Ensuring sustainability via accessible transport systems for all in Accra and Kumasi

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Abstract. Africa is rapidly urbanising, and transport systems often cannot keep pace, leading to disconnected cities that might entrench car dependency (and preference), along with gender and socioeconomic inequality. In Ghana, transport emissions have risen 75% between 2000 to 2016, along with congestion, pollution and traffic accidents – despite attempts to quell the problem via bans on aged vehicles or more recently, penalties. This paper builds on prior work and argues that putting accessibility at the centre of transport systems will foster sustainability in these cities, yet such data is difficult to find, especially gender-sensitive mobility data. This paper uses a novel approach, combining qualitative and quantitative methods, to study the accessibility across genders in Kumasi and Accra and identify future scenarios for sustainable and accessible systems. This working paper presents preliminary findings.

1 Curbing car dependency

Africa accounts for a negligible share of global energy emissions (less than 4%) and will continue to do so until the end of the century [1]. Nevertheless, Sub-Saharan Africa experienced a 75% rise in transport emissions between 2000 and 2016, with transport emissions increasing 153% in Ghana, 73% in Kenya, and 16% in Nigeria [2]. Vehicles are a major cause of chronic respiratory-related illnesses and premature deaths in African cities. For instance, air pollution, to which vehicular emissions contributes significantly, is estimated to kill 600, 000 people every year in Africa [3]. Often, the vehicles cruising African cities are far from state of the art, in terms of emissions standards, Africa is frequently used as, "a dumping site for obsolete, unsafe, dirty, and, often, faulty used vehicles," by the rest of the world [2]. This used vehicle dependency will only continue: the global on-road vehicle fleet is set to rise to 2.5 billion by 2050, with most future vehicle purchases (two out of every three) projected to occur in Africa and other low-income economies [4] along with its consequences of congestion, pollution, emissions and traffic accidents.

African countries often resort to import bans on used vehicles to curb these trends [5]. But technology replacement, used cars for newer ones or even electric, does not *necessarily* make transport systems more sustainable. As African cities rapidly urbanise, their transport infrastructure often fails to keep pace, leading to disconnected cities with *low accessibility*, which then locks-in car dependency [6-7]. This car dependency, in turn, increases pollution, emissions, energy demand, congestion and traffic accidents. Low accessibility in cities creates challenges for women navigating the city due to travelling at off-peak times, greater care responsibilities and trip chaining [8-10, 13].

Transport is *a means of allowing people to access what they need*: jobs, markets and goods, social interaction, education, and a full range of other services contributing to healthy and fulfilled lives. Achieving sustainable transport systems means considering the needs of different users and thereby offering equal levels of accessibility to transport to all groups – across genders, incomes and ages [11-14].

However, African cities often lack data when it comes to accessibility, especially across genders (cities overall the world lack gender-sensitive mobility data) [13]. Access to such data could help policymakers determine the best policies and strategies for making cities accessible for all sustainably. The results of such work can also inform national policies, partner strategies, or access to climate finance after validation and discussion with local experts and decision-makers.

This paper introduces a novel approach to evaluating accessibility in the context of two cities in Ghana, Accra and Kumasi (that is replicable in other cities throughout the continent) and analyses:

(1) To what extent does access to services (e.g., primary schools, hospitals, transport hubs, markets) vary spatially across cities by gender and income depending on transport mode (e.g., walking, trotros, taxis, private vehicles)?

(2) What is the risk of carbon lock-in given the spatial distribution of accessibility throughout cities?

(3) What are potential future scenarios for ensuring the equitable access to public services while reducing carbon emissions, congestion and pollution across genders and incomes?

1.1 Case studies: Kumasi and Accra

Ghana's transport emissions increased nearly 153% between 2000 to 2016 [2]. As of 2002, penalties exist for over-aged vehicles exceeding 10 years, which replaced the outright ban from 1998 to 2002, but with limited impact on transport emissions, pollution, congestion or road safety [2].

Ghana's bustling cities of Accra and Kumasi grapple with overwhelming traffic due to limited street space and poor utilization of existing road networks [6]. Prior work finds an entrenchment of motorized mobility as the optimal means of transport and is at the heart of Ghana's used vehicle dependency [2,6]. This is partially perpetuated by imperfect (informal) public transport, which satisfies demand but with concerns with respect to service quality and safety [8,10-11]. Regulation is largely informal exercised by the operators' associations, aimed at creating equal, stable, and profitable conditions for respective operators, rather than optimising the benefits for users.

Other work finds that colonial planning systems induce sprawl in Ghana from poor land-use patterns that leads to low densities entrenching a culture of automobile consumption – both, in terms of dependency, at times, and preference, from status [2,7].

These characteristics of Ghanaian cities are observable elsewhere on the continent, and therefore, the methodologies introduced in this paper could also be useful elsewhere.

2 Theoretical framework: Systems change, rather than incremental shifts

Transformative change can be achieved by reversing the dynamics that have led to car dependency and overuse, through systems redesign that prioritises high-quality accessibility and low emissions. This involves changing the way the system functions, resulting in less traffic, greater proximity between people and places, and a shift towards sustainable transport modes as people's first choice [14]. Strategies that focus on designing systems for sustainable accessibility are shown to have greater potential for reducing emissions and pollution than strategies that merely decouple emissions from vehicle use, such as replacing older vehicles for newer ones (and electric) [14]. This involves policies that create proximity and reallocate public space, investment and technology to increase the attractiveness of sustainable modes. While emission reductions via decoupling are important, they are embedded in wider efforts to improve systems, rather than being part of systems that are inherently unsustainable.

3 Methodology

Often traditional metrics of accessibility – i.e., the total number of opportunities people are connected to or the share of opportunities that are provided within reach – are biased in terms of city size. Bigger cities perform better on the former whist smaller on the latter metric. Neither of which capture the performance of the transport system itself. We collaborated with the International Transport Forum to adapt the accessibility model to the Ghanian context which spatially maps accessibility to primary schools; hospitals, pharmacies, and clinics; markets (informal/formal); transport hubs and green spaces, by transport modes (i.e., walking, biking, public transport – trotros, taxis – includes moto, ride hailing, and as well as motorcycles cars and motorcycles) in Kumasi and Accra for men and women. To adapt the model, the team started with a gender-sensitive mobility patterns survey in the two cities with a representative sample. Each of these is described in turn.

3.1 Survey Methodology

In each of the selected cities, we surveyed 500 households using cluster sampling methodology. Neighbourhoods of Accra and Kumasi were systematically classified into socio-economic clusters.

(1) Using the same methodology as in the 2017 Ghana Living Standards Survey conducted by the Ghana Statistical Service, neighbourhoods in Kumasi and Accra were classified into low, middle and high income**. Low-income housing units** are typically traditional single rooms, chamber and hall, or 'compound' housing units inhabited by several households within the same vicinity, and who often share toilet, bathroom and kitchenette facilities with other non-family members (usually, not walled or gated). In contrast, **middle-income housing** units are characterised by chamber and hall 'self-contained' (e.g., a bedroom and living room unit) or may with private toilet, bathroom and kitchenette, usually for single households. These units may be walled and gated, but not with sophisticated security features like electric wires or barb-wired fences. Finally, **high income housing units** are generally detached/semi-detached/self-contained townhouses. Typically, these are gated, walled, and mounted with barbed-wire and other sophisticated electronic devices.

(2) In Stage 2, quotas were determined for each cluster – 200 participants each were recruited from the low- and middle-income neighbourhoods in each city while 100 participants were drawn from the high-income neighbourhoods of the two cities. Residents of

high-income neighbourhoods are hesitant to speak with strangers and researchers, hence, our decision to reduce the quota.

(3) The study sites and one pilot study side in each city were selected for each of the three general income clusters through convenience sampling.

(4) We systematically sampled household heads at the study sites. In their absence, any other available and willing adults was considered, else the next house immediately after it was considered. The process was repeated until the desired sub-sample size for a cluster was obtained.

3.2 Accessibility model

Our team – from the University of Ghana, University of Manchester Spatial Policy and Analysis Laboratory, and the OECD – worked with the International Transport Forum to adapt accessibility model to the Ghanian context, e.g., accounting for unpaved/paved roads, the differences in frequencies and stops of informal public transport, accounting for the different pathways in which urbanites walk, amongst other factors. The model measures: (1) the travel time, which is computed from one origin to all possible destinations (e.g., hospitals) within the functional urban area in a given city by a given mode (e.g., on foot) [9]; (2) the accessibility measurement from all origin points of a city. Step one is repeated for every destination cell, and (3) Steps 1 and 2 are repeated for every mode and destination across the entire city [15].

3.3 Scenario building

After analysing the current state of accessibility in Accra and Kumasi, scenarios will be designed in consultation with local authorities to evaluate the changes in accessibility via different future scenarios. For instance, what proportion of the population could access a hospital in 15 minutes if the congestion reduced by X per cent? This would enable us to show how many more people could be served by existing public services if accessibility were improved.

4 Preliminary results

The project is still on-going. The preliminary survey results for Accra travel patterns are presented below. These results will be used to define the assumptions of the accessibility model, which is presently being run.

Data collection took place between 7th and 16th February 2023 in Accra with a sample of 504 participants. The information below refers to travel patterns of participants in the prior 24 hours. 1512 trips observed in the 24-hour period, specifically, 266 trips (high income), 596 (middle income), and 627 (low).

4.1 Greater car dependency and preference associated with rising incomes in Accra

Participants residing in high-income neighbourhoods in Accra use private vehicles (typically car, sometimes motorcycle) regardless of the purpose of the trip, with rare exceptions when taxis or active modes are used (Figure 2). Public transport is almost never used by participants in high income neighbourhoods, even though the public transport is accessible within 5 to 10 minutes of their home. In contrast, low-income neighbourhoods typically use a mix of active, public transport and taxis, across trip purposes, and rarely use private vehicles except for dropping kids off to and from school.

Figure 1. Proportion of trips by mode in high-income neighbourhoods in Accra

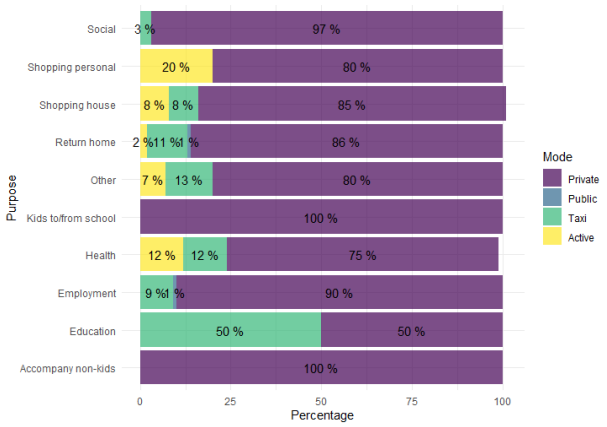
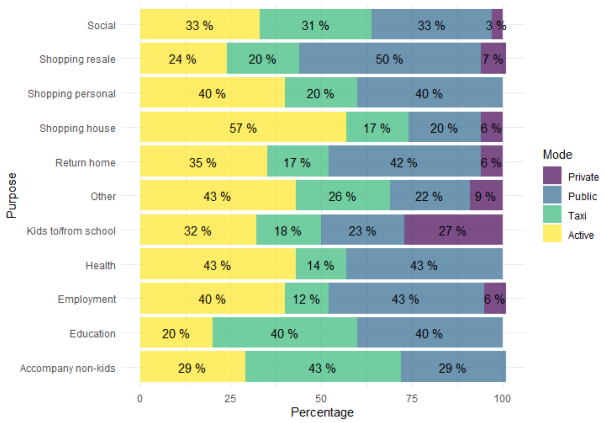
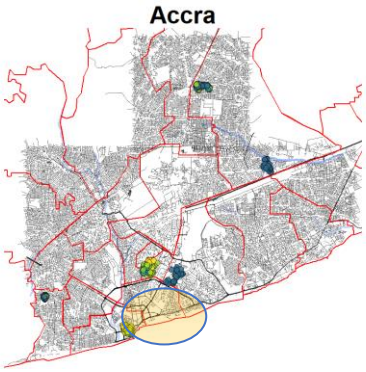


Figure 2. Proportion of trips by mode in low-income neighbourhoods in Accra



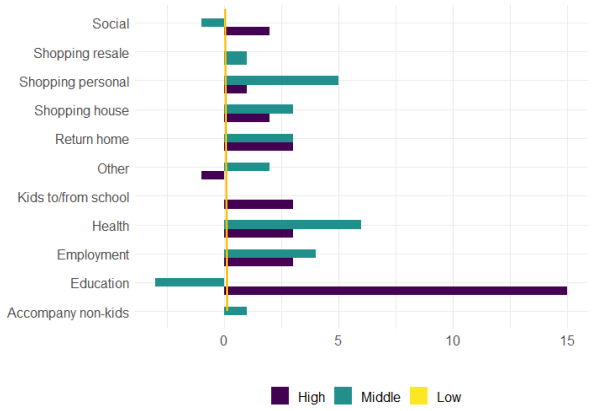
The dependency on private vehicles by high-income neighbourhoods is out of necessity from geographic location. The yellow circle in Figure 3 encloses two sampling locations, a low-income neighbourhood on the left, Nima, and a high-income neighbourhood on the right, the Cantonments, which are next to each other but with entirely different modal choices.

Figure 3. Map of study locations in Accra



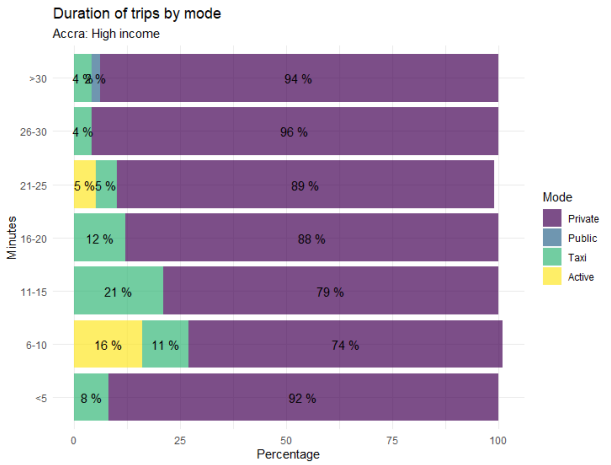
These different preferences result in drastic differences related to the average distances travelled to access services and opportunities. Participants in low-income neighborhoods must access the services and opportunities much closer to home, as compared to participants in high- and middle-income neighborhoods, (Figure 4). Figure 4 compares the median distance travelled across trip purposes by middle and high income relative to participants from low-income neighborhoods. Participants living in more affluent neighborhoods typically travel up to 2 to 5 km further for their daily needs.

Figure 4. High and middle incomes travel further, median distance relative to low income



Part of the reliance of individuals in high-income neighborhoods on cars may be due to the strict start times required for formal employment. Local experts explain that Accra residents will buy a car to ensure prompt arrival times. Our data confirms this hypothesis. Nearly 90% of participants from high-income neighborhoods work in the formal sector, compared to only 72% in middle income neighborhoods, and 24% in low-income. Yet, even if formal employment is one of the causes of private vehicle ownership, once a participant from a high-income neighborhood owns a car, it will be used regardless of the duration of the trip – illustrating a clear preference. Figure 5 shows the duration of trips by mode for participants from high-income neighborhoods. A car is typically used regardless of whether the trip is 5 or more than 30 minutes.

Figure 5. Duration of trips by mode in high income neighbourhoods



Looking at the sample as whole, there seems to be very little differentiation between modal choice and trip distance. Nearly 75 % of trips in Accra are less than 9.3 km, yet private vehicles, public transport, and taxis are used interchangeably, for distances that average around 8km – whilst walking tends to occur for trips around 3-4 km (Figure 6).

4.2 Rare to ride trotros with kids

Women are responsible for 75% of the trips to take kids to/from school. In Accra, 14% of all trips completed by women are accompanied by children. Yet, no one rides public transport with kids. Public transport is used for 40% of trips without kids by those in low-income neighbourhoods, but only 25% with kids. For participants from middle income neighbourhoods, it drops from 28 to 4%. Local experts say that trotro drivers do not want the loss of income that comes from taking passengers under 12 or any delays from boarding and alighting.

5 Conclusions

The work is still on-going, but a couple takeaways emerge. Accra could be at risk of locking in cars as it urbanises, especially, with rising incomes. Cars are viewed as more reliable, faster and safer. Building scenarios that improve accessibility – e.g., dedicated bus lanes, widening streets – such that they can be as fast, reliable and safe as cars will be essential to minimise lock-in. Moreover, this work *already* exposes gender and economic inequalities – e.g., travellers with kids have little to no access to public transport. This, in and of itself, illustrates the importance of gender-sensitive mobility data to better identify the gaps in current systems and points of action.

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