

Abstract

This project was the location, design and construction of a pedestrian suspension bridge in rural Africa. The bridge was designed to overcome community inaccessibility to travel due to a river that separates two areas. This leads to a challenge for residents to access medical services, commerce and education. The hazardous flooding conditions make it difficult for residents to cross the river and has resulted in injuries and deaths in previous years. The presence of the bridge prevents exposure of residents to hazardous incidents due to seasonal flooding that makes crossings treacherous. The bridge was designed and built approximately three meters above the high flood stage of the river. The completion of this bridge will lead to improvements in the economy and overall well-being of residents.

The following parts of the bridge were designed: anchor, approach, saddle, foundation, tiers, tower, handrail cable, fencing, decking, crossbeam and walkway cable. The permanent loads to consider when designing a bridge are those that always remain constant over the life of the bridge, such as the weight of the structure itself. The most significant to consider is dead load (DL). For the suspended cable bridge, a predetermined 1.0 kilonewtons per meter was established as a safe assumption, considering suspenders, fencing, and a one 1-meter-wide walkway. The span of the bridge was calculated to be approximately 47 meters. The difference in height is 1.12 meters, which is a value below the 4 percent of the Bridge span length. The provided survey of the terrain indicated that the left side of the terrain was significantly lower than the right terrain. Therefore, the design of the Bridge was created with consideration of this elevation difference to achieve the four percent (4%) change in height parameter. To fulfill this requirement, the tower on the left side had to be designed with the foundation, three (3) tiers, and the tower was designed to the maximum possible height. The tower on the right had to be designed with the foundation, the tower, with only one (1) tier in order to create it to the minimum possible height. Thus, the four percent (4%) height difference based on the span length was achieved.

The students worked with faculty and two design engineers to complete the design of the bridge. The importance considerations were:

- Safety
- Durability.
- Serviceability.
- Maintainability.
- Constructability.
- Economy.
- Aesthetics

The project provides the opportunity for a group of civil engineering majors to work together with civil, environmental and geomatics engineering faculty, practicing professional consulting engineers involved in the structural and geotechnical fields, volunteers, on site workers, and field staff working across two continents. The students worked with faculty staff, people in Africa and people traveling to Africa to secure the necessary information to facilitate the design. These included a structural engineer in Colorado, field staff in Africa, local construction, and logistics persons. Students did not travel due to covid restrictions.

The safety of all the workers on site, and the pedestrians who desire to utilize the bridge after construction, was the primary focus during the construction phase of the bridge. Lastly, the students participated in a cross-cultural competency module designed to provide an understanding of the cultural barriers and social customs that would be encountered. The bridge was actually constructed late last summer.