

# **Assessing Commuters' Perceptions of Road Safety Regulations and the Effectiveness of Enforcement Strategies in Benue State, Nigeria**

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# THE DISPROPORTIONATE TOLL OF RAPID MOTORIZATION

The Global South faces a severe asymmetry between vehicle ownership and road traffic fatalities.

## GLOBAL SOUTH PARADOX

**93%**  
OF GLOBAL FATALITIES

**40%**  
OF GLOBAL  
VEHICLES

**1.19 MILLION**

Global Fatalities annually

**50 MILLION**

Serious Injuries worldwide



Vulnerable Commuters: Pedestrians, motorcyclists, and cyclists bear the highest risk.

# ROAD TRAFFIC FATALITIES: A GLOBAL SOUTH CRISIS

**93%**

## of Fatalities in the Global South

The Global South accounts for 1.19 million annual road traffic fatalities, despite possessing only 40% of the world's vehicles.

## Rapid Motorization in Nigeria

As Africa's most populous nation, rapid urbanization and motorization are drastically outpacing the enforcement of traffic regulations.

## Socio-Economic Toll in Benue State

Weak institutional enforcement and human behavioral factors are driving an escalating rate of preventable fatalities.

**Aim:** To assess commuter perception, compliance, and enforcement effectiveness in Benue State.

## APPRAISE

Identify the common causes of road traffic crashes within the state.

## EXAMINE

Evaluate commuters' perception and their actual level of compliance with existing traffic regulations.

## CLASSIFY

Deploy Machine Learning techniques (Decision Tree, Random Forest, and K-Nearest Neighbor) to decode human behavioral attributes and enforcement perceptions.

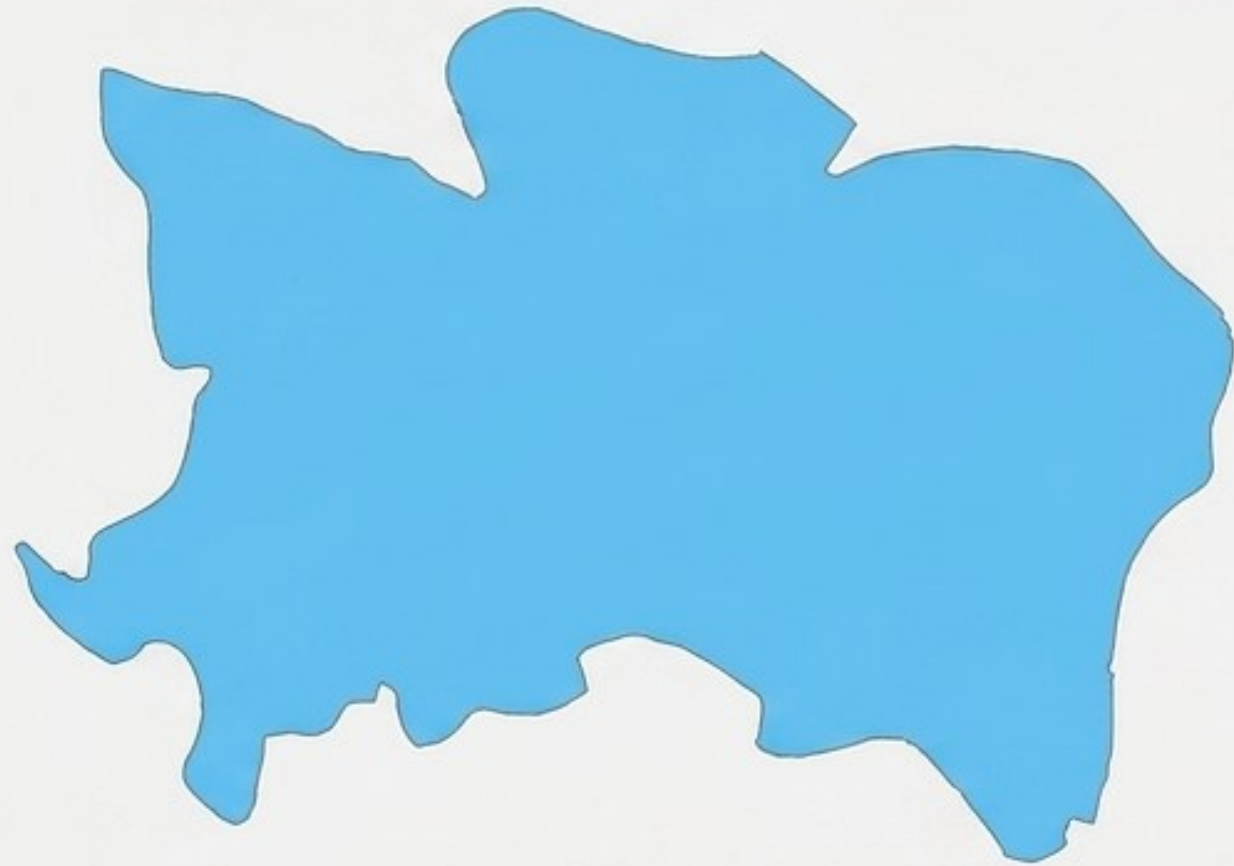
## CORRELATE

Statistically link commuter perceptions with the reality of safety regulations to pinpoint the root of non-compliance.

# ANCHORING THE DIAGNOSTIC IN BENUE STATE

Nigeria, Africa's most populous nation, is the epicenter of the continent's rapid urbanization and motorization challenges. Benue State serves as a critical micro-environment to analyze the intersection of agricultural commerce, human resource development, and traffic system failures.





### Input (The Sample)

400 Commuters surveyed. Representative sample drawn from a population of 6.14 million using the Taro Yamane formula (5% significance level).



### Survey (The Variables)

Captured socio-demographics, driving experience, crash history, and perceptions of safety enforcement.



### Analysis Engine (Models)

Descriptive statistics merged with advanced Machine Learning Classifiers: Random Forest (RF), Decision Tree (DT), and K-Nearest Neighbor (KNN).

# RISK PROFILE: THE VULNERABLE DRIVER DEMOGRAPHIC

The road transport system is heavily dominated by a demographic highly prone to aggressive, risk-taking behaviors, significantly increasing crash susceptibility.

## VULNERABLE DRIVER PROFILE

**81.75%**  
MALE DOMINANCE



**75%**  
ECONOMICALLY ACTIVE  
AGE (16-45)

**HIGH SUSCEPTIBILITY TO AGGRESSIVE DRIVING & SPEEDING**

Underage representation (< 16 years): 3.0%

Overage representation (> 60 years): 4.5%

## Who is driving?



**75% Active Age**  
(16 – 45 years)

**Male-Dominated**  
(Females constitute  
only 18.25%)

**Insight:** The system is dominated by young males, a demographic globally correlated with aggressive driving and risk-taking behavior.

## What do they know?

**91.25%**

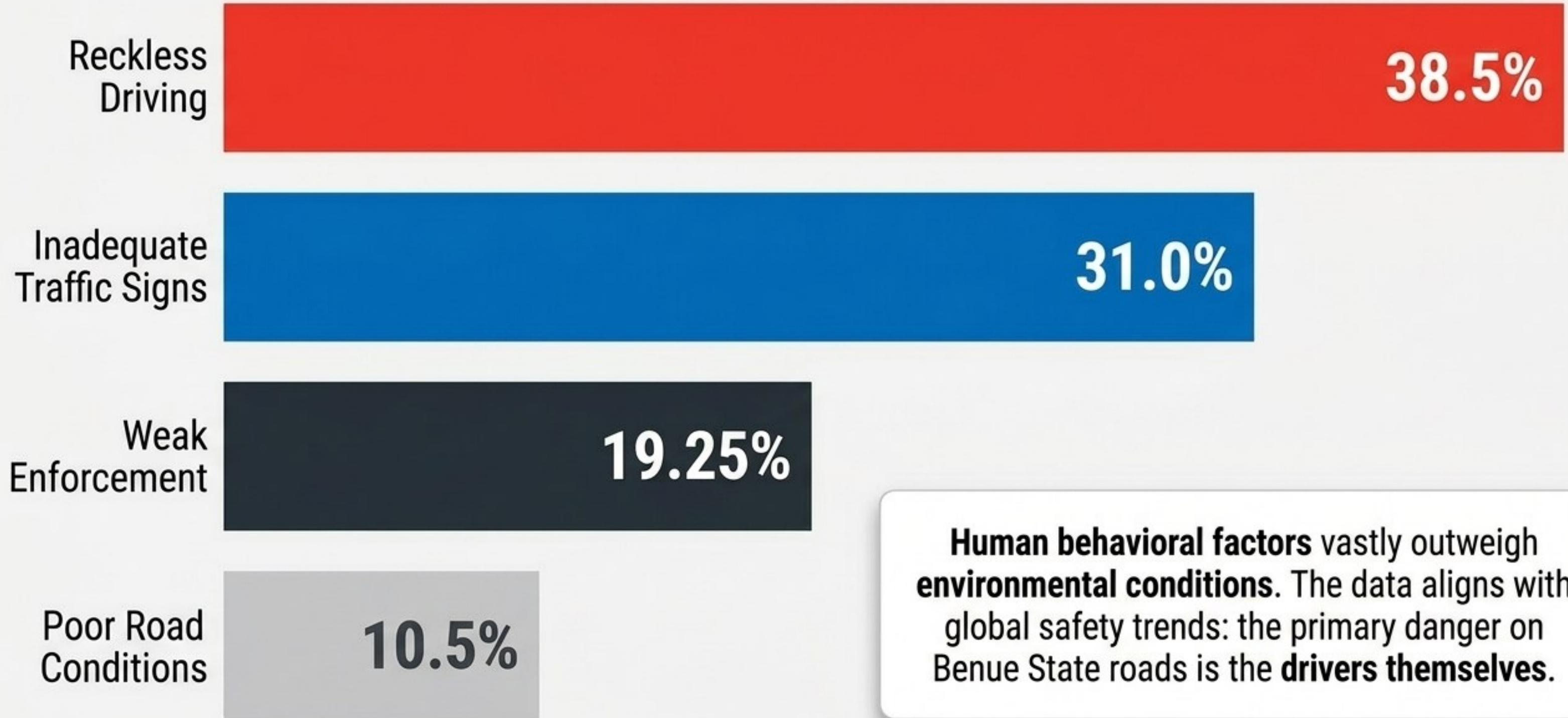
possess formal education and valid driving licenses. High awareness of traffic rules exists.

**7.75%**

are entirely unlicensed, creating a persistent hazard of high-severity crashes.

**Dashboard Insight:** Knowledge alone does not guarantee compliance. Awareness is high, but behavioral risk remains prevalent.

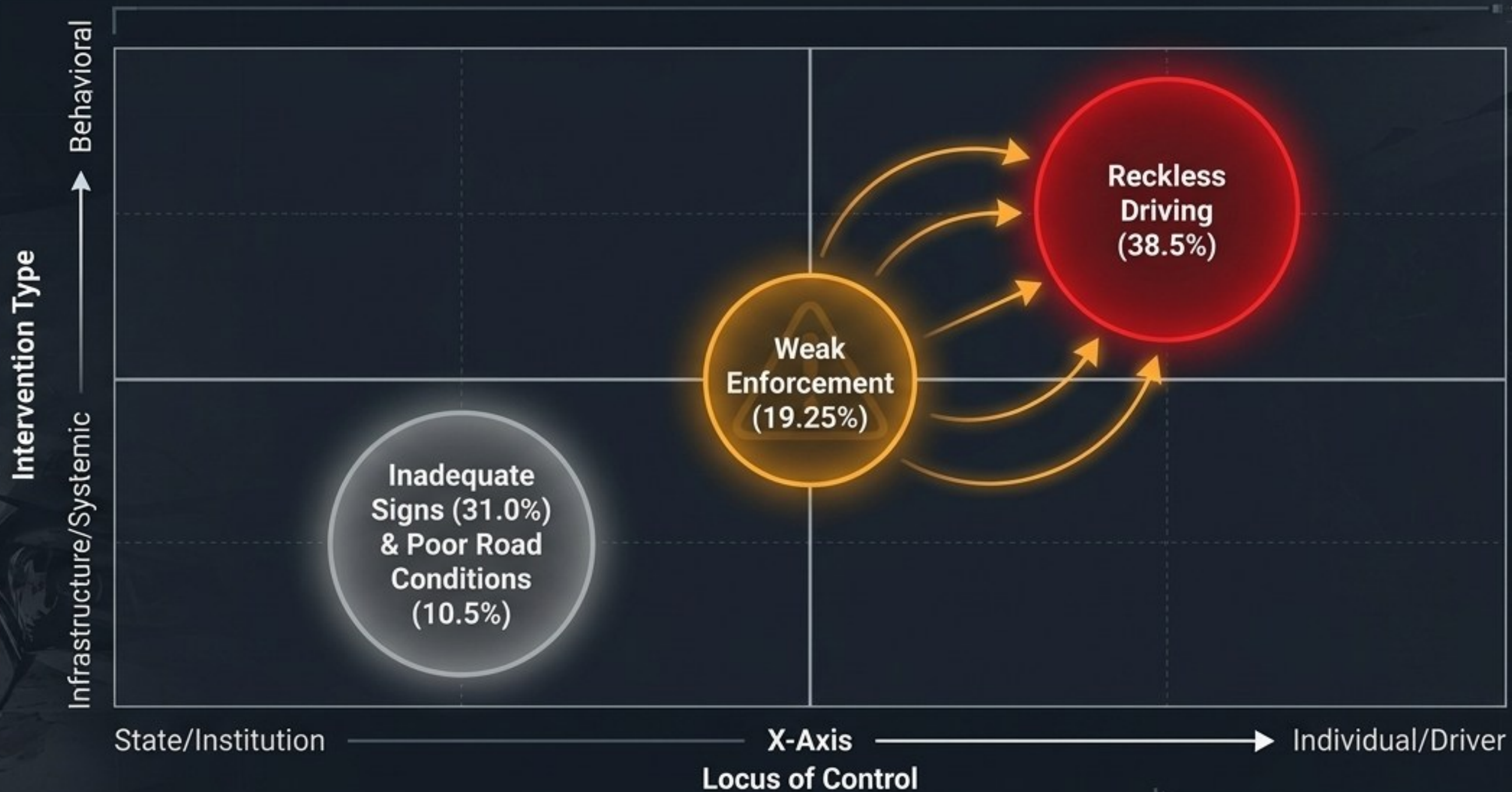
# The Root of the Crisis: Commuter Perceptions



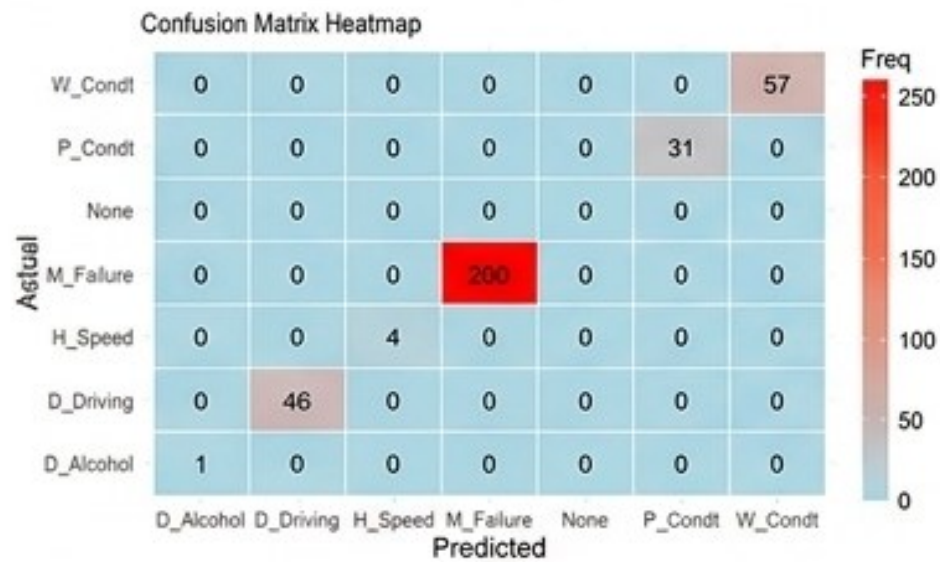
**Human behavioral factors** vastly outweigh **environmental conditions**. The data aligns with global safety trends: the primary danger on Benue State roads is the **drivers themselves**.

# THE ROAD CRASH ATTRACTORS MATRIX

Evaluating the root causes through the dual lenses of locus of control and intervention type reveals that the **highest-impact interventions must target human behavior through systemic enforcement.**



# Decoding Behavior: Machine Learning Performance

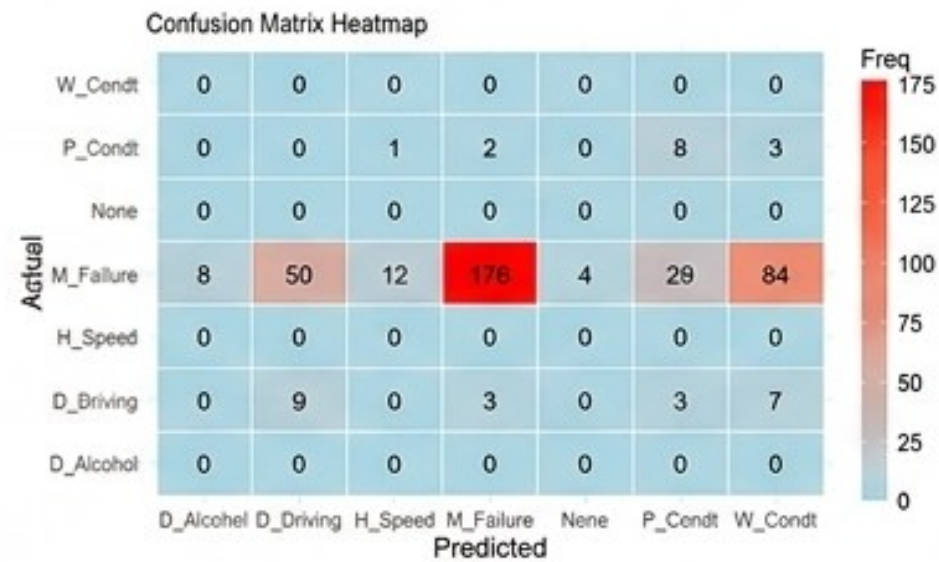


Random Forest (RF)

100% (RMSE: 0.00)

**Verdict: Overfitted**

Perfect diagonal entry on the training data, but highly susceptible to overfitting on small, imbalanced datasets. Fails to capture real-world human nuance.

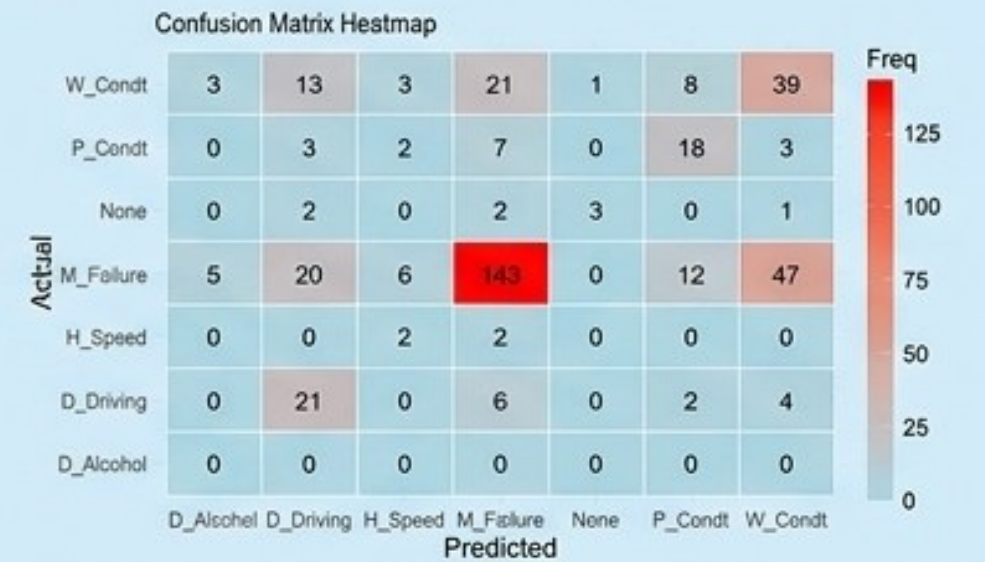


Decision Tree (DT)

46% - 48% (RMSE: 1.88)

**Verdict: Underperformed**

Mixed classification events. Failed to achieve above-average predictive reliability for complex commuter behaviors.



K-Nearest Neighbor (KNN)

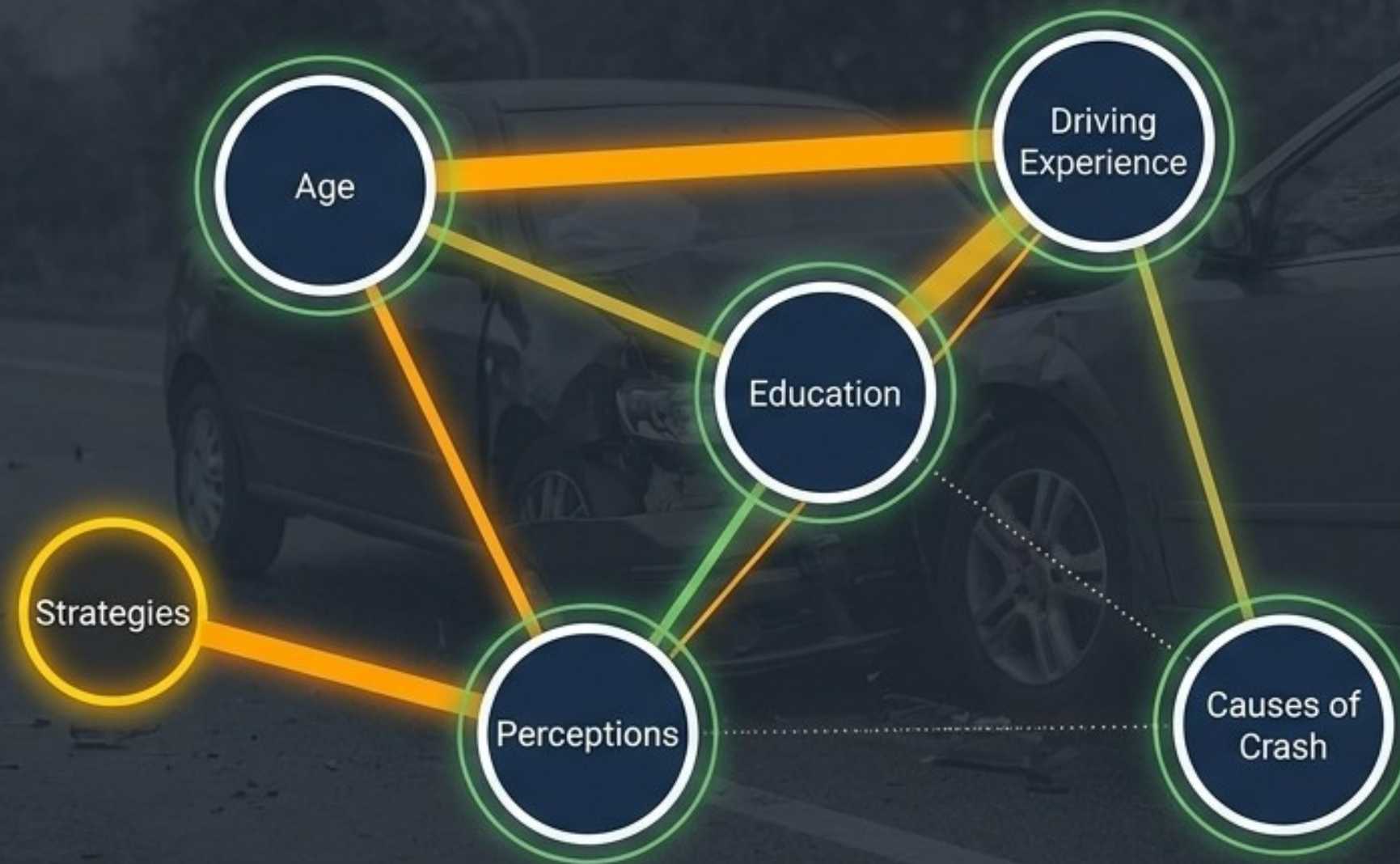
56% - 64% (RMSE: 1.31 - 1.97)

**Verdict: Realistic & Optimal**

Effectively handles overlapping boundaries in social and behavioral datasets. The moderate accuracy reflects the dynamic, non-uniform reality of human compliance.

# Variables in Motion: Mapping Driver Behavior

Correlation analysis reveals the invisible tethers connecting commuter demographics to physical road safety outcomes.

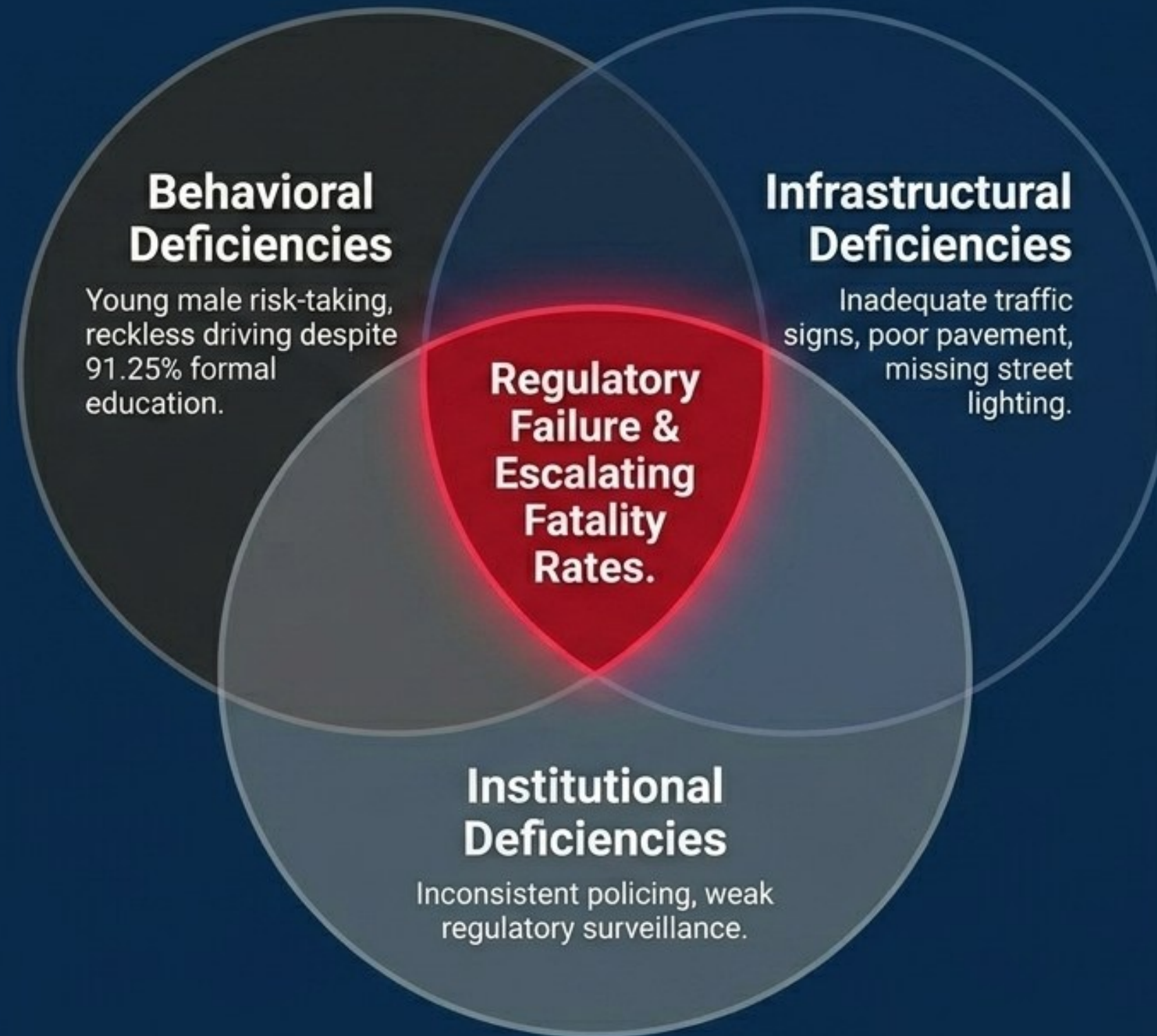


## Key Insight:

Thicker lines = stronger correlation.

Note the negligible link between education and crash causes, reinforcing the compliance paradox.

# The Tripartite Failure Model





The Commuter Profile shows 91.25% are educated and licensed. Basic awareness already exists.

The Systemic Gap. Enforcement is perceived as highly inconsistent (32.75%), rendering driver knowledge useless.

Dashboard Insight: Road traffic crashes in Benue State are not an education problem; they are an interconnected behavioral and institutional failure.

# Commuters prefer stricter enforcement over passive awareness.

The data reveals a strong public preference for institutional control, giving policymakers a direct mandate to act. **Correlation analysis (0.51) confirms that an effective road safety culture shapes public acceptance of rigorous interventions.**



## Strict Enforcement

Highlighted as the primary demand to curb reckless driving.



## Better Traffic Signs

The leading infrastructural request.



## Enhanced Infrastructure

Foundational improvements to complement behavioral control.

# Conclusion



## The Limits of Awareness

Although the vast majority of commuters are educated and licensed, the persistence of reckless driving proves that awareness alone fails without active, visible enforcement.



## The Root Mechanism

Crashes in Benue State stem from a dangerous intersection of aggressive human behavioral factors (speeding, distraction) and severe institutional deficiencies.



## The Algorithmic Reality

Machine Learning validation (specifically KNN) proves that driver compliance is socially and behaviorally dynamic, requiring nuanced, localized intervention strategies rather than generic policies.

# Recommendations: A Systems-Based Approach

## STRENGTHEN

(Institutional)



Deploy regular monitoring, improved surveillance technologies, and strict, consistent penalties to immediately target reckless driving behaviors.

## UPGRADE

(Infrastructural)



Systematically install adequate **traffic signs**, intersection controls, and street lighting, paired with regular pavement maintenance.

## EDUCATE

(Behavioral)



Transition from basic licensing to **continuous**, targeted **driver education programs** designed to shift local commuter culture toward safety compliance.

# Thank You

Open for Data-Driven Policy Discussions

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