p = 2 (mod 4) then G is not edge graceful. \hspace{1cm} (4)

Two conjectures standing since 1986 are that

Conjecture (Lee [8]): The Lo condition (2) is sufficient for a connected graph to be edge-graceful.

Conjecture (Lee [3]): All odd-order trees are edge-graceful.

However, many connected graphs such as cycles, trees (except K_{2}) and unicyclic graphs satisfy the condition (1) but not edge-magic. Finding the edge-graceful and edge-magic labelings of graphs are related to solving linear Diophantine equations. The complexity of these labeling problems based on the fact that there is no efficient way to solve these equations. Several classes of graphs had been shown to be edge-graceful or edge-magic ([2, 3, 4, 5, 6, 10, 11]). Many of the conjectures and results are fairly elementary to state despite their mathematical depth. For more conjectures on edge-magic graphs, the reader is referred to [4] and conjectures on edge-graceful graphs the reader is referred to [8]. In 1992 the first author proposed the following conjecture

**Conjecture.** For a graph G with p vertices and p edges, its total graph T(G) is edge-magic if and only if p is odd and edge-graceful if and only if p is even.

We shall now give the exact definition of the total graph.

Recall that the total graph of G = (V(G), E(G)) is the graph T(G) with V(T(G)) = V(G) \cup E(G) and E(T(G)) = E(G) \cup \{(u, v), u : (u, v) \in E(G) and u \in V\}. (Figure 2)

![Diagram](image)

Figure 2

The purpose of the present paper is to show that the conjecture is true for cycles.

2. **Edge-gracefulness of T(C_n) where n is even.**

We see that for the cycle C_n, the total graph T(C_n) has 2n vertices and 3n edges. For simplicity we present T(C_n) as follows (Figure 3):

![Diagram](image)

Figure 3

C_n

T(C_n)