CHAPTER I

INTRODUCTION

1.1 Statement of Problems.

Owing to the lack of permanent grain storage structures, the loss of rice paddy due to insects, birds, fungi attack and spillage is considerable ranging from 10 to 20 percent. In Thailand alone, with the annual production of rice crop at 16 million tons, the loss would represent up to 3.2 million tons of paddy value at 8000 million baht at the internal market price. At present this loss is a serious matter and must be reduced. According to a fundamental requirement of permanent grain storage structures for rice, the ideal bin must be able to protect its content from atmospheric moisture and insects. Cracks were found in various improperly designed reinforced concrete rice bins, allowing insects and moisture to spoil the grain inside the bin. To minimize these losses, hermetically sealed bins made of ferrocement which is crackproof are introduced. But it is not economic. Beside steel and wire mesh of ferrocement rice bin were difficult to obtained in some areas of Thailand. The solution of this problem is to ultilized the low-cost construction materials and to change the origin design concepts of the construction of low-cost grain storage structures.

1.2 Literature Review.

Kramer (1944) conducted an investigation of rice bins and mentioned that a survey of a few existing bins revealed many mistakes made in their original construction due to the lack of available design data.

Ross and Waller (1968) had suggested a type of cylindrical reinforced concrete bin for farmers to store their harvest. This bin, having vertical walls, requires some form of vertical surface against which the cement mortar may be plastered, and also requires shuttering for the roof construction

Smith and Boon-Long (1970) designed a conical rice bin with a bowl-shaped base made of ferrocement with no longer needs such temporary supports during construction and the water-tight wall can be made in one thickness of construction. The experimental prototype bin reinforced with steel pipes and topped by a steel cap gave satisfactory results through 4 years storage test peroid.

Kanoknukulchai (1973) suggested a cheaper design which eliminates the steel pipes in the wall and replaces the steel cap with a ferrocement cap, making use of the mechanical properties of ferrocement suggested by Raisinghani (1972). This design consists of a ferrocement conical bin of 3.5 tons capacity, reinforced by ring girders at the top opening and at the junction of the conical wall and the inverted conical base. The weight of the ferrocement cap is light enough for manual handling and the requirements for air-tightness and loading are preserved.

Siridanupath (1974) had investigated the construction techniques and taken field measurements of deflections and strains of a conical ferrocement rice bin constructed at the Asian Institute of Technology. He observed that the bin underwent very small deformations but cracks and leakage in the bin occured due to an inadequate compaction and a big loss of moisture content of mortar during construction. He also suggested some improvements for the construction technique of the bin.

1.3 Purpose of Research.

The purpose of the present investigation is to find the reinforcement material to substitute steel reinforcement in the permanent grain storage structures owing to the fact that steel is frequently scarce, costly and difficult to get in some areas. Bamboo, one of the most common materials available in most parts of Thailand, may be proved to be a good substitute for steel because of its high tensile strength and is also the low-cost construction material.

1.4 Scope of Research.

The scope of the present research is to study the construction techniques and the behavior of a modified conical rice bin of a 3.5 ton capacity of that analysed by Kanoknukulchai (16) when it is subjected to the water loading. The experimental bin was constructed at the site at Chulalongkorn University. The horizontal radial deflections and strains in both longitudinal and circum-ferential directions at various positions along the bin wall were measured by dial gages and electrical resistance strain gages respectively. The stress resultant distributions of the bin were determined by the measured strains by the technique discussed in Appendix - C and compared to the theoretical values. Bin loads were compared between water loading and grain loading in Appendix - A. The mechanical properties of bamboo and mortar were determined by tests for use in the design.