UCLA INSTITUTE OF TRANSPORTATION STUDIES

Nowhere to Run

Speed, Proximity, and Their Relative Contributions to Accessibility

Trevor Thomas
Taner Osman
Andrew Mondschein
Brian Taylor

INTRODUCTION

Access to destinations is widely held as the raison d'être of transportation systems. Given its importance, however, little attention has been paid to how the two primary determinants of accessibility – mobility and destination proximity – combine at the neighborhood level to determine levels of access. In seeking to maximize accessibility to destinations, are localities better served by maximizing destination density, or should they manage density in service of greater mobility? The research presented here addresses this question through an examination of Los Angeles regional data.

DATA & METHODS

Our research approach consists of the following steps:

1. Employment data derived from 2008 Nationional Establishment Time Series (NETS), aggregated to neighborhood (TAZ)

2. Neighborhood-to-neighborhood automobile travel times, network distances, and derived speeds taken from 2008 Southern Califronia Association of Governments (SCAG) travel demand model time skims

3. Neighborhood-level estimates of average peak-hour travel speeds within 10 km, total employment proximity within 10km, and an exponential decay employment accessibility measure, all derived from data in (1) and (2)

4. Relationships among these variables modeled through basic descriptive relationships, OLS models, multilevel models, and linear models accounting for spatial lags and variable heteroskedasticity

Data Description:

Data were assembled for 3,999 TAZs across Los Angeles, Orange, Riverside, San Bernardino, and Ventura Counties.

Average peak-hour travel speeds ranged from 20 km/hr to 80 km/hr , with neighborhood average of 47 km/hr.

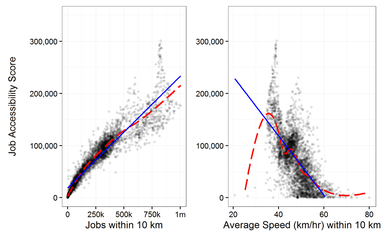
Number of jobs within road network distance of 10 km ranged from over 265,000 to 0. Exponential decay-based accessibility measure also bottomed at (very near) 0.

Statistic	Mean	Standard Deviation	Minimum	Median	Maximum
Average Peak-Hour Speed (km/hr; distance threshold = 10 km)	47.5	6.1	20.7	47.1	80.0
Employment Proximity Count (distance threshold = 10 km)	265,640	226,803	0	230,612	1,002,659
Employment Accessibility Index (decay parameter = 0.2)	75,537	52,123	0	74,744	301,498

Accessibility vs. Proximity and vs. Speed

The graph below-left shows job accessibility as a function of number of jobs within 10 km. The relationship is positive, very tight, and nearly linear.

The graph below-right shows job accessibility as a function of number of jobs within 10 km. Surprisingly, the relationship is strongly negative across much of the range of speeds.



RESULTS

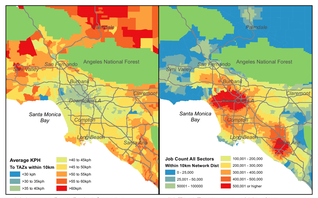
OLS Modeling:

On its own, greater job proximity corresponds to much higher accessibility, while greater peak-hour travel speeds corrospond to much lower accessibility.

Combining predictors, speed becomes positive, but it is vastly outweighed by proximity.

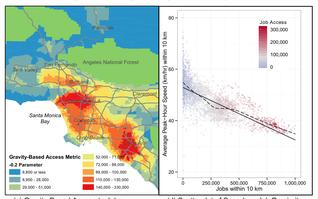
Findings are robust to corrections for heteroskedasticity and spatial lags; effect estimates and their standard errors change very little.

	Dependent variable:		
	Employment Accessibility Score, Scaled		
	(1)	(2)	(3)
Peak-Hour Speed, Scaled	-0.687***		0.078***
	(0.012)		(0.009)
Employment Proximity, Scaled		0.925***	0.980***
		(0.006)	(0.008)
Constant	0.014	0.009*	0.013**
	(0.012)	(0.006)	(0.006)
Observations	3,977	3,999	3,977
R^2	0.451	0.872	0.874
(Standard errors in parentheses)		*p<0.1; **p<0.05; ***p<0.01	



(a) Average Peak Period Speed to TAZs within 10km (network distance)

(b) Total Employment within 10km (network distance)



(c) Gravity-Based Access to Jobs (0.2 decay parameter)

(d) Scatterplot of Speed vs. Job Proximity, Colored by Job Access

Spatial Distribution:

The three panel maps are zoomed in on LA County.

Speed (top left) and job proximity (top right) show roughly inverse patterns.

Proximity and accessibility (bottom left) show nearly identical patterns.

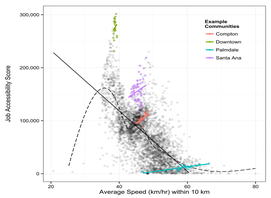
Scatterplot in bottom right shows three-way relationship; speed decreases linearly with job proximity, while accessibility increases steadily with proximity.

At any given level of proximity, speed plays only a marginal role in increasing accessibility.

Accessibility vs. Speed within Communities:

Figure below reproduces accessibility vs. speed relationship across whole region, with highlights showing within-community relationships.

Speed-accessibility relationship can be much different within communities than across communities.



Hierarchical Modeling:

Models below show effects of within-community differences vs. between-community differences.

For speed, within-community differences are less negative/more positive. For proximity, within- and between-community differences have similar effects.

	Dependent variable:		
	Employment Accessibility Score, Scaled		
	(1)	(2)	(3)
Scaled Peak-Hour Speed, Community-Level Mean	-0.618***		0.073***
	(0.037)		(0.023)
Scaled Peak-Hour Speed, Within-Community Difference from Mean	-0.012		0.172***
	(0.038)		(0.027)
Scaled Proximity to Employment, Community-Level Mean		0.977***	1.024***
		(0.017)	(0.025)
Scaled Proximity to Employment, Within-Community Difference from Mean		0.942***	0.966***
		(0.036)	(0.035)
Constant	-0.164***	-0.013	-0.008
	(0.035)	(0.015)	(0.015)
Observations	3,977	3,998	3,977
Log Likelihood	-1,085	1,084	1,304
Akaike Inf. Crit.	2,183	-2,155	-2,583
Bayesian Inf. Crit.	2,227	-2,111	-2,508
(Standard errors in parentheses)		*p<0.1; **p<0.05; ***p<0.01	

CONCLUSIONS

Clear trade-off between travel speed and destination proximity

Destination proximity overwhelmingly stronger predictor of accessibility

Speed increases within communities -> greater positive influence on access

Efforts to improve speed by limiting density likely to be counterproductive

Density-neutral speed improvements still valuable in appropriate context

Importance of examining accessibility impacts of infrastructure + land use decisions

ACKNOWLEDGEMENTS

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