CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Bridge is structure build carrying a road, railway, valley with a purpose of providing passage to cross over the obstacle. The structure spans horizontally between supports, whose function to carry vertical load with two supports holding up a beam. There are many different bridge design which all serve a different purpose and applicable in different situation. Bridge design different depend on the function of the bridge, the condition of the nature where bridge to be constructed, material used, and funds available to build it.

Bridges categorized in several different ways. Bridge classified by how the tension, compression, shear, bending and torsion are distributed through the structure. There are five common type of bridge. The first type of bridge is beam and girder type. Beam bridges are horizontal beams supported at each end by pier or abutment. The beam is simply supported when the beams only connect with a single spans, and continuous when the beams are connected with two or more spans. The bridge must be capable to resist twisting and bending under load. Under load, the beam's top surface is under compression while the bottom edge is stretched or placed under tension. The main beam could be I-section beam, trusses or box-girder. Box girder beam gives better resistance to torsion compared to I-section beam.

The second type of bridge is arch bridge. Arch bridges are characterized by their elegant forms that are supported by the abutment at each end as a curved arch. The load of an arch bridge is carried along the curve of the arch to the supports at each end.
Supports called abutment at either end transferred the weight and carried the load and hold the end of the bridge. These supports carry the load of entire bridge and responsible on holding the arch in the unmoving position. The structure is rigid and strong because of the weight pushes the surrounding rocks down and outward. The greater the degree of curvature, the greater the tension act at the bottom of the bridge. Arch bridges are commonly built with reinforced concrete that lowers the construction cost. A disadvantage of arch bridges is that number of materials required is higher than other type of bridge, even if the span is short.

Next is truss bridge. Truss is a configuration of triangular units composed structure connected at joints called the nodes. Slender and straight triangular unit form a truss. There are two structure design of truss that is space frame and planar frame. Space frame are truss attain 3-dimensional form while planar frame has a 2-dimensional design. Truss bridge is a load-bearing bridge superstructure that consists of truss. The triangular webs located between the long horizontal chords prevent the chords from flexing and bending. Truss can be analysis using the application of Newton's laws of motion according to the branch of physics known as static. Pin joint are point where the truss straight component meet. Truss bridge supported by the abutments at either end. There are many design used for truss bridge construction. The design is different on the configuration of the truss such a Howe truss, Pratt Truss, and Bailey truss. The disadvantages of the truss bridges are lack of aesthetic appeal and high construction cost.

Another type of bridge is suspension bridge. Suspension bridge consists of deck that is suspended from a steel wire cable that connected between the towers. The strength of the suspension bridge is very strong because of the cable. Their design is pleasing to the eye, and because of its suspension, the bridge is suitable for use in a range of lengths. Bridges that are more complex in design than the other types of bridges are the same and are more expensive to build. When built in soft ground, suspension bridges require extensive and expensive foundation work to combat the effects of the heavy load on foundation towers. The disadvantage is when suspension bridge is heavy, concentrated loads are involved.
The last common type of bridge is cable bridges. A cable-stayed bridge is a bridge design that uses large steel cables suspended from high towers or poles to support the bridge deck. The towers are the primary load-bearing structures that transmit the bridge loads to the ground. The tower of a cable-stayed bridge is responsible for reacting to the compressional forces. The cables attach to the roadway to support the span of the bridge. The cables are in tension while the deck is in compression. The advantage of cable bridges is the spans are self-anchoring therefore no need for anchorages to support strong horizontal forces. The construction cost is less than suspension bridges for a given span. Less steel cable required and they are faster to build.

Cable stayed bridge can be classified into two categories that is conventional and unconventional. Conventional cable stayed bridge is describe as the common type of cable stayed bridge used. Standard cable stayed and extradosed bridges are the conventional design used on the cable bridges construction. Extradosed bridges describe as the mix of the girder bridge and the cable-stayed bridge. The decks are supported by the tower of the deck act as a continuous beam. The cable stays act as pre-stressing cables for a concrete deck, whether made with I-beam or box girder. Extradosed bridges are very expensive and material not very efficient. Extradosed bridges show that more variation of cable bridges can be design with more efficiency.

The used of tendon are basic on the cable bridge design with conventional type bridge tendon are located above the deck. When the tendons are situated within the deck and inside the concrete cross-section, the case is referred as the bridge with internal pre-stressing. When tendons are within the deck but outside cross-section, the case describe as bridge with external pre-stressing. Conventional bridges are when the tendon are outside the cross section and above the deck. From this classification, there are new alternatives to the two types of conventional bridge emerge that is when new configuration of tendon location are propose. The tendon may locate below the deck, or both above and below the deck. This new classification scheme is categories as the unconventional bridges.