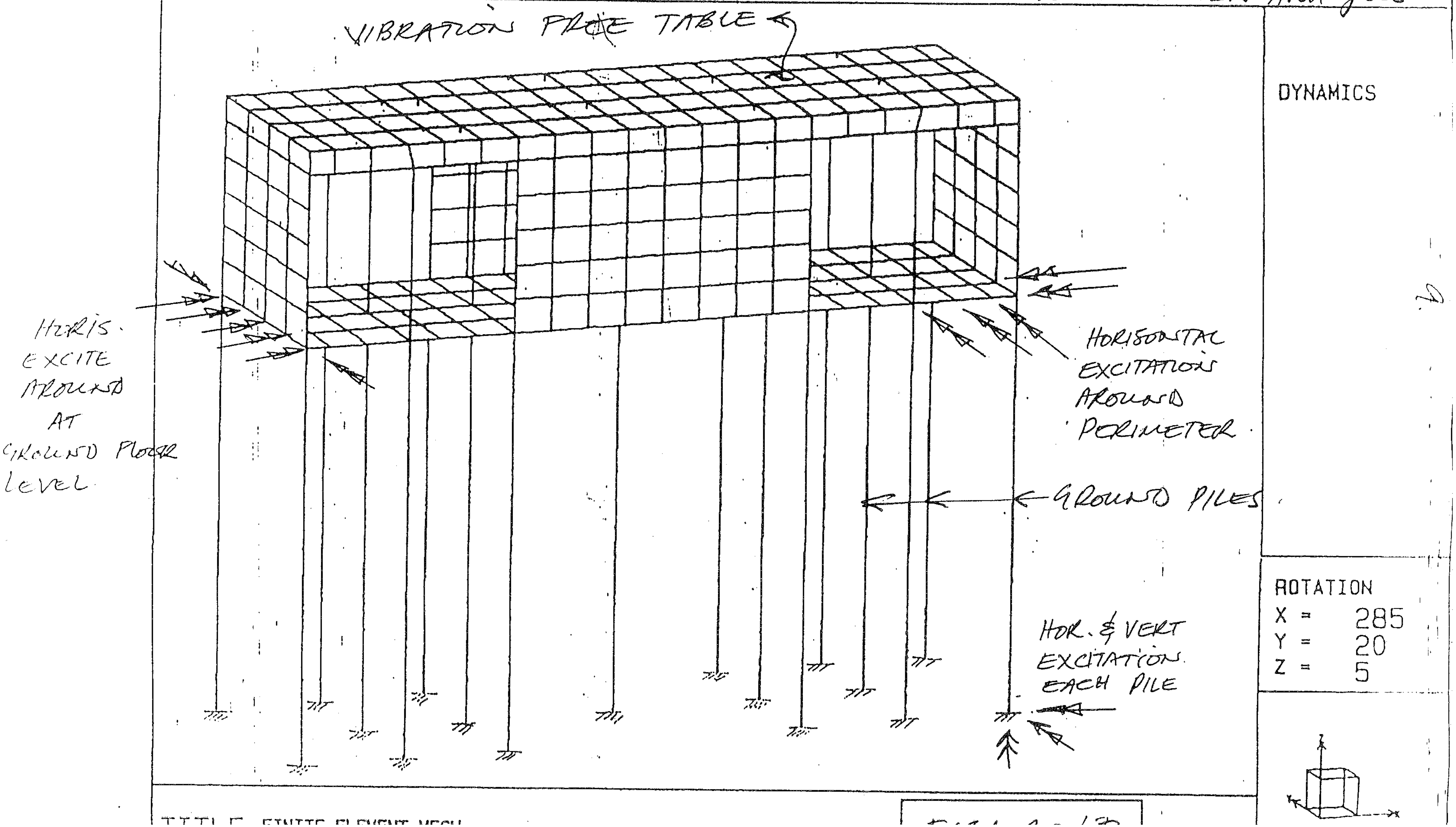


FIGURE 1

FINITE ELEMENT MODEL OF CONCRETE STRUCTURE FOR COMPUTER ANALYSIS



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