1976 Tangshan Earthquake Damage in Beijing

by T. C. Lee

Note: The information in this article was collected by T. C. Lee, an engineer on the staff of URS/Blume, who recently returned from a month's stay in the People's Republic of China.

The July 27, 1976, Tangshan, PRC earthquake caused some property damage in Beijing. The former Imperial Palace, now a national museum covering 720,000 square meters, escaped noticeable damage from the otherwise devastating earthquake. En Tsi-pel, of the Palace Museum Research Institute, stated that the sum effect of the Tangshan temblor on the palace was limited to cracks in the low panel walls of the two pavilions in the Imperial Garden and the loss of roof tiles from a building in the garden area.

The Imperial Garden, illustrated on the Visitors' Guide Map, is at the northern border of the Imperial Palace. The building that lost roof tiles, indicated on the map by the letter A, has been repaired. The two pavilions are identified on the map by the letters B and C. The low panel walls, located behind the stone balustrade, suffered some cracks in their hexagonal ceramic tiles as well as separations in their mortar joints. The joints have been repaired, but the tiles have not. The accompanying photographs show both of these effects as well as showing the building that lost roof tiles.

The Imperial Palace, enlarged by Emperor Wing Lo (1403-1425) from Kublai Khan's original structures and remodeled several times by the Ch'ing emperors, was very strongly built. Pillars, beams, and rafters were assembled with exact mortise-and-tenon joints; stone blocks, balustrade, and bricks were bound with a mortar proven for its binding efficiency and permanency. That a well-designed building employing up-to-standard binding agents for shear wall assembly and construction may play a part in limiting earthquake damage is best illustrated here.

According to Chinese legend, the mortar used as a binding agent in the best stone and brick structures was a thick glue made from cooked glutinous rice. Professor Chou Nei-hsien (Highways and Highway Engineering, Tung Chi University, Shanghai) stated that glutinous rice soup was the chief ingredient of the mortar although lime and other minerals were possibly employed also. He added that both the lid of a stone vault encasing a burial casket and the mortise joint of a headstone attached to a stone slab foundation were sealed with the rice-soup mortar. The recent archaeological excavation of old tombs and mausoleums has verified the binding strength of this mortar. Professor Chou is planning to conduct experiments to determine exactly the mortar's ingredients and their proportions.

Some Chinese scientists believe that the soil formation and subterranean topography of Beijing played a role in attenuating the seismic waves from the Tangshan earthquake, protecting the palace from serious damage.
Building A

Roof tiles have been replaced.
Pavilion B

Note cracked tiles.
Pavilion C. Note cracked tiles and repaired joints. Tiles are 9 cm on a side.