CHAPTER I

INTRODUCTION

1.1 Background

Bridge is a structure build over a river, road or railway as over pass to allow people and vehicles to cross from one side to the other. Other definition of the bridge is a structure build to span physical obstacles without closing the way underneath such as a body of water, valley or road, for the purpose of providing passage over the obstacle. There are many different designs that each design serve a particular purpose and apply to different situations. Design of bridges very depending on the function of the bridge, the nature of the terrain where the bridge is constructed and anchored, the material used to make it, and the funds available to build it.

Beginning with the simple bridge, consist of a horizontal beam supported at each end by piers, and only use for relatively short span, as shown in Figure 1.1., bridge have develop progressively. Numerous types of modern bridge which can be used for long span across the strait of the sea has been developed. Some of those bridges are described as follows:

Figure 1.1. Simple bridge beam, a basic concept of the bridge.

Arch Bridge

An **arch bridge** is a bridge with abutments at each end shaped as a curved arch. Arch bridges work by transferring the weight of the bridge and its loads partially into a horizontal thrust restrained by the abutments at either side. A viaduct (a long bridge) may be made from a series of arches, although other more economical structures are typically used today [1]. Type of arch bridge is shown in Figure 1.2.

Figure 1.2. Alexander Hamilton Bridge, an open-spandrel arch bridge (Source [1])

Suspension Bidge

A **suspension bridge** is a type of bridge in which the deck (the load-bearing portion) is hung below suspension cables on vertical suspenders. The first modern examples of this type of bridge were built in the early 1800s. [2,3] Simple suspension bridges, which lack vertical suspenders, have a long history in many mountainous parts of the world.

This type of bridge has cables suspended between towers, plus vertical *suspender cables* that carry the weight of the deck below, upon which traffic crosses. This arrangement allows the deck to be level or to arc upward for additional

clearance. Like other suspension bridge types, this type often is constructed without falsework.

The suspension cables must be anchored at each end of the bridge, since any load applied to the bridge is transformed into a tension in these main cables. The main cables continue beyond the pillars to deck-level supports, and further continue to connections with anchors in the ground. The roadway is supported by vertical suspender cables or rods, called hangers. In some circumstances, the towers may sit on a bluff or canyon edge where the road may proceed directly to the main span, otherwise the bridge will usually have two smaller spans, running between either pair of pillars and the highway, which may be supported by suspender cables or may use a truss bridge to make this connection. In the latter case there will be very little arc in the outboard main cables. Type of suspension bridge is given in Figure 1.3.

Figure 1.3. Suspension bridge, Akashi Kaikyō Bridge in Japan (Source [4])

Truss Bridge

A **truss bridge** is a bridge whose load-bearing superstructure is composed of a truss, a structure of connected elements usually forming triangular units. The connected elements (typically straight) may be stressed from tension, compression, or sometimes both in response to dynamic loads. Truss bridges are one of the oldest

types of modern bridges. The basic types of truss bridges shown in this article have simple designs which could be easily analyzed by 19th and early 20th-century engineers. A truss bridge is economical construct because it uses materials efficiently. [5]. Illustration of truss bridge is shown in Figure 1.4.

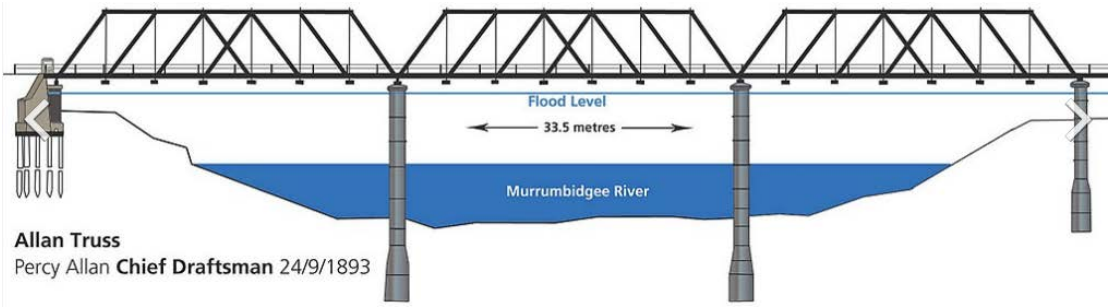

Figure 1.4. Illustration of truss bridge (Source [5])

Cable-stayed bridge

A **cable-stayed bridge** has one or more *towers* (or *pylons*), from which cablessupport the bridge deck. A distinctive feature are the cables, which run directly from the tower to the deck, normally forming a fan-like pattern or a series of parallel lines. This is in contrast to the modern suspension bridge, where the cables supporting the deck are suspended vertically from the main cable, anchored at both ends of the bridge and running between the towers. The cable-stayed bridge is optimal for spans longer than cantilever bridges and shorter than suspension bridges. This is the range where cantilever bridges would rapidly grow heavier if the span were lengthened, while suspension bridge cabling would not be more economical if the span were shortened.

Cable-stayed bridges have been known since the 16th century and used widely since the 19th. Early examples often combined features from both the cable-stayed and suspension designs, including the famous Brooklyn Bridge. The design fell from favor through the 20th century as larger gaps were bridged using pure suspension designs, and shorter ones using various systems built of reinforced concrete. It once again rose to prominence in the later 20th century when the combination of new materials, larger construction machinery, and the need to replace

older bridges all lowered the relative price of these designs.[6]. The type of cable-styaed bridge is shown in Figure 1.5.

Figure 1.5. Cable-stayed bridge in Boston's Leonard P. Zakim Bunker Hill Memorial Bridge at dusk (Source [7])

In this final assignment the superstructure of middle span of Suramadu bridge which is also constructed using cable-stayed will be re-analyzed.

1.2 Problem Limitation

The final assignment is limited to analyze the middle part or middle span the upper structure of Suramadu bridge using data of earlier traffic volume and local environment condition.

1.3 The Objective of the Study

From the above background and problem statement, the objective of this final assignment is to analyze the cable-stayed of the Suramadu bridge.

1.4 Scope of the Study

To accomplish those objectives, this study started with a literature review of the information pertaining to design and calculation of Cable-Stayed Bridge. Literature review then will be followed by methodology. In the chapter of methodology, dimension of pylon, cable, anchor will be determined. Bridge structure calculation will be given in Chapter 4, while the results will be given and discuss in chapter five.