# Intelligent Analysis of Weather-Induced Auto-Crashes and Sustainable Management Strategies in the Global South: A Case of Makurdi Metropolis

Adeke Paul Terkumbur[1,2*], Mohamed Mostafa Hassan Mostafa[1], Dillip Kumar Das[1], Terver Stephen Agagbe[2]

[*]lead presenter: paul.adeke@uam.edu.ng

[1] Sustainable Transportation Research Group, University of KwaZulu-Natal, Durba, South Africa.
[2] Department of Civil Engineering, Joseph Sarwuan Tarka University, Makurdi, Nigeria.

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## Background

Weather-induced road traffic accidents represent a critical public health and transportation challenge in low- and middle-income countries, particularly in the Global South. Weather conditions significantly influence traffic safety, with research showing that precipitation, temperature, visibility, and other atmospheric factors can substantially increase both the frequency and severity of crashes. Beyond natural weather parameters, Nigeria's road safety landscape is often characterized by poor pavement conditions, reckless driving, risky passengership behaviour, and weak enforcement of traffic regulations, similar to other Global South nations, making it particularly vulnerable to weather-related impacts. Makurdi Metropolis, located in Benue State in Nigeria's middle belt region, experiences distinct seasonal variations, including pronounced rainy seasons that coincide with increased traffic volumes, creating compounded safety risks. Understanding these weather-crash relationships is therefore essential for developing context-specific interventions that address both immediate safety concerns and underlying infrastructure vulnerabilities, based on available datasets. Consequently, the need for data-driven decision-making to enhance urban mobility safety under changing climatic conditions cannot be overemphasized

## Aim

This study aims to analyse weather-induced auto-crashes in urban areas of the Global South, considering the case of Makurdi metropolis - Nigeria, using machine learning (ML) techniques. Objectives of the study include;

- To examine historic data on weather conditions and major causes of road traffic accidents in Makurdi metropolis
- To classify weather-induced auto-crashes using random forest (RF) and decision tree (DT) algorithms, and
- To propose an effective and sustainable policy framework for road traffic management that can mitigate weather-induced auto-crashes in the Global South.

## Method

A sample size of 400 was estimated from a population of 10,000 registered vehicles in Makurdi metropolis. A self-structured questionnaire was randomly administered face-to-face to the motorists for data collection. The ML algorithms were used to investigate motorists' travel behaviour and perception of weather-induced auto-crashes.

## Results

Demographic characteristics of respondents were examined using descriptive statistics – frequencies, means and standard deviation. Due to its robust analytical strength, performance metrics of the RF (94.23%) outperformed the DT (91.23%), with both models identifying sunny and rainy weather conditions as the major causes of weather-induced auto-crashes in Makurdi ***(Data Analysis ongoing)***

## Conclusions

A policy framework for effective and sustainable urban mobility to mitigate weather-induced auto crashes was developed for Makurdi and other metropolitan areas with similar weather conditions and traffic characteristics in the Global South.