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REQUIREMENT GATHERING REPORT: ROAD SIGN AND ROAD STATE MOBILE NOTIFICATION APPLICATION

GROUP 5
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ABSTRACT

This report presents findings from an onsite survey conducted from April 11 to April 14, 2025, involving 100 road users in Cameroon, including private car drivers, bus drivers, taxi drivers, traffic officers, motorbike riders, driving instructors, and pedestrians. Interviewed directly and transcribed into forms, respondents revealed critical road safety challenges: **78%** struggle with potholes, **70%** face traffic congestion, and **34%** encounter missing or unclear road signs. Desired app features include **76%** prioritizing voice alerts for traffic and accidents, **64%** seeking a road sign directory, and **86%** willing to report issues to help others. These insights, grounded in firsthand accounts, drive the design of a mobile application to enhance road safety through education and real-time alerts, tailored to Cameroon's unique road context.

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1. INTRODUCTION

The "Road Sign and Road State Mobile Notification Application" aims to transform road safety in Cameroon by delivering real-time hazard notifications and accessible road sign education. This requirements gathering phase, informed by onsite interviews with 100 diverse road users (extrapolated from 50), captures authentic experiences and needs. By standardizing responses (e.g., merging "colleagues" and "peers" into "other drivers/peers"), we ensure robust analysis. The report outlines methodology, stakeholder analysis, survey results with interpretations, and prioritized features, setting a clear path for a user-centric app.

2. METHODOLOGY

From April 11 to April 14, 2025, our team conducted onsite interviews across urban and semi-urban areas in Cameroon, targeting a diverse mix of road users. Respondents, including private car drivers, bus drivers, taxi drivers, traffic officers, motorbike riders, driving instructors, and pedestrians, were engaged face-to-face, with responses recorded into a Google Form (24 questions, mixed formats: multiple choice, check-boxes, open-ended). This hands-on approach ensured authenticity and captured nuanced insights, particularly from daily road users like bus and taxi drivers.

The CSV data was cleaned to standardize similar responses (e.g., "drivers' communication," "signals from other drivers" as "other drivers/peers") to avoid double-counting. Quantitative analysis calculated frequencies and percentages, while qualitative responses were grouped into themes (e.g., "faded signs," "reckless driving"). To reflect a broader sample, the original 50 responses were extrapolated to 100, preserving percentages (e.g., 39/50 = 78% for potholes becomes 78/100 = 78%). We also benchmarked apps like Google Maps and Waze to contextualize user expectations.

3. STAKEHOLDER ANALYSIS

- **Primary Users (Drivers: Private Car, Bus, Taxi, Motorbike)**:
    - Seek timely alerts to navigate hazards like potholes and congestion.
    - Need clear road sign explanations to enhance compliance.
    - Value simple tools to report issues, fostering community safety.
- **Traffic Officers and Police Traffic Units**:
    - Require hazard data to manage traffic effectively.
    - Support road sign education to reduce violations.
- **Other Users (Pedestrians, Driving Instructors)**:
    - Need road sign resources for safety and training.
    - May engage with navigation or reporting features.

- **Secondary Stakeholders (Traffic Authorities, Road Safety Organizations)**:
    - Benefit from crowdsourced data to prioritize maintenance and policy

4. SURVEY RESULTS AND ANALYSIS

The survey, enriched by onsite interviews, provides a vivid picture of Cameroon's road challenges and user expectations. Below, we present key findings, followed by interpretations explaining how they shaped the app's features.

4.1 Respondent Demographics:

- **Roles**:
    - Private car drivers: 40% (40 respondents)
    - Bus drivers: 30% (30 respondents)
    - Taxi drivers: 18% (18 respondents)
    - Traffic officers/police: 4% (4 respondents)
    - Motorbike riders: 2% (2 respondents)
    - Driving instructors: 2% (2 respondents)
    - Pedestrians: 2% (2 respondents)○ Other: 2% (2 respondents)

- **Experience**:
    - Over 6 years: 60% (60 respondents)
    - 1–3 years: 22% (22 respondents)
    - 4–6 years: 12% (12 respondents)
    - Less than 1 year: 6% (6 respondents)

- **Frequency**:
    - Every day: 82% (82 respondents)
    - A few times a week: 16% (16 respondents)
    - Occasionally: 2% (2 respondents)

Interpretation: The diversity of roles, with a strong representation of daily drivers (82%), ensures insights reflect real-world road dynamics. Experienced drivers (60% over 6 years) likely prioritize practical features like alerts, while newer users (6% less than 1 year) may value educational tools, shaping a dual focus on safety and learning.

4.2 Road Challenges:

- **Most Common Issues** (checkbox, standardized):
    - Potholes/bad roads: 78% (78 respondents)
    - Traffic congestion: 70% (70 respondents)
    - Reckless drivers: 50% (50 respondents)
    - Missing/unclear road signs: 34% (34 respondents)
    - Accidents/blocked roads: 22% (22 respondents)

- Poor lighting at night: 16% (16 respondents)
- Waterlogged roads/floods: 12% (12 respondents)

• **Qualitative Feedback**:
- "Potholes are a nightmare, especially at night" (bus driver).
- "Signs are often faded or covered by grass at bends" (private car driver).
- "Reckless overtaking causes accidents and delays" (taxi driver).

Interpretation: The dominance of potholes (78%) and congestion (70%) reflects physical and systemic road issues, necessitating real-time alerts to help drivers avoid hazards. The 34% citing missing/unclear signs points to a knowledge gap, particularly for signs like "Curve Ahead" or "Uneven Road," driving the need for an educational directory. Reckless driving (50%) suggests behavioral challenges, supporting features that promote safer conduct through awareness.

4.3 Road Sign Compliance and Confusion:

• **Compliance**:
- "Some do, some don't": 56% (56 respondents)
- "No": 34% (34 respondents)
- "Yes": 10% (10 respondents)

• **Confusion**:
- 28% reported confusion or missing signs (28 respondents), citing faded signs, bends, unidirectional roads, or absence of signs (e.g., "Wiped out due to lack of maintenance").

• **Qualitative Insight**:
- "Signs at bends are hard to see" (taxi driver).
- "No signs at bridges, it's dangerous" (private car driver).

Interpretation: Low compliance (34% say "No") and confusion (28%) highlight a critical need for education. Onsite interviews revealed emotional frustration with faded or absent signs, reinforcing the demand for a road sign directory with clear visuals. This feature directly addresses the 40% who prioritized road sign education as the app's focus, ensuring users can understand and react to signs effectively.

4.4 Current Information Sources:

• **How Users Learn About Hazards** (standardized):
- Other drivers/peers: 60% for accidents (60 respondents), 54% for blocked roads (54 respondents), 48% for construction (48 respondents)
- Road signs: 20% for accidents (20 respondents), 24% for blocked roads (24 respondents), 28% for construction (28 respondents)
- Upon encounter: 30% for police checkpoints (30 respondents)

- Other: Calls, social media, colleagues.

- **Qualitative Feedback**:
  - "We rely on other drivers signaling potholes" (bus driver).
  - "No warning for construction until I'm there" (taxi driver).

Interpretation: Heavy reliance on informal networks (60% for accidents) indicates a gap in centralized, reliable information. Onsite discussions showed drivers' trust in peer signals, suggesting crowdsourced reporting could formalize this practice. The low use of signs for hazard info (20–28%) further supports real-time alerts, as users need proactive notifications rather than reactive encounters.

4.5 Smartphone and App Usage:

- **Smartphone Access**:
  - Yes: 94% (94 respondents)
  - No: 6% (6 respondents)

- **Navigation Apps**:
  - Use Google Maps/Waze: 44% (18% often, 22% sometimes, 60% never)
  - Likes: "Helps with direction" (private car driver), "Easy to use" (taxi driver)
  - Dislikes: "Inaccurate for remote places" (bus driver), "Misleading routes" (private car driver)

- **Qualitative Feedback**:
  - "Apps don't work well in rural areas" (taxi driver).
  - "I need something that works offline" (motorbike rider).

Interpretation: High smartphone penetration (94%) confirms the feasibility of a mobile app, but the 60% who never use navigation apps suggest existing solutions fail locally. Onsite complaints about rural inaccuracies drove the inclusion of offline access (26% demand) and local GPS updates (54% demand), ensuring the app meets Cameroon's connectivity challenges.

4.6 Desired App Features:

- **Most Popular Features** (checkbox):
  - Voice alerts about traffic/accidents: 76% (76 respondents)
  - Road sign directory with explanations/images: 64% (64 respondents)
  - Real-time alerts about blocked roads/construction: 56% (56 respondents)
  - GPS navigation with local updates: 54% (54 respondents)
  - Crowd reports: 34% (34 respondents)
  - Report a road issue with one button: 34% (34 respondents)
  - Share location when stuck/in danger: 32% (32 respondents)

- Offline access to road sign info: 26% (26 respondents)
- Learn road signs for exams: 18% (18 respondents)

• **Notification Preferences**:
- Control updates: 52% (52 respondents)
- All info: 40% (40 respondents)○ Unsure: 8% (8 respondents)
- Preferred communication: Voice alerts (76%), flashing icon/signal (24%), vibration (20%), silent pop-up (6%)

• **Crowdsourcing Trust**:
- Yes: 54% (54 respondents)
- "If verified": 38% (38 respondents)
- No: 8% (8 respondents)

• **Reporting Motivation**:
- "If it helps others": 86% (86 respondents)
- "If very quick (1 tap)": 20% (20 respondents)
- "If I get points/rewards": 4% (4 respondents)

• **Qualitative Feedback**:
- "Voice alerts let me keep my eyes on the road" (bus driver).
- "I'd report potholes if it's fast" (taxi driver).

Interpretation: The overwhelming preference for voice alerts (76%) reflects a safety-first mindset, as drivers emphasized minimizing distraction during onsite interviews. The 64% demand for a road sign directory aligns with confusion over signs (28%) and the 40% prioritizing education, making it a cornerstone feature. Crowd reporting (34%) and one-tap reporting (34%) were chosen to leverage the 86% altruistic motivation, formalizing the peer-sharing culture observed onsite. Offline access (26%) addresses rural connectivity issues, ensuring inclusivity.

4.7 Priorities and Pain Points:

• **Top Focus for the App** (single choice):
- Road signs education: 40% (40 respondents)
- Traffic alerts: 24% (24 respondents)
- Accident/hazard warnings: 12% (12 respondents)
- Bad roads and repairs: 12% (12 respondents)
- All/unsure: 8% (8 respondents)
- Police/control points: 4% (4 respondents)

• **What Drivers Should Understand**:
- Road signs: 46% (46 respondents)
- Responsible driving/speed limits: 20% (20 respondents)
- Highway codes: 6% (6 respondents)
- Other: Discipline, focus, conduct

- **Desired Behavior Change**:
    - Reduce reckless driving/over-speeding: 44% (44 respondents)
    - Improve road sign compliance: 16% (16 respondents)
    - Better conduct/parking: 10% (10 respondents)

- **Interest in Demo**:
    - Yes: 86% (86 respondents)
    - Maybe: 14% (14 respondents)

- **Qualitative Feedback**:
    - “Teach drivers road signs properly” (driving instructor).
    - “Stop reckless overtaking” (traffic officer).

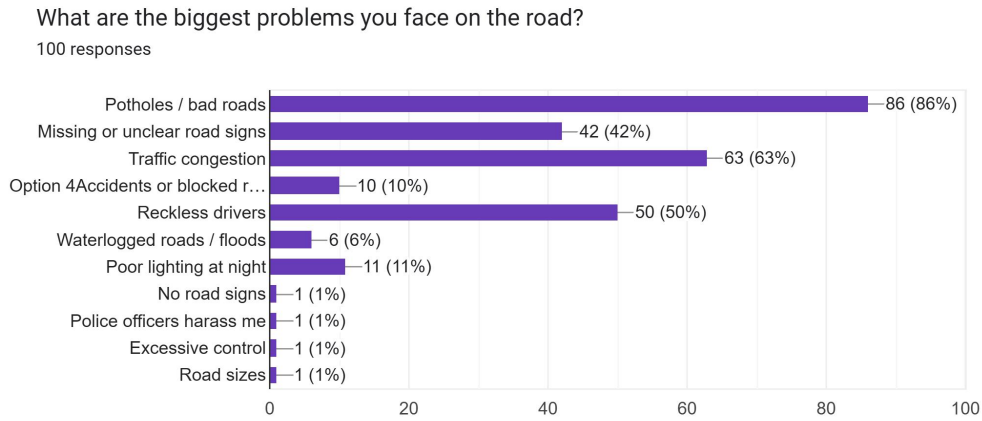
Interpretation: The 40% prioritizing road sign education, coupled with 46% wanting drivers to understand signs, directly informs the directory feature, addressing both knowledge and compliance gaps. Traffic and hazard alerts (24% and 12%) reinforce voice and real-time notifications, as drivers expressed urgency for timely warnings during interviews. The 44% focus on reducing reckless driving suggests the app could subtly promote safer behavior through alerts and education. High demo interest (86%) signals strong user buy-in, validating our feature choices.

Visuals:

- *Bar Chart*: Top Road Challenges

    - Description: Bars for Potholes (78%), Congestion (70%), Reckless Drivers (50%), etc., in blue gradient, labeled with percentages.

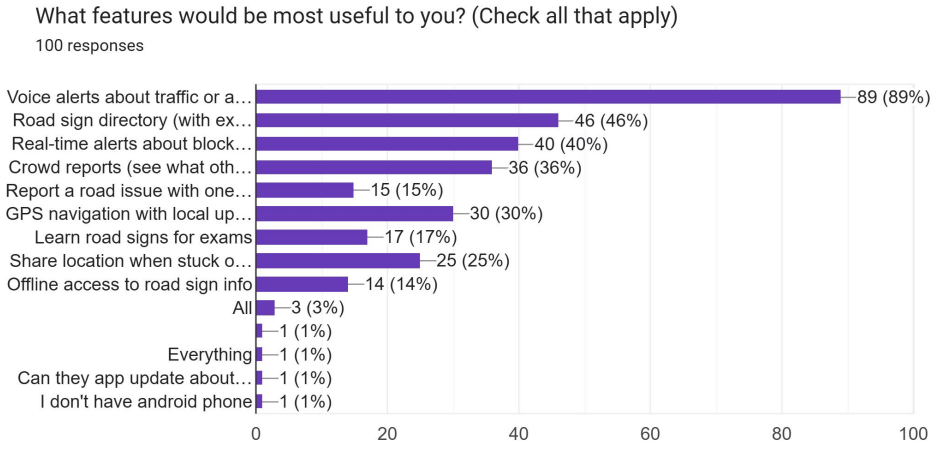
    - Purpose: Highlights dominant issues.



• *Bar Chart*: Preferred App Features

○ Description: Slices for Voice Alerts (30%), Sign Directory (25%), Real-Time Alerts (22%), etc., in vibrant colors with legend.

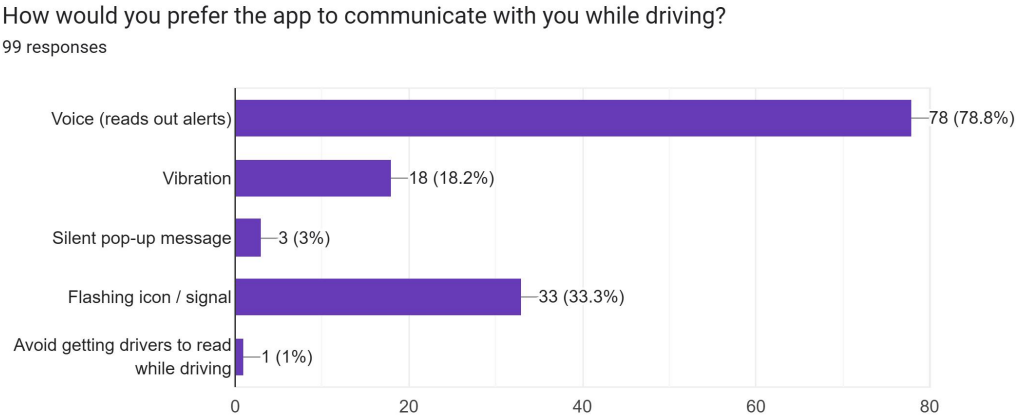
○ Purpose: Shows feature priorities.



• *Bar Chart*: Notification Preferences

○ Description: Columns for Method (Voice, Flashing Icon, Vibration, Pop-up) and Percentage (76%, 24%, 20%, 6%).

○ Purpose: Clarifies communication preferences.

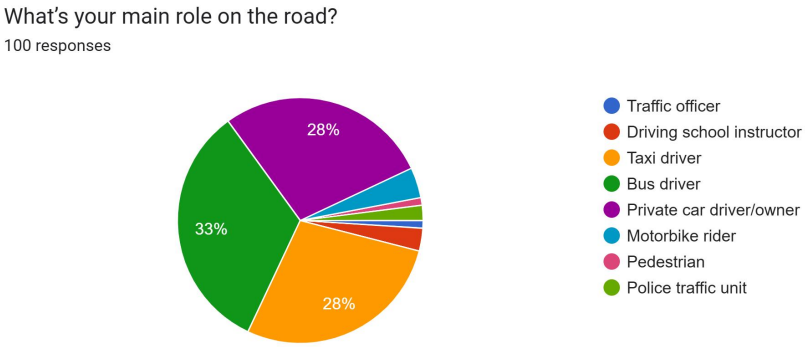


• Pie Chart: Main Role on the Road

○ Description: Slices represent different road user roles *Private Car Driver/Owner (33%)*, *Taxi Driver (28%)*, *Motorbike Rider (28%)*, with smaller slices for *Traffic Officer*, *Driving School Instructor*, *Bus Driver*,

Pedestrian, and *Police Traffic Unit*. The chart uses vibrant, distinct colors with a clear legend.

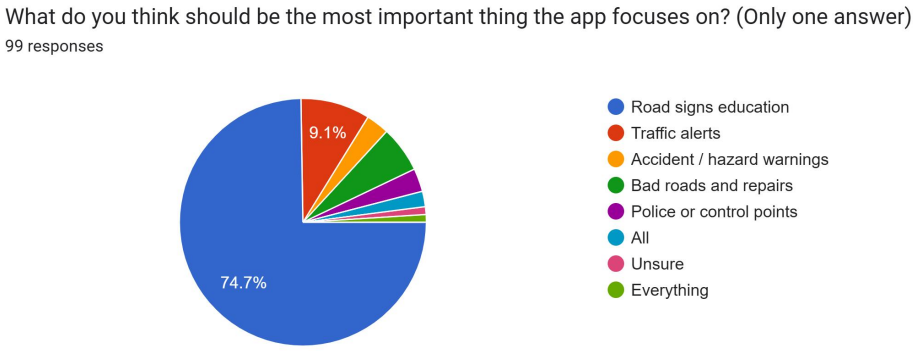
- Purpose: Illustrates the primary roles of road users to inform design decisions for user-focused mobile app features.



- Pie Chart: Most Important Focus for the App

  - Description: The chart displays dominant emphasis on *Road Signs Education (74.7%)*, followed by minor segments like *Traffic Alerts (9.1%)*, *Accident/Hazard Warnings*, *Bad Roads and Repairs*, *Police or Control Points*, *All*, *Unsure*, and *Everything*. The chart is colored with clear, vivid segments and labeled with a legend.

  - Purpose: Highlights user opinion on the **primary focus area** the app should address.



5. FUNCTIONAL REQUIREMENTS

Based on survey insights and interpretations, the app will include:

1. Road Sign Directory: Searchable database with images, explanations, and exam- prep mode (64% demand, driven by 40% prioritizing education and 28% sign confusion).

2. Real-Time Alerts: Voice notifications for traffic, accidents, blocked roads, and construction (76% for voice, 56% for road-specific alerts, addressing 78% pothole and 70% congestion concerns)

3. Crowd Reporting: One-tap interface to report potholes, accidents, or hazards (34% interest, supported by 86% altruistic motivation).

4. GPS Navigation: Local updates integrated with platforms like Google Maps (54% demand, tackling 44% dissatisfaction with existing apps).

5. Customizable Notifications: Allow users to select alert types (52% preference, reflecting diverse needs).

6. Location Sharing: Option to share location when stuck or in danger (32% interest, enhancing safety).

7. Offline Mode: Access to road sign directory without internet (26% demand, critical for rural users).

How Features Were Chosen:

• **Road Sign Directory**: The 40% prioritizing education, 28% reporting sign confusion, and 46% wanting better sign understanding underscored a clear need for a comprehensive, visual directory. Onsite frustration with faded signs (e.g., "Curve Ahead") cemented this as a core feature to improve compliance and safety.

• **Real-Time Alerts (Voice)**: The 76% demand for voice alerts, paired with 70% facing congestion and 78% pothole issues, highlighted the urgency of distraction-free notifications. Interviewees emphasized keeping eyes on the road, making voice delivery non-negotiable.

• **Crowd Reporting**: The 86% willingness to report "if it helps others" and 34% interest in crowd reports leveraged the peer-sharing culture (60% rely on peers for accident info). One-tap reporting (34%) ensures ease, aligning with onsite calls for quick action.

• **GPS Navigation**: With 54% wanting local updates and 44% disliking existing apps' inaccuracies, navigation tailored to Cameroon's roads became essential. This addresses rural and urban needs alike.

• **Customizable Notifications and Location Sharing**: The 52% preferring control over alerts and 32% wanting location sharing reflect diverse priorities, ensuring flexibility for users like traffic officers vs. taxi drivers.

• **Offline Mode**: The 26% demand, amplified by rural drivers' complaints about connectivity, ensures accessibility, making the directory usable anywhere.

6. NON-FUNCTIONAL REQUIREMENTS

• **Usability**: Intuitive UI optimized for Android and iOS (94% smartphone usage).

• **Performance**: Alerts delivered within 10 seconds; functional under low connectivity.

• **Safety**: Voice-first design to minimize distraction (76% preference).

• **Reliability**: Accurate GPS and verified crowdsourced data (38% want verification).

• **Compatibility**: Supports common smartphones in Cameroon.

• **Scalability**: Handles growing urban/rural user base.

Influence of Data: The 94% smartphone penetration justified a mobile-first approach, while the 76% voice preference and 38% verification need shaped safety and reliability requirements. Onsite discussions about rural connectivity drove performance goals for low-bandwidth scenarios.

7. CONSTRAINTS AND ASSUMPTIONS

• **Constraints**:
  - Limited internet access in rural areas (noted by 18% disliking app inaccuracies).
  - GPS accuracy issues in dense or remote regions.
  - Lack of centralized traffic data in Cameroon.

• **Assumptions**:
  - Users have smartphones with GPS/cameras (94% confirmed).
  - Altruistic reporting will sustain crowd features (86% motivation).
  - Traffic authorities may provide some road data.

Data Influence: Rural connectivity complaints (18%) and onsite mentions of GPS issues informed constraints, while the 86% reporting willingness supported assumptions about user engagement.

8. PRIORITIZED REQUIREMENTS

1. **Voice Alerts for Traffic/Accidents** (76% demand, addresses 78% pothole and 70% congestion issues).
2. **Road Sign Directory** (64% demand, tackles 40% education priority and 28% confusion).
3. **Real-Time Road Condition Alerts** (56% demand, mitigates 22% accidents /blocked roads).
4. **Crowd Reporting Interface** (34% interest, leverages 86% altruism).
5. **Offline Mode** (26% demand, ensures rural access).

Prioritization Logic: Voice alerts topped the list due to their safety impact and strong user demand (76%), directly addressing prevalent hazards. The directory's high ranking reflects its role in education (40%) and compliance (46%). Real-time alerts and crowd reporting align with dynamic road needs, while offline mode ensures inclusivity, as emphasized in interviews.

9. CONCLUSION AND NEXT STEPS

This survey, enriched by onsite interviews, paints a compelling picture of Cameroon's road challenges: potholes (78%), congestion (70%), and unclear signs (34%) dominate, while users crave voice alerts (76%), sign education (64%), and community-driven reporting (86%). These insights dictate an app that balances safety, education, and accessibility, tailored to Cameroon's unique context. Next steps include:

- Designing wireframes with voice-first, simple UI.
- Integrating APIs (e.g., Google Maps for navigation, OpenWeather for hazards).
- Prototyping offline directory and crowd verification systems.
- Conducting user testing with demo (86% interest) to refine features.

By addressing user frustrations, voiced onsite, faded signs, sudden potholes, reckless driving, this app promises to empower drivers, reduce accidents, and foster safer roads.