Abstract: - Priority intersections are intersections controlled by a stop or yield sign. A turning vehicle from a minor road at a priority intersection makes a choice to either accept or reject an available gap when joining the main road. Various factors affect the driver’s decision when deciding on the type of gap to accept or reject at the priority intersection. The driver’s characteristics, vehicle characteristics and intersection characteristics play a major role in the driver’s behavior at the intersection. Factors such as the driver’s age, gender, waiting time, intersection delay and the vehicles’ accelerating capability affects the decision to accept or reject a gap. This research discusses various gap acceptance strategies at priority intersections and develops a research framework for gap acceptance in developing countries, such as Ghana, Africa.

Key-Words: - Priority intersections, driver behavior, critical gaps, stop-controlled intersections, traffic operations, logit and probit model.

1 Introduction

1.0 Background and Motivation

Human (driver) behavior on transportation networks always plays a major role in the flow of traffic. Transportation planning research shows that driver behavior on a transportation network can either cripple or enable the effective flow of vehicles in the network; therefore researchers attempt to predict the driver’s behavior in a network. The driver’s behavior in a network depends on various factors associated with an individual driver and the network. The factors associated with the driver’s behavior on the network range from gap acceptance, driver perception, driver reaction, car following behavior, travel choices, and others. An essential part of predicting the effective flow of vehicles on a network is the relationship between the driver’s behavior and the acceptable and/or available gap. Golias and Kanellaidis [6] stated that most accidents that are caused on collector, urban and rural roadways, are due to the lack of a driver’s understanding of the relationship between the acceptable gap and the driver’s behavior.

Transportation planners and engineers in the past decade have conducted much research on gap acceptance, travel time and travel choices, as well as optimizing signals on arterial roadways to determine the relationship between the acceptable gap and the driver’s behavior on a
transportation road network. However, less effort has been spent on the relationship between driver behavior and gap acceptance at priority intersections. Priority intersections can be defined as intersections that are controlled by a stop or yield sign, or a flashing beacon.

There are three main types of vehicular intersection control that direct the movement of traffic at an intersection. They can be classified as: Intersections controlled by traffic signals, Intersections controlled by signs (Unsignalized intersections), and Uncontrolled intersections. Intersections controlled by signs (i.e., stop or yield signs) have been proven to be the most complex type of intersection to analyze [11]. The geometry of unsignalized intersections range from T-intersection (three-legged) to cross intersections (four-legged) to multi-legged intersections. The most complicated intersection to analyze is the multi-legged.

This research will focus on gap acceptance and driver behavior at T-intersections (unsignalized intersections). The research will determine the gap acceptance for vehicles on the minor roadways and the choices involved with the driver’s decision to accept the gap. The driver’s gap acceptance and behavior at an unsignalized intersection plays an important role in determining how an intersection operates. A driver approaching an intersection on a minor road onto the major road must make a decision on when to join, cross or merge into the roadway. The available gap between two vehicles on the main road is an important factor for the driver and must determine if the gap is sufficient to accept. An illustration of an available gap is shown in Figure 1.1. Various factors that affect the driver’s decision to accept or reject a gap are as follows: driver’s characteristics, such as level of education and level of familiarity with an area, the ability to estimate a vehicle’s speed for oncoming traffic, condition of traffic, the type of vehicles, types of gaps, such as lead gap, lag gap, and front gap, environmental conditions, driver-inter influence, size of queue behind the driver, the number of vehicles entering the gap, and its distance.

The most difficult gap to accept at unsignalized intersections is when left turning vehicles from minor road are turning onto major road (see Figure 1.2). In Fig. 1.2, movement number three (3) is the most difficult movement to complete; gaps for this movement tend to be difficult to accept, as the driver has to consider conflicting traffic movement from both directions on the major road. Movements two (2) is the least difficult since the driver only need to worry about the oncoming traffic eastbound traffic from the major road and safely merge.

Traditional methods used to evaluate delay and capacity at intersections mainly used the concept of gap acceptance. Simulation studies on arterials and intersections have incorporated parameters describing the gap acceptance of merging, crossing and joining vehicles on roadways. However, studies in the past have focused on the time gap concept and seldom incorporated the relationship between the driver’s behavior and the gaps available on the roadway. Researchers have found the relationship between the driver’s behavior and the gap accepted or rejected as being extremely difficult to understand and model due to drivers having different personal characteristics and attributes.

![Fig. 1.2: Traffic Movement at a T-Intersection](image-url)
The gap between successive vehicles in developed countries (e.g., United States of America) has historically been studied and researched at unsignalized intersections. However, little research has been conducted on gaps between vehicles at intersections in Ghana, yet traffic analysis programs built to suit a developed country’s conditions are often used to analyze intersections in Ghana. Engineers and planners in Ghana fail to build programs suited for the specific traffic conditions in the country due to resource constraints.

This research will analyze gaps and driver behavior at T-intersections, specifically left and right turning vehicles from minor streets onto major streets, in five major cities in Ghana. Secondly, the research will determine if the use of programs developed from the western world should be used in Ghana. The research will focus on the following: the method of selecting priority intersections to conduct the gap study, interviewing drivers at the selected intersections, determining the critical and accepted gap as well as developing a model to further understand the relationship between the gap acceptance and the driver behavior. The research will also compare values from the developed model (i.e., critical gap and accepted gap) to similar intersection values in the USA, aaSIDRA, HCS and Synchro.

1.2 Research Goals and Objectives
The objectives of this research, are as follows:
1. To create and develop a model suitable for priority intersections in Ghana and other developing countries.
2. To determine the critical gap, gaps accepted and gaps rejected at Two Way Stop Controlled (TWSC) intersections in five major cities in Ghana.
3. To compare critical gap results from the research with that of the critical gap results obtained from the Highway Capacity Manual (HCM) and other simulating programs.
4. To use the data collected to help understand the relationship between driver behavior and gap acceptance in Ghana and other developing countries, to determine if the default gap values in simulation programs can be used.
5. To analyze intersections in Ghana and other developing countries.
6. To use the results collected from the research.
7. To determine if Ghana and other developing countries must develop specific simulation programs designed to suit the countries’ transportation needs.

Some of the factors not considered in the research are as follows: factors related to delay on a minor or major street, factors related to the detail geometrical design of the intersection, factors related to drivers' psychological and socio-economic status, factors related to weather, pavement and light conditions, the in-vehicle environment of the driver, and factors related to the presence of passengers in the vehicle. These factors were not considered in this research because it would have either complicated the research goals or did not have a significant impact on the driver’s decision to accept or reject a gap. Data for the research will be collected during off-peak hours in the AM, PM and midday when weather conditions are ideal (i.e., dry pavement) with unrestricted sight distance.

2 Literature Review

2.0 Introduction
The gap acceptance concept has been studied for decades and cross referenced with other related research studies, such as traffic signalization, traffic signal optimization, and delay studies. This section gives an overview of various gap acceptance studies conducted in various countries, methods and transportation models used to conduct the study and other transportation studies related to the behavior of drivers at unsignalized intersections.

2.1 Gap Acceptance and Driver Behavior

It should also be noted that the research is limited to the relationship between driver behavior and gap acceptance at T-intersections for left and right turning vehicles at priority intersections from the minor road onto the major road (gaps for movements two (2) and three (3) in Figure 1.2). It also aims to determine the factors that affect a driver’s decision to accept or reject a gap and how it relates to the driver’s behavior at the intersection. Gaps will be collected on the major road (i.e., left turning vehicle from the major road onto the minor road in Figure 1.2). The scope of this research related to the factors that affect the driver’s decision to accept or reject a gap is as follows: factors related to driver’s gender and age, factors related to the acceleration capability of the turning vehicle, factors related to gap size, opposing traffic flow, presence of a following vehicle, speed and type of opposing vehicles, factors related to the type and condition of the vehicle, factors related to the distance of travel and travel time of the trip, and factors related to the type of passengers in the car.
probability of a gap being accepted or rejected (see, Eq. (1)). Other studies have used a fixed critical gap for each vehicle, which varied over a population size as described in Eq. (2).

\[
P(i|C_n) = Pr[U_{in} \geq U_{jn}, \forall j \in C_n, j \neq i] \quad (1)
\]

where:
- \(P(i|C_n)\) = The probability of choosing alternative i out of a complete set of alternatives.
- \(C_n\) = The set of alternatives available to individual n.
- \(U_{in}\) = The utility of alternative i to an individual n.

\[
P(t) = \frac{1}{\beta(t)} \times \left(\frac{t-a}{\beta}\right)^{k-1} \times e^{\left(\frac{t-a}{\beta}\right)} \quad (2)
\]

where:
- \(P(t)\) = probability density function of headway (t).
- \(a\) and \(\beta\) = location and scale parameters.
- \(K\) = parameter that determines the shape of the distribution.

Researchers again have used the utility maximization principle, originated from the choice theory, to obtain the probability of a gap occurring as described in Eq. (3).

\[
C_{p,i} = \frac{3600}{t_m} \times e^{-\frac{t_o + \sum V_{c,j}}{3600}} \quad (3)
\]

where:
- \(C_{p,i}\) = potential capacity of minor movement i, in pcph
- \(V_{c,j}\) = Volume of traffic in conflicting stream j, in vph.
- \(t_o = t_g - \left[\frac{t_g}{2}\right]\).
- \(t_g\) = Critical acceptance gap, in seconds.
- \(t_m\) = move-up time, in seconds.

The concepts of gap acceptance at signalized intersections is somewhat similar to the concept of gap acceptance at unsignalized intersections. Researchers have used the Fuzzy Set Theory, developed by Lotfi A. Zadeh in 1965 to study drivers’ decisions to accept or reject a gap during a change interval at a signalized intersection. Studies performed in other areas of traffic engineering, based on the available headway and gaps, have been used to determine the effect gaps have on the delay and accidents at intersections. Traffic simulation studies performed on the gap acceptance concept focus on an individual’s choice (i.e., a driver’s choice or decision) rather than the actual gap available. In 1977 Ahworth and Bottom [2] studied driver’s behavior related to traffic conditions at uncontrolled intersections. Part of their study involved the driver’s variability by recording the driver’s behavior at a given location. In that study, thirty exponential drivers were used to determine the human factors that affect the driver’s gap acceptance behavior. The study concluded that under real-life conditions, the driver’s behavior varied significantly. The Ashworth and Bottom study on gap acceptance stated that “investigation between subject differences were restricted by incomplete data which resulted from factors such as the inability to interview observed drivers and the difficulty in relating driving behavior to indices of driving experience” [2]. In 2005, a study conducted on left runs at intersections [16] found a wide range of acceptable gaps from 3 seconds to 12 seconds even within the same intersection. The study also concluded that, the vast majority of gaps accepted by drivers appear to choose a sufficiently long gap for their left turns to avoid a collision or major conflict.

### 2.2 Factor Affecting Gap Acceptance and Driver Behavior

In the past years gap acceptance researchers have made an effort to investigate into factors that affect the driver’s decision to accept or reject a gap. The studies fail to be consistent with their conclusion which proves the complexity in the gap acceptance theory. Notable Gap acceptance studies that have been conducted are as following:

- Adebisi and Sama study in 1989 [1],
- Asworth and Botton in 1977 [2],
- Darzentas et al. in 1980 [4],
- Pant and Balakrishnan in 1994 [13],
- Israel Institute of Technology in January 2007 [17],
- Xuedong Yan, Essam Radwan, Dahai Guob, 2007 [18]

Various factors that were described in the listed studies mentioned above were as follows:

- driver’s age
- drivers gender
- presence of a passenger in the turning vehicle
- class of the turning vehicle
- type of opposing vehicle
- speed of the opposing vehicle
- opposing traffic volume
Researchers employ various techniques in studying the gap acceptance theory. Most studies conducted on this theory focus on the time gap acceptance or rejection. Little research has been conducted on the driver’s behavior at an intersection when he or she has to decide on when to accept or reject a gap. Very few studies have employed other contributing factors to the gap acceptance phenomenon. Despite the large number of research studies conducted on the gap acceptance phenomenon, there still remains a lack of understanding on the driver’s decision to accept or reject a gap.

2.3 Critical Gap

The critical gap of an individual driver is impossible to measure ([5], [6], [9], [10]). Research conducted by Hewit [10] showed that at most intersections, the observation of gaps will show only a range of values within which the critical gap falls, i.e., between the length of the gap he/she rejected and the length of the gap he/she eventually accepts ([9], [10]).

The 1985 HCM defined the critical gap as “the median time headway between two successive vehicles in the major street traffic stream that is accepted by drivers in a subjected movement that must cross and/or merge with the major street flow”. A few years later, the 1994 HCM defined the critical gap as “the minimum time interval between vehicles in a major traffic stream that permits side-street vehicles at a stopped controlled approach to enter the intersection under prevailing traffic and roadway conditions in seconds” [7]. However, the 2000 HCM defines the critical gap as “the minimum time between successive major street vehicles where minor street vehicles make a maneuver” [8]. The HCM also states that a particular driver will reject any gaps less than the critical gap. Although the HCM from previous years defines the critical gap in a specific way, other researchers have interpreted the critical gap concept and defined it in their own terms. Hewitt, Pant and Balakrishnan [10] defined the critical gap as “the time interval between two successive main road vehicles which the waiting driver at the minor road considers to be just adequate to allow him to execute his desired maneuver safely” ([10], [13]). Hewit, Pant and Balakrishnan [13] as well as Golas and Kanellaidis [6] stated that “Critical gap (by its nature) cannot be measured exactly”. They also stated that “a driver’s reaction to lags is different than his reaction to gaps” ([6], [10], [13]). “The gap size for which the number of drivers who accept the gap equals the number of drivers who reject” was the definition by Aston, Darzentas, Madanat et al., and Polus ([3], [4], [12] [14]). Greenshields in 1947 [22], defined critical gap as the gap that is accepted by a certain percent of drivers. Raff [21] defined the critical gap size at which the number of accepted gaps shorter than a particular gap, is equal to the number of rejected gaps longer than that gap. Thus, different researchers interpreted critical gap differently.

Critical gap was first formulated in the 1940’s. Its objective was to model gap acceptance by assuming that an individual driver will only accept a critical gap if it appears to be longer than his ideal projected critical gap. Figure 2.3 shows how Raff determined the critical gap. The critical gap from Figure 2.3 was determined by plotting two cumulative distribution curves on the same graph. One curve on the graph describes the accepted number of gaps shorter than a time interval and the other curve shows the rejected number of gaps longer than the time interval. The time at which the two curves intersected is how the value of the critical gap was determined by Raff in 1950 [21].

Figure 2.3: Distribution of Accepted, rejected Gaps and Lags at Intersections for Left Turning vehicles.

Source: Solberg and Oppenlander, 1996 [15]
3 Methodology

3.0 Introduction
The research focuses on gaps available for left and right turning vehicles from the minor street onto the major street at a TH intersection. Research shows that vehicles that cross the major street and vehicles that turn left onto the major street will accept gaps that are sufficient enough to enter the entire width of the roadway. Therefore, gaps for vehicles that crossed the major street were not included in the research because they are assumed to have a gap equal to or less than the gaps for the left turn onto the major road. Left turning vehicular gaps for vehicles from the major road onto the minor road were also not included in the research.

This research did not investigate all the factors that may affect the driver’s decision to either accept or reject a gap, but focused on the factors that are related to the Choice Theory described earlier.

3.1 Description of the Research Problem
Imagine a driver arriving at an intersection controlled by a stop or yield sign (priority intersection) observes a lag and identifies numerous gaps in the roadway. The driver evaluates the gaps on the main road giving his or her utility and make a choice on when to accept or reject the desired gap. Through the decision making process, numerous factors may affect the driver’s decision to accept the gap. Factors such as the environment, density of vehicles on the main road, number of available gaps, geometric conditions, age, sex and gender may affect the driver’s decision to accept or reject a gap. The process of accepting or rejecting a gap is considered to be a choice and cannot be treated as a uniform decision. This choice cannot be determined for each driver that arrives at the intersection. Hence, this decision is considered to be random as each driver may have their individual characteristics that may trigger the decision to accept or reject a gap. In other words, the characteristics of each driver vary. Due to the uncertainty of accepting and rejecting a gap, predicting the probability of driver’s decision to accept or reject a gap is the closest gap acceptance value that can be used for analysis purposes. The most important measurable factor that can influence the decision of accepting or rejecting a gap should be taken into consideration when predicting the probability of the driver’s decision. Drivers approaching a priority intersection will be forced to make a decision while at a decision making point while considering the attributes of available gap. The attributes of available gap may also influence the driver’s decision to accept or reject. This decision is guided mainly by two motives:
- To minimize the total travel time when entering the main road.
- To proceed as safely as possible onto the main road.

As the opposing flow rate on the main road increases, the two motives conflicts with each other, which makes the decision to accept or reject a gap difficult to understand. This process may lead to two different choice model forms:
- The choice among different available gaps.
- The choice to accept or reject the current gap.

This research is based on the decision of making a choice to accept or reject a gap. With the understanding of a driver’s gap acceptance behavior and the basic probabilistic discrete choice modeling concepts, the collected data is modeled using the binary choice process while incorporating the binary logit model. The model is based on the probability of accepting or rejecting a gap giving the utility offered by that gap.

3.2 Method of Collecting Accepted and Rejected Gaps
There are several methods in collecting the data required to analyze the number of accepted and rejected gaps. These methods have been employed in previous gap acceptance research studies. The methods include:
- Time-lapse photography (time motion pictures).
- Controlled field experiments.
- Closed circuit television or video camera.
- Event pen recorder actuated. (This is done by either an observer using a hand operated switch board or by road tubes/cables.)
- Laboratory driving simulation experiments.
- Laptop computer.

The method of choice to collect the data will be a combination of the closed circuit television or video camera and the event pen recorder.

3.3 Model Development

3.3.1 Proposed Model
Gap acceptance research has shown that accepting and rejecting a gap on a roadway is a choice made by each driver based on their individual characteristics. Various factors affect the choice of accepting or rejecting a gap. In 1985, Ben-Akavia and Lerman [20] described the choice of accepting or rejecting a gap in their research as
The utility to accept or reject a gap is not deterministic, but random and varies with a specific distribution as predicted using the utility of that exact gap. The probabilistic binary model (PBM) used in the Discrete Choice method is adopted in this research. The PBM is used where the probability of accepting a gap is predicted using the utility of that exact gap.

The principle of the utility maximization states that a driver assigns a subjective value known as the “utility” that reflects the attractiveness of a choice alternative in relation to its attributes. The utility of the alternative could be presented as a function of the attributes of the alternative and the decision maker’s (i.e. the driver) characteristics. It is always assumed that the driver chooses the alternative with the highest utility. The utility maximization theory states that, if the utility of accepting a gap is greater than the utility of rejecting that particular gap, the driver will always decide on accepting the gap and proceed into the roadway. Reversing this statement will yield the same result as, if the utility of rejecting a gap is greater than the utility of accepting that same gap, the driver will always choose to reject the gap rather than accepting.

The utility to accept or reject a gap is not deterministic, but random and varies with a specific distribution as vehicles approach the intersection. The individual’s choice is therefore a probabilistic choice from the set of alternatives available. The probability of choosing an alternative from the set of alternatives is equal to the alternative’s probability utility being greater than or equal to the other alternatives’ utilities.

Equation 4 shows the probability of choosing alternative (i).

\[ P(i | C_n) = \begin{cases} 
0, & \text{if } U_{in} < U_{jn} \\
1, & \text{if } U_{in} > U_{jn} \\
\frac{1}{2}, & \text{if } U_{in} = U_{jn} 
\end{cases} \]

where:

- \( P(i | C_n) \) = The probability of choosing alternative i out of a complete set of alternatives.
- \( C_n \) = The set of alternatives available to individual n.
- \( U_{in} \) = The utility of alternative i to an individual n.
- \( U_{jn} \) = The utility of alternative j to an individual n.

### 3.3.2 Binary Choice Model

The choice to either accept or reject a gap is known as a binary choice. In this research, the use of the binary choice model is incorporated to model the set of alternatives using the utility maximization theory. The utility maximization theory is employed when a driver is assumed to select an alternative from a set of alternative with the highest utility. Equation 4 shows the probability of chosen alternative i where the choice is denoted as \( C_n \): \{i,j\}.

Alternative i = Accept a specific gap.
Alternative j = Reject the gap that was not accepted from alternative i.

Therefore, the probability that a person (n) will chose an alternative (i) is expressed in Equation 5 and the probability that a person (n) will reject an alternative (j) is expressed in Eq. 6.

\[ P_n(i) = \Pr(U_{in} \geq U_{jn}) \]  \hspace{1cm} (5)

\[ P_n(j) = 1 - P_n(i) \]  \hspace{1cm} (6)

Therefore,

\[ P_n(i) = \Pr(U_{in} \geq U_{jn}) \]
\[ = \Pr(V_{in} + E_{in} \geq V_{jn} + E_{jn}) \]
\[ = \Pr(E_{in} - E_{jn} \leq V_{jn} - V_{in}) \]
\[ = \Pr(E_{n} \leq V_{jn} - V_{in}) \]

where:
- \( E_{in} = E_{jn} \)
- \( U_{in} = \) The utility of alternative i to an individual n.
- \( V_{in} = \) Deterministic components
- \( E_{in} = \) Random or disturbance component

Ben – Akiva and Lerman [20], in 1985, also stated that \( E_{in} \) can be assumed in two forms that produces different distributions.

- When the assumption is varied about the distribution of \( E_{in} \)
- When the assumption \( E_{in} \) is normally distributed, two conditions occur.
It forms a mathematical choice model different from the above described. At a point when \( E_n \) is uniformly distributed between two fixed values \(-L\) and \( L\), the mathematical distribution forms a linear probability. If this distribution occur, the probability that a person will choose an alternative \( i \) \( P_n(i) \) can be expressed in Eq. (7). The mathematical model is called a probit model which takes a form expressed in Eq. (8).

\[
P_n(i) = \begin{cases} 
0 & \text{if } V_{in} - V_{jn} < L \\
\frac{V_{in} - V_{jn} + L}{2L} & \text{for } -L \leq V_{in} - V_{jn} \leq L \\
1 & V_{in} - V_{jn} > L 
\end{cases}
\]

(7)

\[
P_n(i) = \Phi \left( \frac{V_{in} - V_{jn}}{\sigma} \right)
\]

(8)

where: 
\( \Phi \) = The standard cumulative normal distribution
\( 1/\sigma \) = The scale of the utility function which can be set to an arbitrary positive value.

The Logit Model originates from the assumption that \( E_n \) is logically distributed, which basically represents the Weibull distribution expressed in Eq. (9).

\[
P_n(i) = \frac{e^{V_{in}}}{e^{V_{in}} + e^{V_{in}}}
\]

(9)

However, \( V_{in} \) can be conveniently assumed to be a linear unknown parameter, where:

\[
V_{in} = \beta_1 X_{in1} + \beta_2 X_{in2} + \beta_3 X_{in3} + \beta_4 X_{in4} + \ldots + \beta_k X_{ink}
\]

and \( X_{in} \) are observed variables describing the attributes of the gap and the drivers characteristics. \( X_{in} \) can be generic or an alternative specific variable in the development of the model.

\( \beta_1, \beta_2, \beta_3, \beta_4, \ldots, \beta_k \) is a vector of \( k \) unknown parameters (coefficients) to be estimated. Researchers have used this assumption for nonlinear utility distribution functions, therefore it is not essential to use it for the development of the logit model.

Generic variables are the variables \( X_{ink} \) that appear in the utility function for all alternatives.

Alternative specific variables are variables \( X_{ink} \) that appear in the utility function for an alternative \( i \) and have all other values as zeros for the other alternatives. However, for an alternative \( J \), there can only be \( J - 1 \) alternative specific constant.

The logit model is used in this research because it is the most logical binary choice model for this research.

### 3.3.3 Binary Logit Model

The general form of the Binary Logit model can be expressed in Eq. (10). This equation is expressed in the form of an “event” and “non-event”. However, in the case of an accepted and rejected gap, Eq. (8) is revised to incorporate the choice of either accepting or rejecting. This is expressed in Eq. (11) and is known as the gap acceptance phenomenon equation.

\[
P_n(i) = \frac{e^{V_{in}}}{e^{V_{in}} + e^{V_{in}}}
\]

(10)

\[
P_n(i) = \frac{e^{V_{in}}}{1 + e^{V_{in}}}
\]

(11)

where:
\( V_{in} - \beta_1 X_{in1} + \beta_2 X_{in2} + \beta_3 X_{in3} + \beta_4 X_{in4} + \ldots + \beta_k X_{ink} \)

\( X_{ink} V_{in} \) is the deterministic part of the drivers' utility function with linear with unknown parameters.

\( X_{in} \) are the observed variables describing the attributes of the gap and the drivers characteristics. These can be a generic or alternate specific variables in the development of the model. These are also the values or scores of the \( k^{th} \) factor attribute which affect the acceptance of the gap.

\( \beta_1, \beta_2, \beta_3, \beta_4, \ldots, \beta_k \) is a vector of \( k \) unknown parameters (coefficients) to be estimated. It can be described as the weight of the \( K^{th} \) attribute. \( K \) is the factor that influences the driver’s gap decision.

The Binary logit model uses an iterative process. It is built using the following steps:

1. **Model Specification:**
   - An Assumption made regarding the model structure.
2. **Model Estimation:**
   - It can be accomplished using the NLOGIT sofware package.
3. **Model Calibration:**
   - The model is calibrated using formal and informal test methods to help narow the range of alternative models. The selected model will be based on the
model’s constant with the assumption from step 1 and the selected model that performs the best using the goodness of fit method and/or the statistical significance test.

4. Model Testing:
The selected model is tested to confirm its accuracy. tested using the Informal Test method to determine the sign (positive or negative) of the vector $\beta$.

5. Model Validation:
The model is validated using a percentage of the prescribed part.

The Binary logit model described above requires estimating the individual vector $\beta$. Calibrating the model is also known to estimate the vector $\beta$ using the software package NLOGIT or BLOGIT. The NLOGIT software package is used to estimate the data collected. The NLOGIT software package contains all of the discrete choice estimators.

The model is then tested using the Informal Test to determine the sign (positive or negative) of the vector $\beta$.

4 Conclusion and Future Works

4.0 Expected Results

The critical gap values obtained from the Adebisi, O. and Sama, G. N., [1] 1981 study conducted in Nigeria was based on two intersections and was for left turns only. The results of these critical gaps compared to the 1985 HCM left turn critical gaps were high. Recent research has proved that the driver behavior at priority intersections in developing countries has drastically changed over time and will continue to adapt to the changing transportation environment. Field observations from transportation research studies conducted in developing countries shows that driver’s react aggressively when entering the roadway from a minor road.

The data collection from Ghana sites will be conducted in the future. An analysis of the data is expected to yield critical gaps that may be lower than the 2010 HCM critical gaps. The data analysis is also expected to identify aggressive driver behavior.

References:


