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## An ergonomic analysis of tricycle sidecars in Quezon City

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### Abstract

Tricycles are considered one of the most popular modes of transportation in the Philippines, due to their accessibility and capability to drop off passengers at almost any point. However, passengers that ride in the tricycle sidecar are subject to awkward postures and motions that cause discomfort, according to different surveys. The aim of this research was to use different methods of ergonomic assessment to evaluate the factors that contribute to discomfort of passengers during 3 phases: while entering, riding, and exiting a tricycle. Multivariate analysis and logistic regression were used to determine the correlation between anthropometric measurements and the perception of discomfort, while RULA and REBA were used to provide postural analysis. 95 samples of anthropometric data were taken, along with surveys regarding the presence of discomfort during the 3 study phases. The results show that the two statistically significant factors in predicting discomfort were sitting height and popliteal height. The regression model also predicts a high probability of discomfort for passengers with average and above average anthropometric measurements, during all 3 study phases. However, passengers during ingress and egress motion had higher of experiencing discomfort than those riding inside the sidecar. The postural analysis further strengthens this result, as the ingress and egress motion scored 11 for REBA, concluding that the motions were high-risk and needed change immediately.

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## 1. Introduction

In the Philippines, there are numerous forms of public transportation that normal commuters can use on a daily basis. These range from small type vehicles to the larger types that can accommodate a greater amount of people at a particular time. All around the country, these modes of transportation are frequently seen along roads, and they serve as the primary form of getting from one place to another.

The tricycle is one of the most commonly used modes of transportation in the Philippines. Its structure is composed of a motorcycle connected to a sidecar which serves as the cabin for the commuters who will be riding the vehicle. Due to its small size, structure and capability to drop passengers off at specific points, it is one of the most preferred vehicles of passengers [1]. Unlike the jeep or taxi however, the tricycle can only serve a limited amount of people at a time and the distance it can travel is limited depending on the location of the tricycle itself. Along with this fact, there have been some issues concerning riding tricycles, especially the discomfort passengers are subject to when riding in the sidecar.

Surveys have been conducted regarding the overall safety and comfort rate of tricycles, and the results convey that majority of passengers are not satisfied with their tricycle ride experience due to discomfort. A majority of these passengers have been known to use the tricycle as a last resort due to the discomfort it brings, along with other factors that will be further discussed in the study. [1] In Quezon City, considered as one of the most populated areas in Metro Manila, tricycles can be seen around every corner, serving and accommodating the commuters in the different municipalities and barangays. Ergonomic analysis could determine the factors that affect discomfort, and could provide scientific basis for changes in tricycle design to create a more comfortable experience for passengers.

## 2. Problem statement

Passengers using the tricycle transportation system in Quezon City are exposed to awkward postures and have difficulties in embarking and disembarking which may lead to injuries coming from prolonged exposure to unnecessary strain. (See Table 3)

## 3. Significance of the study

The tricycle is one of the most commonly used public transportation modes in the Philippines. People from different social strata use the tricycle on multiple occasions per day at most. Due to its popularity, it is important to create an ergonomic assessment of different tricycle designs. According to recent surveys conducted by the group itself and from various sources surrounding the topic, majority of the commuters complain about the overall ride comfort and experience when riding a tricycle. [1] (See Table 3) Therefore, the safety and comfort of the passengers should be assessed in order to prevent injuries from prolonged exposure to awkward postures and cramped conditions. Recommendations for the improvement of the tricycle design would lead to a more comfortable and safer experience for the passengers.

## 4. Scope and limitations

The study is limited to Tricycles in Quezon City, Philippines alone. Only the sidecars of the Tricycles were measured and analyzed. Only the anthropometric data of people who rides the tricycle were measured.

## 5. Review of related literature

In a study based in the island of Siquijor in the Philippines, the tricycle was rated the second-lowest preference for modes of public transportation when comfort and safety were the deciding parameters. In addition to this, 17% of those who took a survey stated that the only reason they rode the tricycle was that it was the only public transportation mode available. However, 53% preferred the tricycle as a mode of transportation because it has the capability to bring the passenger closest to the desired destination. [1] Since the demand for tricycle operation is

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