

DEVELOPMENT OF URBAN TRANSPORTATION SYSTEM BASED ON THE TRAM-TRAIN LINE (THE CASE OF LAGOS, NIGERIA)

Sammy Enomfon

Supervisor E.A. Efimova

Самарский национальный исследовательский университет им. ак. С.П. Королева

Lagos is Nigeria's most populous city and its main economic hub; it is a miniscule area bearing the heaviest load in a fluctuating economy but it desperately needs some help. Due to its rapid urbanization, it is Nigeria's commercial nerve center and this has placed a huge strain on its transportation infrastructure. While the recent introduction of the Bus Rapid Transit (BRT) system and the landmark Lagos Blue Line rail represent a step forward, a more integrated and high-capacity solution is required to meet the city's future mobility needs. Introducing a tram-train system presents a positive transformative opportunity to redefine urban transit in the great economic hub.

A Tram-Train is a unique light rail vehicle that is able to operate seamlessly on both city street tramlines and mainline railway networks [1]. This flexibility offers a significant advantage, merging the extensive coverage and accessibility of a tram with the high-speed, dedicated right-of-way of a train. For a megacity like Lagos, this means creating a continuous journey for passengers from dense urban centers to suburban and rural areas without the need for inconvenient transfers.

The development of a Tram-Train system requires serious capital investment, a modern rail infrastructure, and a robust regulatory framework. The current state of some existing rail lines will require substantial upgrades to accommodate Tram-Train operations. The implementation will be a complex, demanding multi-year megaproject requiring careful planning, significant investment, and strong public-private collaboration. The following phased approach outlines the key stages, strategies, and detailed analysis for successful execution.

Phase 1: Feasibility and master planning: This foundational phase is important for reducing risks to the project and ensuring stakeholder buy-in.

Identifying key areas and analyzing demand: Using Geographic Information Systems (GIS) and origin-destination survey data, identify high-demand corridors where the Tram-Train can have the most significant impact. A prime candidate would be a route integrating the Marina/CMS hub with the Ikeja Central Business District, utilizing and upgrading existing but underutilized Nigerian Railway Corporation (NRC) corridors for the "train" segment, and deploying street-level "tram" sections through the dense urban cores of Mushin, Yaba, and Surulere.

Financial modeling and procurement strategy: Developing a detailed total cost of ownership model, including capital expenditure and operational expenditure. Also exploring innovative financing models like a Public-Private Partnership (PPP). A potential model could be: 20% equity from the Lagos State Government, 60% debt financing from consortiums of local and international

development banks (e.g., AfDB, World Bank), and 20% from private investors like Aliko Dangote or Wale Adenuga.

Phase 2: System design and procurement: This phase transforms the master plan into actionable engineering designs and contracts.

Detailed design: Finalizing station locations, designing vehicle specifications, and creating detailed construction documents is a very crucial step in the process. These stations could be designed as multi-modal hubs with secure, integrated facilities for BRT buses, pedestrian walkways, and bicycle parking. This focus on universal design principles ensures access for all, including the elderly and people with disabilities. Climate resilience must be engineered into the system, with adequate drainage to combat flooding which is rampant in riverine areas.

Fleet procurement and technology selection: There would be a need to launch an international tender for the supply of Tram-Train vehicles. A key requirement should be a high percentage of local content and technology transfer. The selected vendor must commit to establishing a local assembly and maintenance facility in Lagos. This aligns with the Nigerian government's industrialization goals, creates skilled jobs, and reduces long-term maintenance costs and foreign exchange expenditure. Vehicles could be dual-voltage to seamlessly transition between mainline (e.g., 25kV AC) and tram (e.g., 750V DC) networks.

Phase 3: Construction and integration.

Civil works and utility relocation: Construction of at-grade, elevated, and street-running sections includes laying new tracks, building stations, and relocating a complex web of underground utilities (fiber optics, water lines, etc.). To mitigate traffic disruption, a "designated construction corridor" strategy will be used, with phased closures and robust public communication. Construction must be sequenced to prioritize segments that connect to existing transit hubs first, to provide early benefits.

Phase 4: Operational readiness and launch.

Testing and commissioning: Graduated testing begins with isolated vehicle testing, then progresses to full-system testing without passengers, and finally trial runs with invited passengers. This phase is crucial for debugging software, training drivers on the transition between tram and train modes, and refining the timetable.

Staff Training and business system development: Train drivers, maintenance crews, and control center staff. Develop a formal spare parts supply chain and finalize the fare structure and ticketing system. The ticketing must be integrated with the existing Cowry Card system used for BRT and the Metro to enable seamless multi-modal journeys.

Phase 5: Operations, maintenance, and possible expansion.

Launch and continuous improvement: As full commercial operation begins, real-time performance data (punctuality, capacity, ridership) should be monitored closely. Getting customer feedback and effectively using it to adjust service frequency will ensure the growth and success of the tram-train line.

The tram-train line will be hugely beneficial and the advantages are multi-faceted and align with the city's current developmental aspirations. Some of these include:

1. Enhanced connectivity: A Tram-Train network can integrate existing rail corridors, like the Lagos-Ibadan standard gauge line, with new intra-city tram lines, creating a unified and extensive transit web.

2. Reduction in congestion: By providing a reliable, efficient, and comfortable alternative to private cars and informal transport, the system can significantly reduce the number of vehicles on key road corridors.

3. A massive economic boost: The construction and operation of the system will generate thousands of jobs. Furthermore, improved mobility boosts commerce by connecting labor pools to employment hubs and facilitating the movement of goods.

4. Sustainable development strategy: As an electrically powered system, the Tram-Train offers a greener alternative to fossil fuel-dependent vehicles, contributing to improved air quality and a lower carbon footprint for the city.

Currently, Lagos's public transport system is fragmented. The reliance on road-based transport is unsustainable, leading to significant economic losses estimated in billions of Naira annually due to lost man-hours and fuel consumption [2]. Despite the hurdles this project will no doubt face, the potential return on investment is enormous. Experts project that a well-structured and planned integrated transport system, with the Tram-Train as a core component, could increase Lagos's internal revenue by up to 30% by boosting formal economic activities and increasing property values along transit corridors [3]. By learning from the successful implementation of Tram-Train systems in cities across Europe and Asia, Lagos can leapfrog its mobility challenges.

References

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