TERMS OF REFERENCE

FOR

CONSULTANCY SERVICES FOR TRAFFIC COUNT, ORIGIN–DESTINATION, STATED PREFERENCE, AND WILLINGNESS-TO-PAY (WTP) SURVEY FOR PROPOSED TOLL HIGHWAY CORRIDORS IN LIBERIA

Prepared by:

Ministry of Public Works through its Infrastructure Implementation Unit (IIU), Republic of Liberia

Monrovia, Liberia

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1. BACKGROUND AND CONTEXT

The Government of the Republic of Liberia, through the Ministry of Public Works' Infrastructure Implementation Unit (IIU) (MPW), is pursuing a strategic programme with funding from the International Development Association (IDA) to develop and operationalize a network of toll highways across major national corridors. This initiative forms part of the Government's broader infrastructure development agenda under the ARREST Agenda for Inclusive Development (AAID), which prioritizes the rehabilitation, expansion, and sustainable financing of Liberia's road network.

Toll highways represent a critical mechanism for mobilizing private sector investment and generating revenue for long-term road maintenance and development. However, the viability and financial sustainability of toll road schemes are fundamentally dependent on a thorough understanding of current traffic volumes, travel patterns, and road users' willingness to pay for improved road services.

In this regard, the Ministry of Public Works, through its Infrastructure Implementation Unit (IIU) with funding from the IDA, intends to engage a qualified and experienced consulting firm to conduct comprehensive Traffic Count Surveys, Origin–Destination (OD) Studies, Stated Preference (SP) Experiments, and Willingness-to-Pay (WTP) analyses across identified toll highway corridors in Liberia. The findings of this assignment will serve as the primary evidence base for toll rate setting, demand forecasting, financial modelling, and the structuring of Public-Private Partnership (PPP) arrangements for the proposed toll corridors.

2. OBJECTIVES OF THE ASSIGNMENT

The overall objective of this assignment is to provide the Ministry of Public Works through its Infrastructure Implementation Unit (IIU) with reliable, statistically robust, and actionable data on traffic volumes, travel demand patterns, and road user preferences and willingness to pay, to inform the design, financial viability assessment, and operationalization of proposed toll highway corridors in Liberia.

2.1 Specific Objectives

The specific objectives of the consultancy are to:

1. Conduct comprehensive classified traffic count surveys at designated stations along all proposed toll corridors to establish baseline Annual Average Daily Traffic (AADT) and seasonal traffic variation factors;
2. Undertake Origin–Destination surveys to determine travel patterns, trip generation and distribution, vehicle occupancy rates, trip purposes, and cargo characteristics along the corridors;
3. Design and implement Stated Preference experiments to elicit road user preferences for improved road quality versus toll charges under various service scenarios;
4. Conduct Willingness-to-Pay surveys to determine the maximum toll levels acceptable to different categories of road users, disaggregated by vehicle type, trip purpose, and socioeconomic characteristics;
5. Develop traffic demand forecasts for a 30-year project horizon based on historical growth trends, economic projections, and modelled induced demand;
6. Provide recommendations on appropriate toll rate structures, including differentiation by vehicle class and time of day, consistent with financial viability and social equity considerations.

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3. SCOPE OF SERVICES

3.1 Survey Corridors

The Consultant shall conduct surveys along the following proposed highway toll corridors. The Ministry of Public Works through its Infrastructure Implementation Unit (IIU) reserves the right to revise, add to, or remove corridors from this list prior to or during the assignment:

- Corridor 1: Monrovia–Gbarnga – Ganta – Guinea Border Highway (approx. 247 km)
- Corridor 2: Monrovia–Buchanan Road (approx. 120 km)
- Corridor 3: Ganta–Sanniquellie–Loguatuo Border Crossing (approx. 65 km)
- Corridor 4: Ganta – Saclepea – Tappita Highway (approx. 100km)
- Corridor 5: Monrovia–Bo Waterside (Sierra Leone Border) Highway (approx. 90 km)
- Corridor 6: Buchanan- Botota – Gbarnga – Ganta (approx. 250km)
- Corridor 7: Coastal Corridor MRU V, Phase I

The Consultant shall propose optimal survey station locations along each corridor in the Inception Report, subject to MPW approval.

3.2 Traffic Count Surveys

The Consultant shall undertake the following traffic counting activities:

- Installation and operation of Automatic Traffic Recorders (ATRs) at a minimum of three (3) permanent or semi-permanent count stations per corridor for a continuous period of not less than seven (7) consecutive days, inclusive of weekdays and weekends;
- Manual Classified Count (MCC) surveys at all survey stations covering a minimum of sixteen (16) hours per day for seven (7) consecutive days, classifying vehicles into not fewer than twelve (12) vehicle categories consistent with Liberian and regional standards (motorcycles, cars, taxis, minibuses, buses, light goods vehicles, medium goods vehicles, heavy goods vehicles, articulated trucks, construction vehicles, agricultural vehicles, and others);
- Axle load surveys at designated weigh stations to determine Equivalent Standard Axle (ESA) loads for pavement design and toll differentiation purposes;
- Turning movement counts at key intersections and interchange locations;
- Seasonal adjustment of traffic counts using appropriate seasonal variation factors;
- Calculation of AADT, AAWT, and peak hour volumes for each station and vehicle class.

3.3 Origin–Destination Surveys

The Consultant shall conduct roadside Origin–Destination surveys using a combination of the following methods:

- Roadside Interview Surveys (RIS) at designated survey points using structured questionnaires covering origin, destination, trip purpose, frequency of travel, vehicle occupancy, cargo type and weight, and journey time;
- GPS-based vehicle tracking of a representative sample of vehicles on each corridor to capture actual travel patterns, speeds, and stop locations;
- Roadside intercept surveys for freight operators to capture commodity flow data, freight tariffs, and supply chain characteristics;

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- Development of OD matrices disaggregated by vehicle class, trip purpose, time of day, and day of week;
- Estimation of traffic diversion potential and route choice behavior under toll scenarios.

3.3.1 Developing the Base OD Matrices

The consultant shall convert raw roadside survey data into structured origin–destination flows by conducting the following:

- **Roadside interviews** (screenline surveys, cordon surveys, mid-block surveys) produce trip records: origin, destination, purpose, mode, vehicle occupancy, departure time.
- These records shall be **expanded to represent total traffic** at each survey location using the observed traffic counts at that point.
- The Trips shall be **coded to zones** in the transport model (TAZs), creating a seed OD matrix.

3.3.2 Expanding the OD Matrices

The consultant shall adjust the seed matrix to represent **all trips**, not just those captured at survey points, using the following expansion factors:

- **Hourly factors**: converting peak-period observations to daily flows.
- **Vehicle class factors**: adjusting for trucks, motorcycles, and taxis not fully captured.
- **Purpose-based factors**: work, school, freight, social/recreational.
- **Socio-economic scaling**: population, employment, car ownership, land-use intensity.

Methods used

- **Fratar / Growth Factor models**: apply growth factors to seed matrices.
- **Gravity models**: estimate flows based on trip generation and attraction.
- **Machine-learning or statistical models**: increasingly used to refine expansion using observed counts.
    - ML-based OD estimation integrates traffic counts to improve matrix accuracy.

3.3.3 Calibrating the OD Matrices

The Consultant shall ensure the calibration of the expanded OD to ensure that the matrix produces **assigned traffic volumes** that match **observed counts** across the network.

Calibration workflow shall include

1. **Assign the expanded OD matrix** to the road network using a traffic assignment model (e.g., CUBE, VISUM, TransCAD).
2. Compare **simulated link volumes** with **observed traffic counts**.
3. Adjust OD flows iteratively until errors fall within acceptable thresholds.

Techniques used

- **Matrix estimation algorithms** (entropy maximization, generalized least squares).
- **Genetic algorithms** integrated with assignment software (e.g., CUBE) to update OD matrices based on count discrepancies.
    - Genetic algorithms refine OD matrices by minimizing link-volume errors.

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- **Simulation–Optimization (SimOpt)** approaches balance historical OD consistency with count accuracy.

Calibration targets

- Link volume error (e.g., <5–10%).
- Screenline and cordon count matching.
- Travel time and speed validation.

4. Integrating Roadside Survey Data with Traffic Counts

This is the most important conceptual link: roadside surveys give **trip patterns**, while traffic counts give **volume constraints**.

Integration should include the following steps:

- **Step 1: Expand roadside survey samples** using traffic counts at the same location.
- **Step 2: Use counts to validate and adjust expanded OD flows** during calibration.
- **Step 3: Use counts at non-surveyed locations** to constrain OD flows indirectly through assignment.
- **Step 4: Use counts to detect anomalies** (e.g., underreported freight, unobserved bypass routes).

3.4 Stated Preference Surveys and Experiments

The Consultant shall design and implement a statistically robust Stated Preference (SP) experimental programme covering the following elements:

- Development of SP experimental designs presenting road users with hypothetical choice scenarios involving combinations of toll charges, travel time savings, road quality attributes (pavement condition, safety features, rest areas), and reliability of journey time;
- Administration of SP questionnaires to a stratified random sample of road users on each corridor, ensuring adequate representation of all vehicle classes, trip purposes, and socioeconomic groups;
- Minimum sample sizes shall be determined in accordance with accepted statistical standards and shall be justified in the Inception Report;
- Pilot testing and refinement of SP instruments prior to full-scale administration;
- Estimation of discrete choice models (Binary Logit, Multinomial Logit, Mixed Logit, or Latent Class models as appropriate) to quantify the relative importance of toll charges and service attributes in route choice decisions;
- Estimation of the Value of Travel Time Savings (VTTS) by vehicle class and trip purpose.

3.5 Willingness-to-Pay Analysis

The Consultant shall conduct a structured WTP analysis encompassing:

- Administration of WTP questionnaires using Contingent Valuation (CV) methods including both Dichotomous Choice (DC) and Payment Card (PC) formats to elicit maximum acceptable toll levels from road users;
- Disaggregation of WTP by vehicle class, trip purpose, freight commodity type, income group, and corridor;

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- Econometric analysis of WTP responses to identify key determinants of toll acceptance and price sensitivity;
- Derivation of WTP thresholds and demand elasticity estimates for toll rate setting purposes;
- Assessment of potential traffic diversion to alternative routes under various toll rate scenarios;
- Equity analysis of the distributional impacts of proposed toll charges on low-income road users and rural communities.

3.6 Traffic Demand Forecasting

Based on the traffic count and OD survey data, the Consultant shall:

- Develop a traffic demand forecasting model for each corridor for a 30-year project horizon (base year to 2055);
- Establish historical traffic growth trends using available secondary data (Ministry of Public Works through its Infrastructure Implementation Unit (IIU) records, economic statistics, vehicle registration data);
- Integrate GDP growth projections, population growth, urbanization trends, and vehicle ownership forecasts into the demand model;
- Develop three traffic demand scenarios (low, base, and high) reflecting different macroeconomic and development assumptions;
- Estimate toll traffic volumes, toll revenue streams, and non-toll (diverted) traffic volumes under each demand scenario and toll rate option.

3.7 Toll Rate Recommendations

The Consultant shall, on the basis of the WTP analysis, demand forecasting, and international benchmarking, provide:

- Recommended toll rate structures for each corridor, differentiated by vehicle class (at minimum: motorcycles, cars/taxis, minibuses, buses, light trucks, heavy trucks, and articulated vehicles);
- Assessment of time-of-day pricing options and their revenue and demand implications;
- Recommended toll adjustment mechanisms including annual escalation formulas linked to inflation and road condition indices;
- Assessment of social protection provisions (exemptions, concessions, or subsidies) for vulnerable road user groups.

4. DELIVERABLES

The Consultant shall produce and submit the following deliverables in both hard copy (three printed copies) and electronic format (MS Word and PDF):

No.	Deliverable	Description	Due (from Commencement)
1	**Inception Report**	Detailing survey methodology, data collection instruments, sampling plan, staffing, and workplan	Week 3
2	**Traffic Count Database**	Raw and processed 7-day continuous traffic count data for all survey stations in acceptable formats	Week 8

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No.	Deliverable	Description	Due (from Commencement)
3	**Origin–Destination Survey Report**	Full OD matrices by vehicle class, trip purpose, and time period	Week 10
4	**Stated Preference & WTP Report**	SP experimental results, econometric modelling, and demand forecasts with WTP analysis	Week 14
5	**Draft Final Report**	Integrated report consolidating all survey findings, analysis, and recommendations	Week 16
6	**Final Report**	Revised report incorporating all Client comments and peer review inputs	Week 18
7	**Presentation of Findings**	PowerPoint presentation to Ministry of Public Works through its Infrastructure Implementation Unit (IIU) and key stakeholders	Week 19
8	**Data Handover Package**	All raw data, cleaned datasets, models, and GIS shapefiles in agreed formats	Week 20

All reports shall be submitted in English. The Ministry of Public Works through its Infrastructure Implementation Unit (IIU) shall review and provide written comments within ten (10) working days of receipt of each deliverable.

5. DURATION OF ASSIGNMENT

The total duration of the assignment is estimated at twenty (20) weeks (approximately five months) from the date of commencement. The Consultant shall propose a detailed workplan and schedule in the Inception Report. The indicative timeline may be revised by mutual agreement between the Consultant and the Ministry of Public Works through its Infrastructure Implementation Unit (IIU).

6. QUALIFICATIONS OF THE CONSULTING FIRM AND KEY PERSONNEL

6.1 Firm Qualifications

The consulting firm shall demonstrate the following minimum qualifications:

- A minimum of ten (10) years of corporate experience in transport demand studies, traffic surveys, and toll feasibility assessments;
- Demonstrated experience in conducting traffic and demand surveys in Sub-Saharan Africa, with at least three (3) completed assignments of comparable scope;
- Experience in stated preference survey design and discrete choice modelling;
- Capacity to mobilize field survey teams of adequate size and technical competence within Liberia or the West Africa sub-region;
- Access to modern traffic counting equipment including ATRs, pneumatic tube counters, and video-based vehicle classification systems;
- ISO certification or equivalent quality management system is an advantage.

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6.2 Key Personnel Requirements

No.	Position	No.	Minimum Qualifications & Experience
1	**Team Leader / Transport Economist**	1	Advanced degree in Transport Economics, Civil Engineering, or related field; minimum 15 years' experience in transport demand studies and traffic surveys; demonstrated experience in toll feasibility studies in developing countries.
2	**Traffic Survey Specialist**	1	Degree in Civil/Transport Engineering; minimum 10 years' experience in traffic counting surveys, classification counts, and ATR operations; proficiency in traffic data processing software.
3	**Origin–Destination Survey Expert**	1	Degree in Transport Planning or Statistics; minimum 10 years' experience in roadside OD surveys, home interviews, and GPS tracking; experience in developing transport demand models.
4	**Stated Preference / WTP Expert**	1	Advanced degree in Economics, Statistics, or Econometrics; minimum 10 years' experience in stated preference survey design, discrete choice modelling (logit/probit), and willingness-to-pay analysis.
5	**GIS & Data Management Specialist**	1	Degree in GIS, Geography, or related field; minimum 7 years' experience in spatial data management, GPS data processing, and GIS mapping for transport projects.
6	**Socioeconomic Survey Specialist**	1	Degree in Social Sciences, Economics, or Statistics; minimum 7 years' experience in household and roadside surveys in Sub-Saharan Africa.
7	**Field Survey Supervisors**	4	Degree in Civil Engineering, Statistics, or related field; minimum 5 years' experience in field data collection supervision; familiarity with Liberian road networks desirable.
8	**Enumerators / Data Collectors**	As required	Secondary/tertiary education; training in survey data collection; proficiency in English and local languages (Loma, Mandingo, Kpelle preferred).

7. REPORTING AND COORDINATION

The Consultant shall report directly to the Director General of the Ministry of Public Works through its Infrastructure Implementation Unit (IIU) or a designated representative. A Technical Steering Committee (TSC), comprising representatives of the Ministry of Public Works through its Infrastructure Implementation Unit (IIU), Ministry of Finance, National Road Fund, and other relevant agencies, shall be constituted to provide technical oversight and review of all deliverables.

The Consultant shall attend and present progress updates at monthly coordination meetings with the TSC. The Consultant shall also be required to present findings at a national stakeholder validation workshop prior to finalization of the Final Report.

8. DATA OWNERSHIP, CONFIDENTIALITY, AND INTELLECTUAL PROPERTY

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All data, reports, models, datasets, and other outputs produced under this assignment shall be the exclusive property of the Government of the Republic of Liberia, represented by the Ministry of Public Works through its Infrastructure Implementation Unit (IIU). The Consultant shall not publish, disclose, or otherwise disseminate any data or findings arising from this assignment without the prior written consent of the Ministry of Public Works through its Infrastructure Implementation Unit (IIU).

The Consultant shall implement appropriate data security measures throughout the assignment to safeguard all collected data against loss, theft, or unauthorized access.

9. ETHICAL AND ENVIRONMENTAL STANDARDS

The Consultant shall conduct all survey activities in full compliance with internationally recognized ethical standards for social research, including:

- Obtaining informed consent from all survey respondents prior to data collection;
- Ensuring the anonymity and confidentiality of individual respondents;
- Treating all community members, road users, and stakeholders with respect and dignity;
- Complying with Liberian data protection laws and regulations;
- Minimizing disruption to traffic flow and road user safety during roadside surveys;
- Ensuring gender sensitivity and inclusion in survey design and team composition.

10. FACILITIES AND INFORMATION TO BE PROVIDED BY CLIENT

The Employer will provide all relevant documents in its possession, request any additional documents from other stakeholders as may be required, and provide all necessary assistance to facilitate the firm in carrying out the services.

11 FACILITIES TO BE PROVIDED BY THE CONSULTANT

The Consultant Team will be based in Monrovia but is expected to travel extensively across all road corridors covered by the studies.

The Consultant will otherwise be required to make his own arrangements for all supplies and services required for the conduct and completion of the assignment, including but not necessarily limited to:-

i. Vehicles
ii. Office furniture and equipment
iii. Office consumables
iv. Accommodation, etc.

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