

Transportation and Physical Development around Kumasi, Ghana

Justice K. Owusu-Ansah, and Kevin O'Connor

Abstract—This research explores the links between physical development and transportation infrastructure around Kumasi, Ghana. It utilizes census data as well as fieldwork and interviews carried out during July and December 2005. The results suggest that there is a weak association between transportation investments and physical development, and that recent housing has generally occurred in poorly accessible locations. Road investments have generally followed physical expansion rather than the reverse. Hence policies designed to manage the fast growth now occurring around Ghanaian cities should not focus exclusively on improving transportation infrastructure but also strengthening the underlying the traditional land management structures and the official land administrative institutions that operate within those structures.

Keywords—Housing, Kumasi, population, physical development, transportation, villages.

I. INTRODUCTION

METROPOLITAN areas grow and spread out into the surrounding countryside as new investments in transportation infrastructure opens up previously less accessible lands for physical expansion. Hence the urban fringe is constantly in a state of flux as urban residents, land speculators and developers compete and often displace existing land uses and activities as cities disperse. Rising land values generates ripples of anticipation and uncertainties among resident farmers which could lead to gradual disinvestments (or conversely intensification of agriculture), the idling of farmlands and eventually relocation, land sale, occupational diversification or retirement of farmers [5]. This pioneering wave of urban development generally occurs along transportation corridors and generates landscapes consisting of sporadic new housing interspersed with old farmhouses and agriculture, public institutions, undeveloped lands, manufacturing plants and other 'obnoxious' activities. Successive waves of land use intensification and relocation and the eventual displacement of some persisting activities completes the picturesque low-density suburbia. Planners, environmentalists, preservationists and local pressure groups often succeed temporarily in slowing the down urban

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Justice Owusu-Ansah is enrolled in the PhD program at the Faculty of Architecture Building and Planning, University of Melbourne, Parkville, Victoria, 3010 Australia (phone: +613 9337 7347; e-mail: j.owusu-ansah@pgrad.unimelb.edu.au).

Kevin O'Connor is Professor and Head of Urban Planning, Faculty of Architecture and Planning, Parkville, Victoria, Australia (e-mail: kevin@unimelb.edu.au).

expansion by utilizing fiscal policies, growth boundaries, greenbelts, urban consolidation, and the purchase or transfer of development rights. However development often leapfrogs due to the shortage of land within contiguously built areas forcing land speculators, developers and individual homeowners to proceed further out the urban frontier to break new grounds. Hart [4] metaphorically refers to the continuous displacement of rural land uses by the expanding city as 'bow waves'. However as pointed out by Whitehand and Morton [7], deeply embedded land use and activities persist and so are surrounded by new urban land uses. Pre-existing rural villages have often survived though these eventually disappear through successive waves of land recycling and urban renewal.

Transportation planning is central to these regional metropolitan outcomes as physical development is often channeled along improved transportation corridors. For example, the Copenhagen Plan in 1947 [1], [10] prescribed physical development in a fingerlike form along suburban radial rail and road transport networks. In the contemporary era, the changing household choices that have favored space available at lower settlement densities [9], the industrial technologies in some sectors that require large areas of inexpensive lands in less restrictive operating environments, and the pursuit of cheap labor have all hastened the urban dispersal typically along improved transportation corridors. Several studies of South Eastern Asian cities [5] [11] also show how previously rural communities have been significantly transformed by domestic and multi-national manufacturing industries investing in new facilities utilizing improved road and communications infrastructure. This outcome of urban dispersal was captured in Friedman and Miller's initial work [6] on what they called the 'urban field'. They saw the spread of cities largely as a transport issue, as corridors of improved access were created by new road construction so urban subdivision followed. However physical development may be due to factors other than transportation systems.

II. THE SCOPE OF STUDY

This research explores the links between physical development and transportation infrastructure around Kumasi, Ghana. It focuses on four sample villages in the dispersal zone utilizing housing and population census data and field observation and interviews carried out between July and December 2006. The dispersal zone is defined as the spatial continuum spanning a set of pre-existing rural villages within nine and twenty kilometers from city centre.

Kumasi is the second largest city and home to nearly 1.2 million people representing a third of the regional population. Its strategic central location and the disproportionate concentration of industrial and commercial activities have enabled the city to function as an entrepot and to extend its sphere of influence into all parts of the country and across to neighbouring countries. Hence Kumasi has flourished and dispersed and incorporated several pre-existing rural villages.

The fieldwork showed that physical development around Kumasi is not driven by corporate developers, mortgage institutions or pressure groups, nor by the dispersal of economic activities from central cities as found in advanced industrialized countries. It is also not driven by the out-migration of the urban poor or the stepwise migration of rural residents into the city as the case is in many developing countries. Rather physical development is driven by a complex mix of accelerated residential land demand by urban middle class, the traditional land management structures embedded in the institution of chieftaincy, and the official land administrative structures that operate within traditional land management systems. This pattern of urban dispersal is not necessarily linked to the pattern of transport development around the city.

III. GENERAL OVERVIEW OF TRANSPORTATION INVESTMENTS AND URBAN CHANGE

Following the years of political and economic instabilities mass emigration and slow growth during the 1970s and 1980s, the IMF/World Bank intervened to restructure and stabilize the Ghanaian economy through a number of policies packed as 'Structural Adjustment Programs'. The central focus of these revolves around market deregulation and currency devaluation. These policies inadvertently accelerated housing growth and population dispersal [4]. It facilitated the importation of a large fleet of vehicles thereby increasing mobility and opening up the urban fringe for development. Local businessmen invested capital surpluses in housing which was considered a safe sector under the inflationary spiral set off by the structural adjustment programs. In addition, Ghanaian nationals living abroad were able to remit money for home construction in preparation for their eventual return. This behavior features prominently among Ghanaian emigrants. The fieldwork revealed that nearly 40 percent of homes constructed in the four sample villages were owned by Ghanaian nationals living abroad. Recently, consistent higher annual GDP growth [2] has sustained the growth of home construction.

As shown in Fig. 1, the area around 12 kilometers from the city center has experienced intensive population growth. This pattern of population change was similar for all major road corridors with the exception of the Kumasi-Accra Highway where the rate of change was more intense and continuous over a longer distance due to the national importance of that highway which makes it the preferred location for housing, industries and large scale state-sponsored projects such as the proposed inland port and a sports stadium.

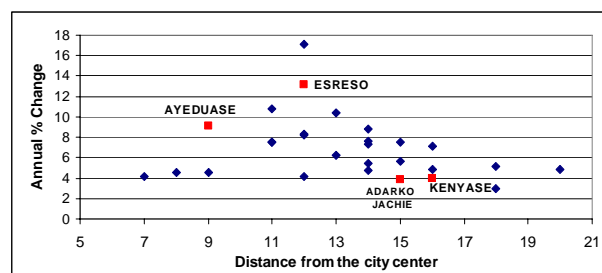


Fig. 1 Population change in the dispersal zone around Kumasi (1984-2000) Source: 2000 Population Census, Ghana Statistical Service (GSS)

However, this high rate of change also reflects the small populations in these previously rural villages prior to urban impact.

Road networks and mass transit systems in Kumasi deteriorated considerably for over a decade between 1970s and 1980s as a result of the political and economic instabilities earlier mentioned. The now defunct Railway Corporation only provided limited long distance services to few settlements in southern Ghana, and intra-municipal commuter rail system was never introduced in Kumasi. The two public bus corporations (Omnibus Services Authority and City Express) that provided intra-city commuter services were divested in 1995 as part of the economic liberalization and market deregulation policies introduced by the IMF/World Bank during that era. In an attempt to resuscitate public mass transportation, the Metro Mass Transit (MMT) was set up in 2003 as a limited liability corporation to provide intra-city and rural commuter services. With respect to Kumasi, these services are mostly overcrowded and unreliable and are limited to few suburbs. Hence mass transportation systems in Kumasi and Ghana in general are undeveloped, and commuter services are the prerogative of private sector transport unions operating with low-capacity minibuses and taxis. In fact about over 49 percent of all vehicles in the city are taxis [8], thus clogging the roads with traffic.

Major road investments occurred in and around Kumasi during the 1990s. The first of these investments involved the reconstruction and repaving of city streets. These projects were funded under a bilateral agreement between the governments of Ghana and that of the then East Germany. The initial sections of the following roads were widened and converted from two-lane into dual carriageways: the 24th February Road (also doubling as Kumasi-Accra Highway), the Western and Eastern by-passes (parts of the ring road), and the Kumasi-Obuase Road. The rehabilitated roads constituted only 32 percent of all roads within the city. These were followed up by improvements in arterial roads leading out from the edges of the city to district and regional capitals. These projects were jointly financed through the Road Funds (levies from licensing, bridge tolls and fuel) and various bilateral loan agreements. Examples include the Kumasi-Techiman Road (funded jointly by the ODA and Ghana) and the Kumasi-Obuase Road which was re-paved in 1998.

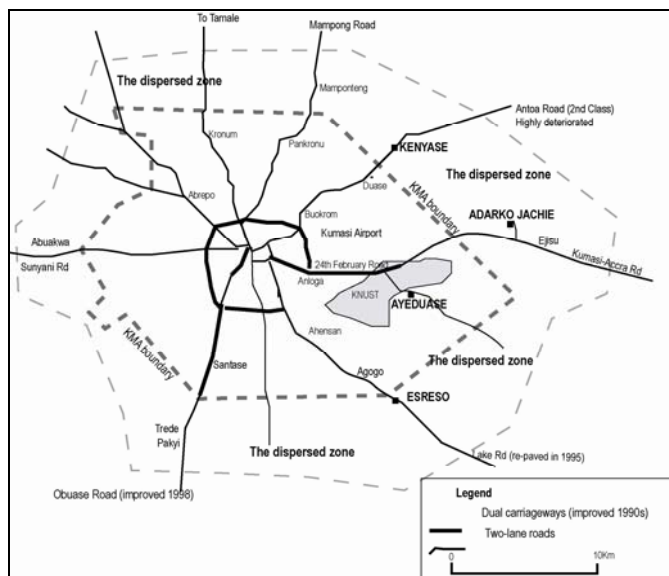


Fig. 2 Arterial roads in Kumasi and in the dispersal zone

Together with traffic management measures, these investments were aimed at reducing vehicle operating costs, travel time and transport costs. Thus areas previously considered as edges of the city were opened up for physical development. However roads that were in relatively good conditions or those given low priorities roads were not part of the general rehabilitation program.

The housing and population census data spans over a relatively long period of time (the 1984-2000 inter-censal period), while the road investments occurred during the 1990s. Therefore the census data had to be supplemented with interviews and field observation in order to draw meaningful conclusions. While road investments may have been a key factor shaping housing and population dispersal, its effects on the four villages were variable and generally weak. It is possible that stronger positive correlation between transportation investments and population change may be felt in villages located further out of the dispersal zone. The next section analyzes the nature and conditions of roads leading into four sample villages used in this research.

IV. ROAD IMPROVEMENTS IN FOUR SAMPLE VILLAGES

To investigate the impact of road investments, four villages arrayed in increasing distance from the city centre and all located on or close to arterials leading outwards from the city, were selected for closer study. The villages are Ayeduase (9km), Esreso (12km), Kenyase (15) and Adarko Jachie (16).

A. Ayeduase (Kumasi Metropolitan Authority)

This village is the closest among the four sample villages in terms of both travel time and physical distance and the only one which is located within the metropolitan boundary. As illustrated in Fig. 2, Ayeduase is located off the Kumasi-Accra Highway (24th February Road) leading outwards from the city in an easterly direction. This was one of the roads that were widened and converted into a dual carriageway in the 1990s. Though not regularly maintained, it is currently in a relatively

good condition. That road is however mostly congested as a result of vehicular-pedestrian conflicts generated by vending activities and several uncontrolled entry and exit points from taxi terminals located alongside the road. In addition, heavy-duty vehicles occasionally break down along sections of the road and thereby exacerbating traffic conditions. Peak-hour commuters utilizing mini-buses occasionally have to wait in long queues. Trips made by shared taxis typically involve at least two separate taxis; first from the village to the Kwame Nkrumah University of Science and Technology (KNUST) where passengers are offloaded onto other taxis that may or may not head directly into the city centre. Thus commuters face increasing difficulties and long travel periods despite the improved road conditions and increased road capacity. The road improvement works may have had limited impact on the expansion of the village as physical development occurred in the village prior to road investments. Besides, the village is only indirectly accessed to the highway by a three-kilometer secondary road passing through the KNUST campus. The section that continues through the village into the new subdivision was neither paved nor graded prior to the creation of new subdivision and new housing investments.

B. Esreso (Bosomtwe Kwanwoma District)

Esreso is the second closest village to the city center in terms of physical distance. The village is located in another district though physical development is contiguous with Kumasi. Hence it has stronger links with the city than its district headquarters located several kilometers beyond the village. The two-lane Lake Road leading outwards from the city in the south-easterly direction is the only available route to Esreso. This road goes through a string of older and populous suburbs such as Atonsu and Agogo. The section of located within the jurisdiction of the KMA was repaved in 1993 as part of the general road rehabilitation program, while the rest of the road up to the district capital (Kuntanase) was completed in 1996. However, physical expansion in the village actually started in 1986 when the village land was first subdivided and offered for sale. Hence the road improvement was probably carried out in response to the intensification and dispersal of housing and population along the road corridor rather than the other way around.

Despite the road improvement and the physical contiguity with the city, travel time to Esreso is unexpectedly longer than the other villages. The maximum speed during peak-hour travel is about 15 kilometers per hour and a trip to the city during rush-hour can actually exceed 45 minutes as compared to off-peak travel time of 15 minutes. The village is not served with MMT buses and passengers rely on private minibuses. A trip typically involves at least one stop in older suburbs where passengers are offloaded here and have to wait in queues for city-bound minibuses. Taxis operators often avoid the Lake Road during peak hour travel times as vehicles are not equipped with meters.

Congestion along the road is attributed to several factors. First, entry and exit points from the lorry and taxi terminals and pedestrian crossing points are not clearly marked and controlled by traffic lights. Traffic is slowed down considerably especially at the point where a dual carriageway

merges with the Lake Road. Secondly, unauthorized trading activities occurring along the entire stretch of the road generate pedestrian-vehicular conflicts. Additionally, the intensification and the spread of housing and population along that road corridor beyond Esreso have also contributed to increased traffic and lengthened travel time. Hence physical development in the village may be more linked to the attractiveness of the village or its physical contiguity to the city rather than the nature and conditions on the Lake Road and the associated travel time.

C. Kenyase (Kwabre District)

The village is located about 15 kilometers away from the city centre on the Antoa Road which runs in a north-easterly direction of Kumasi. Kenyase is relatively easier to access than the village of Esreso despite its spatial remoteness. Several alternative routes exit up to the Kumasi Airport from where the rest of the 11 kilometers journey is done via the two-lane Antoa Road. The ring road shown in Figure 2 links the Antoa Road with Kumasi-Accra Highway and the Suame-Kajetia Road and both lead to the city centre though in a rather circuitous manner.

The Antoa Road had been sealed during the late 1980s and hence was not part of the general road investment program during the 1990s. Due to the lack of periodic maintenance, the road has deteriorated considerably over the years thus slowing down traffic. However, long stretches of land along that road from the contiguously built up areas of the city are devoted to residential development and hence the pedestrian-vehicular conflicts found on the Lake Road are virtually absent on the Antoa Road. As shown in later sections, despite the spatial remoteness and the poor road conditions leading to village, it experienced high growth rates in population and housing between 1984 and 2000. The poor road conditions did not substantially limit housing investments and population dispersal from the city into the village.

D. Adarko Jachie (Ejisu-Juaben District)

A trip from Adarko Jachie into the city center is only possible via the Kumasi-Accra Road which is officially classified as first class road. The initial six-kilometer stretch of the road up to the KNUST campus is a dual carriageway while the additional eight kilometers up to the village junction on the Kumasi-Accra Road has two lanes. The latter section is currently in poor conditions. That road is highly congested with articulated trucks and passenger freight vehicles as it connects Kumasi with northern Ghana and Burkina Faso and the national capital of Accra and the seaport at Tema. However, the links beyond the KNUST are spaced further apart and commercial activities are not organized immediately alongside the road as the case is on the Lake Road. The traditional village core is located two kilometers off the Kumasi-Accra highway and it is connected by an unpaved road.

A trip to the city may involve the use of Metro Mass Transit buses or minibuses. However due to the difficulty of obtaining city-bound transport in the village, commuters frequently walk up to the junction at Kumasi-Accra Highway from where they join city-bound minibuses coming from other settlements

beyond the village. However, Adarko Jachie is relatively easier to access from the city than Esreso despite the busy road conditions and its spatial remoteness from the city. Industries are known to have been located on lands abutting the Kumasi-Accra highway for decades. The new subdivision was created close to this important highway rather than beyond the village where transportation would have been difficult. Hence the nature and importance of the Kumasi-Accra road appears to have shaped physical development in the village.

V. DETAILED ANALYSIS OF IMPACTS ON THE FOUR VILLAGES

The following sections explore some of the indicators of urban change with respect to transport conditions in the four villages in more detail.

A. Travel Time

Due to wide variations in the nature and conditions of roads leading into the four villages, distance is measured by travel time rather than linear distance. Travel times were estimated based on five trips on five consecutive days (from the city to the each village and vice versa) during rush hours and off-peak hours. With reference to off-peak travel time shown in Fig. 3, the well-established distance-decay relationship does hold for the four villages.

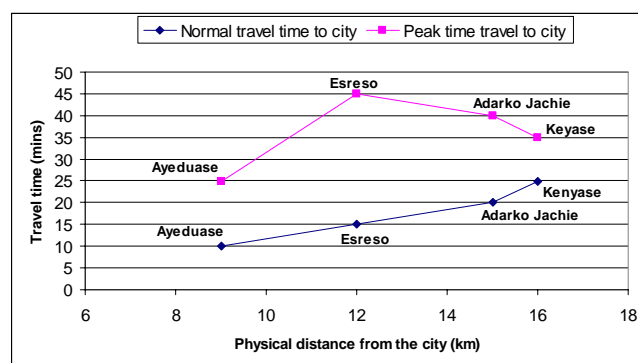


Fig. 3 Travel time to the sample villages in the dispersal zone (Source: Authors' Survey)

However peak-hour travel times (often persisting for up to three hours) complicates this relationship. Travel time to Esreso is unexpectedly longer than Adarko Jachie and Kenyase which are located further out. The extended travel time to Esreso is linked to the increased fleet of vehicles plying the older suburbs and the newly expanding villages beyond the sample villages which has resulted in road capacity problems and the nature and conditions of the road already pointed out in earlier sections. The road capacities were probably never sufficiently matched with future traffic.

B. Land Values

The second dimension of urban change relates to land values. In this research, land values refer to average prices of housing lots typically 30 meters by 32 meters in size. These results are based on interviews with chiefs and landowners as commercial or official statistics are unavailable. These prices

are traditionally disguised as 'drink money' but they now appear to reflect market value rather than the cost of few bottles gin as the case was traditionally the case. However, these average prices mask variations in land prices according to size, actual location and potential uses. In both Fig. 4 and Fig. 5, land values at Ayeduase are the most expensive. This is possibly due its proximity to the KNUST (university) rather than by improved conditions on the road. In Fig. 4, land values decline with distance but increases for Kenyase and Adarko Jachie with increasing distance. This also shows that the effects of physical distance and the nature of roads could have variable effect on land values.



Fig. 4 Land values and physical distance (Author's Survey)

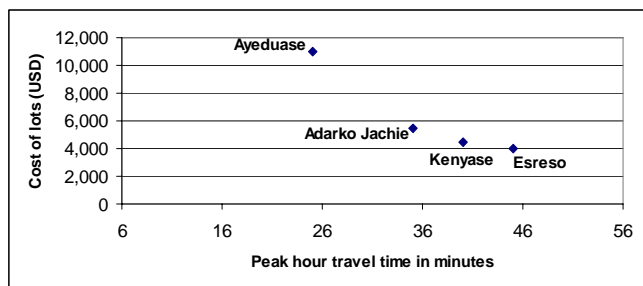


Fig. 5 Land values and travel time (Authors' Survey)

Fig. 5 shows that the last three villages have traded places with reference to travel time. Thus Esreso recorded the least land values despite its physical proximity. This reflects not only the extended travel time to the village but also the ongoing dispute among royal families that have made lands in the village less attractive to homebuilders. With respect to Fig. 5, the cost of lots at Adarko Jachie is higher than both Esreso and Kenyase despite the physical remoteness of the former. The village of Adarko Jachie is located on the Kumasi-Accra highway which is nationally more important hence attracts significantly higher land values. The dual-carriageway is currently being extended from the KNUST past Adarko Jachie. Together with ongoing large projects such as Kumasi Polytechnic hostels, the proposed Sports Stadium and an inland port further out on the Kumasi-Accra highway will in future further enhance land values at Adarko Jachie. While the relatively higher land values at Adarko Jachie are strongly associated with the Kumasi-Accra highway, that association is weak in the other three villages. However, difficulties encountered in estimating actual land values may distort these results. Land deals are based on negotiations and trust rather than on accurate, accessible and verifiable land registry or

database. Hence the estimated land values may not necessarily reflect the highest and best use of land but may incorporate social values traditionally attached to land around Kumasi.

C. Housing and Population Change

These dimensions of urban change further explore the well established distance-decay relationships between housing and population change and travel time. Figs. 5 and 6 show that these relationships do hold in general terms but once again this is distorted by conditions in specific villages.

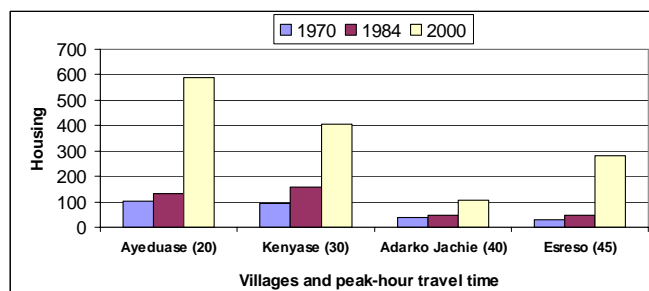


Fig. 5 Housing change (1970 to 2000) Source: Housing and Population Censuses, Ghana Statistical Service [GSS]

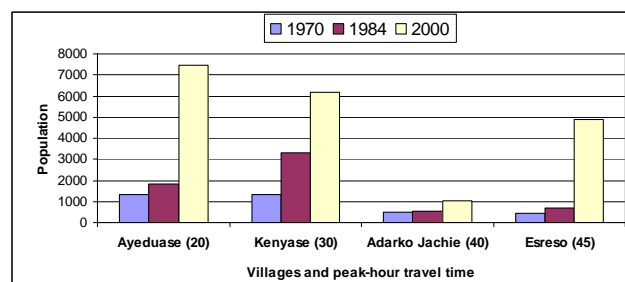


Fig. 6 Population change in sample villages (1970 to 2000) Source: Housing and Population Census, GSS

Ayeduase which is the closest village gained the highest number of new houses and population in absolute terms than all the sample villages despite its location off an arterial road. On the other hand Esreso which is the remotest village in terms of travel time gained more new houses and population than Adarko Jachie which is closer in terms of travel time. Thus road network and improvements do not appear to be the only force shaping housing and population dispersal in the sample villages.

However, the absolute figures used in the above analysis mask growth dynamics in the villages and hence require further clarifications using growth rates. Figure shows that while Ayeduase and Kenyase gained more population and new housing units in absolute terms between 1984 and 2000, the remotest village in terms of travel time was the most dynamic with growth rates exceeding all other villages. Hence travel time is not necessarily a good indicator of urban change around Kumasi.

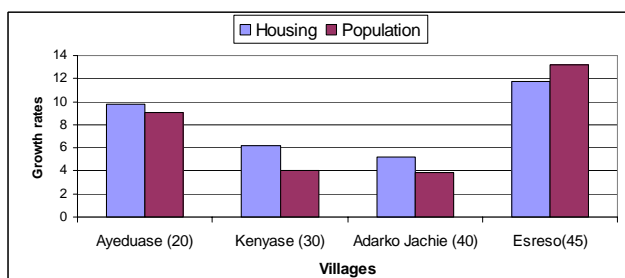


Fig. 7 Population growth rates between 1984 and 2000

Another perspective on this issue can be gained by identifying numbers of undeveloped, incomplete or skeletal housing structures dotting the landscape in the dispersal zone. This is a significant feature of housing expansion in Ghanaian cities. Table I shows that there is a strong inverse relationship between distance and partially completed buildings or even undeveloped lots. Almost 33 percent of all homes at most distant Adarko Jachie are either incomplete or partially complete, and about 24 percent are either undeveloped or have footings constructed on the plots and interspersed with food crops and weeds.

TABLE I
STAGES OF HOUSING CONSTRUCTION

Village	Travel Time	Number of plots	Complete & Occupied	Partially complete & Occupied	Footings or skeletal structures	Vacant land
Ayeduase	20	790 (100)	587 (74)	102 (13)	80 (10)	21 (3)
Kenyase	30	738 (100)	407 (57)	130 (18)	79 (11)	104 (14)
Adarko Jachie	40	420 (100)	106 (25)	76 (18)	138 (33)	100(24)
Esreso	45	545 (100)	282 (52)	76(14)	120 (22)	67 (12)

Esreso is a special case as it stands out as having unexpectedly fewer percentages of undeveloped lots despite its longer travel time. Once again, it is possible that physical proximity and contiguity to the city is more relevant than conditions on the road and the associated travel times. Complete and incomplete housing units are interspersed due to the self-paced construction mechanisms based on personal resources. Some complete and habitable houses occur further out in inaccessible locations and are only connected to the rest of the village by narrow lanes created by construction vehicles. Due to the general lack of enforcements of building regulations, there is little pressure on homeowners to speed up completion. Hence some footings and skeletal structures are constructed with the sole purpose of securing *defacto* land ownership with no intention of completing construction in the short term. Thus homes are constructed irrespective of the nature of access or transportation facilities.

VI. OVERVIEWS AND CONCLUSION

During the formative years of the four villages, houses were constructed along the road in a ribbon manner or huddled around village intersections. In the contemporary era, modern housing constructions have generally occurred away from roads and in many cases in areas lacking proper road access.

Physical expansion attracts road investments and infrastructure rather than the reverse. In fact the lack of access to new subdivisions paradoxically accelerates rather than slows housing dispersal. Land is affordable in areas not served by roads. The unearned profits generated by new road investments after home construction can be considered as a public subsidy to homebuilders, many of whom would have been excluded on the basis of high cost of land if it had been improved or connected with roads beforehand.

Thus increased home construction in a village may be associated with physical proximity and contiguity with the city as well as other attractions such (large educational institutions), and this is irrespective of the actual travel time. However, there is the need for further research to explore critical factors such consumer behavior, commuting patterns, land release policies and the institutional capacities of official administrative structures that operate within the traditional land management structures. These may have greater effects on the pattern of dispersal than the development of roads.

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