

## SP-2006-39 ABSTRACT

# TRANSPORT MODELING FOR THE NAIROBI METROPOLITAN AREA: AN ACTION RESEARCH AND STRATEGIC NETWORK APPROACH

### OVERVIEW

The purpose of this work was to create new tools to assess the transport and land-use challenges, as well as to contribute to research on the larger land-use and transportation policy dialogue in the Nairobi Metropolitan Region (NMR). Relieving stifling traffic congestion is a critical issue in Nairobi and while Kenya is heavily investing in roads in efforts to mitigate the problem, this research offers insights that can help broaden the thinking around improving the transport system in a more integrated, holistic manner. The research elements of the work evaluated the strengths and weaknesses of the existing transport and land-use situation as well as available data in the NMR. In line with its action research and strategic network approach, the [Center for Sustainable Urban Development \(CSUD\)](#) engaged several partners in the process of producing the various elements of the work (outlined below) as well as formally disseminating and discussing them with Nairobi stakeholders.

### Transport Studies and Research: Transport Modeling and Social Dimensions of Urban Travel

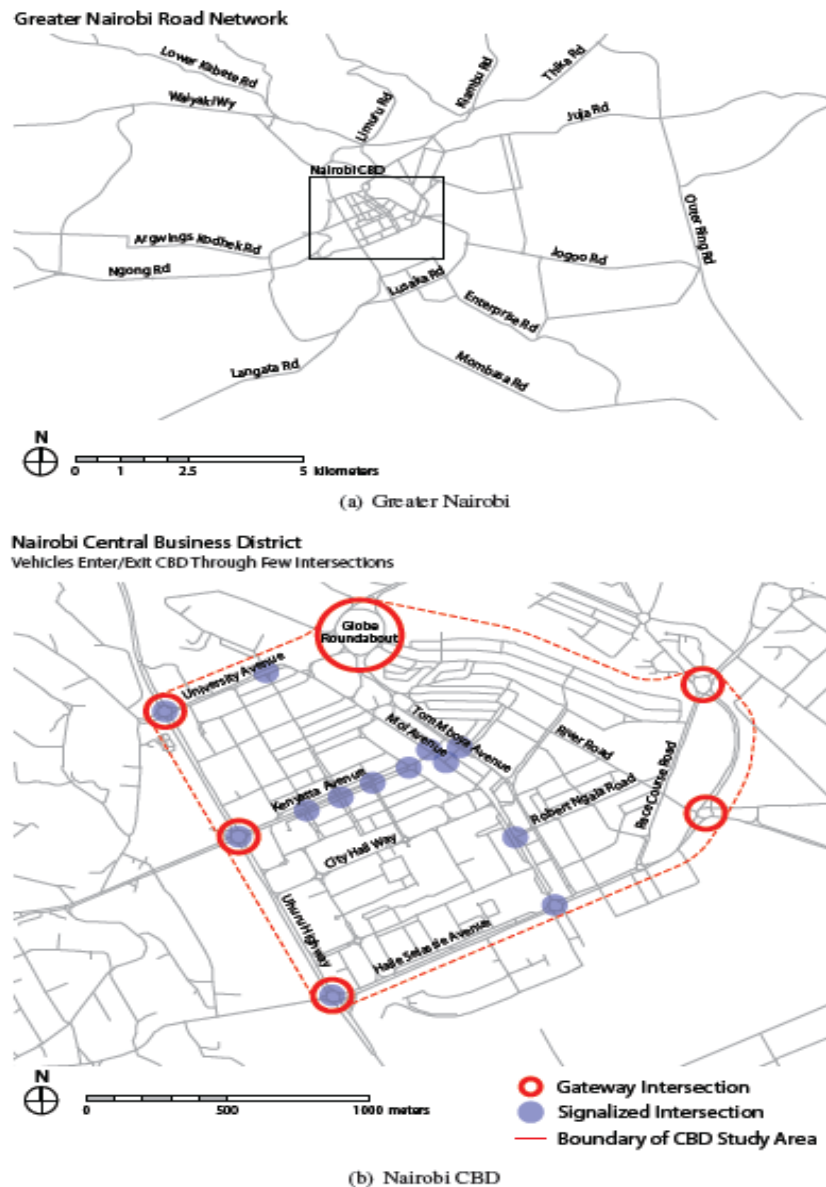
CSUD partnered with Dr. Deborah Salon (University of California, Davis) and Dr. Eric Aligula (Kenya Institute for Public Policy Research and Analysis) to analyze travel survey data in Nairobi. Their paper, “The Social Dimensions of Urban Travel in Nairobi, Kenya: Analysis, Insights, and Opportunities,” presents an in-depth analysis of the travel patterns and preferences of Nairobi residents as well as the implications for transport policy in the city. This is an important contribution to existing studies as it used a large representative sample of the Nairobi population to study travel behavior, highlighting Nairobi’s transport planning challenges in a holistic way.

**Table 1: Factors that influence preferred modes of travel in Nairobi**

Influencing Factor	<3x poverty (N=1300)			>5x poverty (N=223)		
	% In	% In	% In	% In	% In	% In
	Top 3	Top 5	Bottom 3	Top 3	Top 5	Bottom 3
Accessibility from home, work, etc.	59%	76%	6%	63%	72%	4%
Fare/Cost/Expense to Destination	55%	66%	18%	33%	41%	33%
Speed (short travel time)	30%	48%	16%	22%	37%	17%
Frequency (short waiting time)	27%	50%	11%	20%	43%	12%
Safety on board vehicle	24%	42%	15%	35%	53%	13%
Reliability (dependable)	22%	45%	13%	34%	60%	8%
Security	19%	34%	25%	28%	52%	14%
Comfort (cleanliness, seating)	19%	36%	21%	34%	55%	7%
Regularity (on time)	14%	37%	15%	15%	41%	15%
Crew Hospitality and Behavior	11%	21%	39%	7%	13%	45%
Comprehensiveness of Network	9%	18%	42%	5%	14%	40%
Flexibility/Maneuverability	8%	21%	33%	9%	18%	35%
Music in the Vehicle	6%	10%	73%	3%	5%	80%

Source: “The Social Dimensions of Urban Travel in Nairobi, Kenya: Analysis, Insights, and Opportunities”.

CSUD also partnered with the University of California, Berkeley (UCB) Center for Future Urban Transport to model the relationship between Nairobi’s limited street network and the number of vehicles on the network using a UCB developed traffic simulation. Their “Multimodal Transport Modeling for Nairobi: Insights and Recommendations with an Evidence-Based Model” paper provides the first systematic and dynamic understanding of the connection between observed traffic patterns and street designs in the NMR. Results from the study were used to identify potential policies to improve traffic conditions in Nairobi.

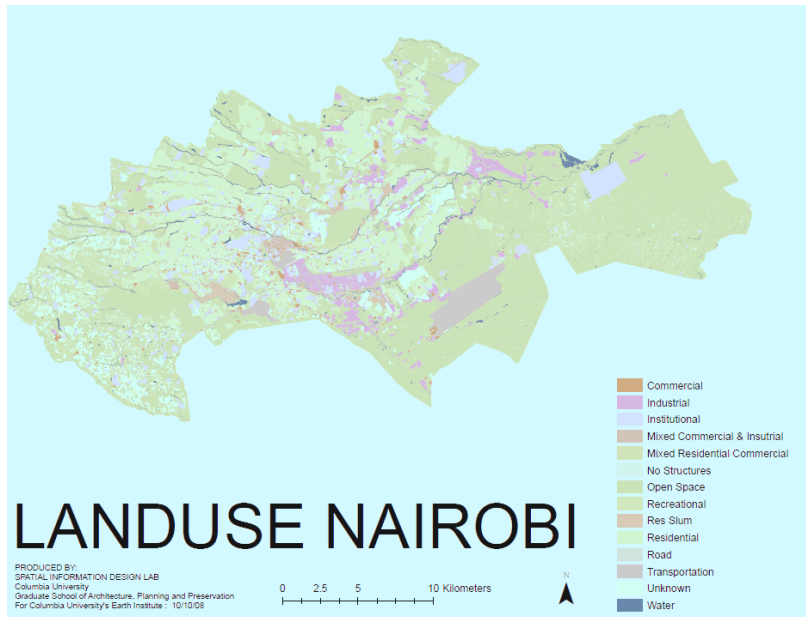


**FIGURE 2** The road network in Nairobi is primarily composed of radial routes connecting surrounding regions to the CBD. The lack of circumferential roads forces many peripheral trips through the center. The street network of central Nairobi is restricted by 6 intersections through which all traffic entering and exiting the CBD must pass. Only 13 of the intersections in the city center are signalized.

Source: “Multimodal Transport Modeling for Nairobi: Insights and Recommendations with an Evidence-Based Model”.

GIS Maps, Ground-Truthing Exercise, Roundtable Discussion, Open Source Nairobi

Increased access to maps and digital spatial information through geographic information systems (GIS) can catalyze change in urban and municipal planning, management, policy and politics (Goodchild et al 2007, in Williams, Marcello and Klopp 2011). This information can be difficult to attain, particularly in a developing country context. To address this need, digitized maps were created in partnership with Columbia University's Spatial Information Design Lab (SIDL) and updating them was done through a



ground-truthing exercise with the University of Nairobi's Department of Urban and Regional Planning (DURP), which yielded updated data as well as fieldwork and technical skill capacity building opportunities for students.

CSUD created a wiki-site providing public access to the maps and their corresponding data sets (<http://nairobiGISmaps.wikischolars.columbia.edu/>) and held a mapping roundtable discussion with DURP to introduce the wiki-site to Nairobi-based organizations active in mapping techniques as well as to faculty and students. The discussion highlighted the barriers to data and how access could be improved. With this in mind, CSUD and Williams (SIDL) wrote, "Open Source Nairobi: Creating a GIS Database for the City of Nairobi to Provide Equal Access to Information," sharing the experience of generating a GIS database for Nairobi. This research illustrated that sharing data has the potential to shift power dynamics during the urban-planning and policy-making process, an important element in our concept of strategic policy networks.

Transport Workshop Series and Follow-up Public Lecture by Enrique Peñalosa

CSUD's 2009 Transport Workshop Series, organized with the Kenya Institute for Public Policy Research and Analysis (KIPPR) and the Kenya Alliance of Resident Associations (KARA), presented our research project findings, provided methodological and technical tools for stakeholders to continue the work, and helped build a policy network for change. The workshop series brought together key players involved with shaping the future development of Nairobi and created dialogue across different ministries and stakeholders. Following on the momentum of the Transport Workshop Series, CSUD partnered with the Institute for Development Studies at the University of Nairobi and the Institution for Transportation and Development Policy to host a lecture by former Mayor of Bogotá and urban visionary Enrique Peñalosa. We initiated this public lecture, attended by policy makers, community groups and academics, at the university for the strategic purpose of sharing with the Nairobi community alternative ways to think about urban environments, public space and transport. Peñalosa was featured on national TV in Kenya.

### Thika Road Expansion Research and Forum

CSUD is building an inter-disciplinary research consortium and has developed a methodology to start in-depth systematic research on the Thika Road Expansion Project, which is transforming the old dual carriage 45 km Thika roadway into Kenya's first super highway. Many problems currently plague commuters, residents and business owners along Thika Road, including heavy congestion, dilapidated infrastructure, poor air quality, and high accident and fatality rates. The public largely expects the highway to alleviate these problems along this main artery for satellite towns and economic hubs along and near the corridor, and the high-profile project is being studied by Uganda and Tanzania as a model. Yet, our preliminary research suggests that investing in the construction of a super highway instead of measures towards an integrated multi-modal transport system for the NMR may be a serious policy misstep with serious consequences. This research aims to deepen knowledge of the highway upgrading, address emerging stakeholders' concerns, and bring academia, policy makers and the community together to develop more appreciation for the way land use and transportation must be tackled together.

### References

- Goodchild, M.; Fub, P.; Rich, P., *Annals of American Geographers*. Sharing Geographic Information: An Assessment of the Geospatial One-Stop, 97(2), 2007, pp. 250-256.

### List of Scientific Production

#### **Articles Submitted**

- Salon, D., and Aligula E., "The social dimensions of urban travel in Nairobi, Kenya: Analysis, Insights, and Opportunities." Submitted to *Journal of Transport Geography*.
- Gonzales, E., Chavis, C., Li, Y., and Daganzo, C., "Multimodal Transport in Nairobi, Kenya: Insights and Recommendations with a Macroscopic Evidence-Based Model." Revised and resubmitted to Transportation Research Board.
- Williams, S., Marcello, E., and Klopp, J., "Open Source Nairobi: Creating a GIS Database for the City of Nairobi to Provide Equal Access to Information." Submitted to *Annals of the Association of American Geographers*.

#### **Policy Tools**

- Updated Land Use GIS Map (September 2010) of Nairobi city center and outskirts (using base of October 2008 GIS Maps and Data Sets funded with VREF CoE grant). 2010 and 2008 maps and data publicly accessible on CSUD wiki site <http://nairobiGISmaps.wikischolars.columbia.edu/>.

#### **Reports and Presentations**

- August 2009 Transport Workshop Series: Completion Report.
- Peñalosa, E., "What is a Good City: Public Space, Transport and Quality of Life." PowerPoint Presentation, October 16, 2009.
- September 2010 Mapping Roundtable Launch: Completion Report.
- "Thika Road Upgrading Project: What Lessons for Policy?"
- Wamukaya, E., "A Parcellary Approach to Mapping Existing Land Uses: The Case of Nairobi city." Presentation, September 15, 2010.