SMARTTRAFFIC AI PROJECT

FIELD VISIT REPORT

Visited Station: Toll-Weigh Bridge Station
Date of Visit: Monday, 30th June 2025
Prepared By: Smarttraffic-AI Team
Date of Report: 1st July 2025

1. Executive Summary

On 30th June 2025, the SmartTraffic AI team conducted a field visit to the Toll-Weigh Bridge Station to understand the operations of the existing traffic and weighing system, identify its strengths and gaps, and gather insights for enhancing the SmartTraffic AI project. The visit revealed the operational architecture, sensor technologies, data flow, and management practices at the station. Key challenges noted include sensor latency, communication breakdowns, and manual data review inefficiencies. The visit underscored opportunities for local AI-driven solutions to address these issues.

2. Introduction

2.1 Purpose of Visit

The primary goal of this field visit was to gain firsthand understanding of how traffic management and weighing systems operate on the ground, in order to inform the development of SmartTraffic AI. The visit aimed to identify operational processes, challenges, and opportunities for technological improvements.

2.2 Scope

The team focused on observing the station's system architecture, sensor technologies, communication infrastructure, data management, and operational challenges.

3. Methodology

- The team reported to the station at 9:00 AM, signed data consent and integrity forms at the OCS office, and received visitor reflector jackets.
- Field guidance was provided by Fred, the station's System Administrator.
- Data was gathered through observation, guided tours, interviews, and review of internal forms and processes.
- A brief presentation of the SmartTraffic AI project was made to the OCS at the end of the visit.

4. Detailed Findings

4.1 Station Structure

The Toll-Weigh Bridge Station comprises two main departments:

- **Technical Department**:
    - Canons: Inspect vehicles.
    - General Assistants: Guide summoned vehicles.
    - Computer Operator Weigh (COW): Weigh vehicles, verify configurations and load.
    - Computer Operator Prosecutor (COP): Handle prosecution of violators.
    - System Administrators: Manage and ensure system efficiency.

    - Technicians: Handle system debugging.
    - System Manager: Oversees the entire system.
- **Police Department**:
    - Hierarchy from OCS to officers managing traffic and enforcement.
    - Collaborates directly with KENHA.

4.2 Sensor and Detection Technology

- **Technologies Used:**
    - Inductive loops
    - CCTV/IP cameras
    - Automatic Number Plate Recognition (ANPR)
    - RFID/V2I systems
    - Weigh-In-Motion (WIM) system (for static scale weighing)
- **Data Captured:**
    - Vehicle weight
    - Axle configuration (over 80 classes, e.g., 2A, 3A, 6G)
    - Number plate recognition
    - Speed detection
    - Direction (fixed lane assignment)

- **Process:**
    - Sensors detect vehicles (mandatory for vehicles ≥3.5 tonnes, school buses, trucks).
    - ANPR captures number plates, data displayed 100m ahead with direction guide (green arrow for pass, other arrow for inspection).
    - Vehicles flagged for inspection proceed to static scale; details (weight, load, origin/destination) are logged.
    - Permits verified automatically where linked; otherwise, drivers provide manual permits.
    - Violators are charged, may face court action if necessary.
    - Emergency/government vehicles are generally exempt but recorded in the occurrence book if they violate.

4.3 Communication Infrastructure

- LAN-based control center; fiber optic multistrand cable backbone.
- Radio call communication for enforcement coordination.
- Microphones and speakers for driver communication.
- WAN only for data sharing with KENHA/government.
- Backed by servers, HDD storage, cloud backups, UPS and generator systems.

4.4 Signal and Queue Management

- Ticketing is automatic; tagged if offense committed.
- Queue management is manual at waiting zones.
- Daily throughput: ~1400–1500 vehicles.

4.5 Data Handling

- Data integrated and stored in editable Excel sheets.
- Manual review for correcting camera/sensor errors.
- Violations generated via filtering of stored data.
- Forms: Release form (for cleared vehicles), occurrence books (for special cases).

4.6 Observed Challenges

- Communication breakdowns and network latency.
- Sensor lag or inaccuracies at high traffic volumes.
- Manual queue and data review processes prone to human error.
- Electricity interruptions (mitigated by backup systems).

4.7 Opportunities for Improvement

- Modernize weighing systems to reduce manual workload.
- Implement AI for automated permit verification, queue management, and anomaly detection.
- Develop local solutions tailored for local challenges, rather than relying solely on imported systems.

4.8 External Insights

- OCS highlighted similar imported systems (e.g., from China and the US) implemented in Nairobi and Mombasa with large camera networks and control centers.

- Encouraged development of locally adapted smart systems.

5. Conclusion

The visit to the Toll-Weigh Bridge Station provided critical insights into the station's structure, technology stack, and operational challenges. There is significant opportunity for SmartTraffic AI to contribute local, AI-enabled solutions to improve accuracy, efficiency, and scalability in traffic and weighbridge management.