# CHAPTER V

# EXPERIMENT INVESTIGATION OF PROTOTYPE RICE BIN

## 5.1 Test Equipment and Instrumentation.

According to the theory, the horizontal radial deflections of the top cone were very small if being compared to the accuracy of the dial gages used but they were still measured in the experiment. Four dial gages were arranged to measure the deflection at each direction of formwork shown in Fig. (22). The dial gages were attached at 158.84, 172.76, 186.68 and 200.6 centimeters from the top ring girder along the wall of the top cone. The formwork for attaching the dial gages was shown in Fig. (27a)

Strains at various positions along the generators of the top and bottom cones in both longitudinal and circumferential directions were measured by electrical strain gauges. At each position, the strains in both directions in two distinct fibers were measured, i.e., on the outer, inner surface and in the skeletal reinforcements of the upper cone, and on the inner surface and in the skeletal reinforcements of the bottom cone. The strains at 117.09, 144.92, 158.84, 172.76, 186.68 and 200.6 centimeters from the top ring girder along the generator of the top cone and strains at 14.49, 28.98, 43.47, 57.96 and 72.45 centimeters from the bottom ring girder along the generator of the bottom

cone were measured. The positions of gauges were shown in Fig. (23). The sticking strain gauges in skeletal bamboo as shown in Fig. (19) and a general view of test set-up as shown in Fig. (29)

## 5.2 Testing Procedure.

The bin was tested under the loading of water at the age of 21 days. All the dial gage and strain gauge reading were first recorded when the bin was empty. The water was then loaded into the bin. The increment of the load were $\frac{17.4}{100}$, $\frac{1}{3}$, $\frac{2}{3}$ and 1 of the full load, i.e., when the bin was full of water. All the readings were recorded at every step of the loading. Reading was also recorded when the bin was unloaded which was the same way the loading was done. The bin was tested by loading and unloading with water up to two cycles. All the two cycles, the dial gages and demec strain gauges were used to measure horizontal radial deflections and strains at various positions.

## 5.3 Experimental Results.

Experimental results of horizontal radial deflections at position (a), (b) and (c) were shown in Table (14a), (14b) and (14c) respectively and experimental results of stresses in longitudinal and circumferential direction at inner fiber,

outer fiber and skeletal bamboo were shown in Table (15a) (15b), (15c) and (15d) (15e) respectively. Comparative results of horizontal radial deflection curves at position (a) (b) and (c) were plotted in Figs. (30a) and (30b) by theoretical and experimental results and experimental results of horizontal radial deflection curves of various loading at position (a), (b) and (c) were shown in Figs. (31a), (31b) and (31c) respectively. Finally, comparative results of stresses in longitudinal and circumferential direction at inner fiber, outer fiber and skeletal bamboo were shown in Figs (32), (33) and (34) respectively.

## 5.4 Cost of Prototype Rice Bin.

The labour and material costs used in the construction of the experimental prototype rice bin were given in Table. (16). The labour cost amounts to only 65.31 percent of the material cost or 39.51 percent of the total cost. The cheap item are the bamboo skeletal and bamboo fiber mesh the costs of which were 6.85 percent and 14.28 percent of the total material cost respectively.

## 5.5 Discussions.

Theoretical curve of horizontal radial deflection at position $y/y_2 = 1.00$ had moved into the center of rotation

of the bin but the experimental curve of full loading at the same position had not moved while the rebound full loading had slightly moved into the center of rotation of the bin, this is the result of the friction between the outer fiber of bottom cone and the surface of rigid pavement foundation see Fig. (30).

The horizontal radial deflection revealed by the experiment was higher than the horizontal radial deflection stated in the analysis about 52 percent, owing to the bond stress between the bamboo fibers and the mortar was not confirm stiffly but the assumption of analysis where the bamboo fibers were firmly bonded to the mortar and the deflection of bamboo should be high see Fig. (30).

The theoretical distributions of stress resultants and horizontal radial deflection based on the material properties in Table (5) due to the loading of water were shown in Figs. (7) and (8). The measured value of the horizontal deflection was so small when being compared to the accuracy of the dial gages and the errors caused by the wind effect. Due to these effects, the measured deflections were not reliable and could not be compared to the theoretical results but the direction of curves were similar.

The strains measured by electrical strain gauges at various positions along the top and bottom cones were also

not reliable. Results obtained in each cycle of loading were entirely different from each other. The answers to this happening were that, first, the accuracy of the strain indicator could not predict the number of up to 5 digits, second, the strain gauges were leaking due to the inadequate coating of the gauges. Only the gauges on the outer surface of the top cone are not leaking but the strain reading of these gauges were very small and inconsistant, third, it was the effect of the surrounding such as the wind. When the bin was nearly full of water in the second cycle of loading, leakages were found at the outside vicinity of the bottom ring girder due to the high pressure of water loading.

Assumption of soil foundation below the rice bin:

(1) Soil is frictionless soil.

(2) Neglecting active earth pressure acting on the foundation of the rice bin.

(3) Contact pressure is uniform.