**Accessibility Observatory Literature**

**Overview**

The Accessibility Observatory at the University of Minnesota is focused on the research and application of accessibility-based transportation system evaluation. The Accessibility Observatory builds on earlier work conducted at the University of Minnesota, including the [*Access to Destinations* study](http://access.umn.edu/research/destinations) and the first [*Access Across America*](http://access.umn.edu/research/america) series report.

The Access to Destinations (Owen and Levinson 2012) study laid the groundwork for accessibility evaluation at the University of Minnesota. The Observatory uses the methods and tools developed by this project as a starting point for an integrated, multi-modal accessibility evaluation system that can be applied nationwide.

The *Access Across America* series measures accessibility to jobs via various modes of transportation in major metropolitan areas across the United States. Latest release reports are Access Across America: Transit 2014 (Owen and Levinson 2014) and Access Across America: Auto 2013 (Owen and Levinson 2013).

**Methodology**

1. Cumulative Opportunities Accessibility

Owen and Levinson use a cumulative opportunities measure of accessibility. This approach begins by specifying a mode and travel time of interest, and then counts the number of opportunities that can be reached via that mode within that travel time. This study examines six time threshold (from 0 to 10 minutes, from 10 to 20 minutes, from 20 to 30 minutes, from 30 to 40 minutes, from 40 to 50 minutes, from 50 to 60 minutes). Accessibility is calculated as:

*Aj*, co = cumulative opportunities accessibility from a zone (i) to the considered type of opportunities

*Oj*= number of opportunities of the considered type in zone j (e.g., employment)

*Cij* = generalized (or real) time or cost of travel from i to j

*f (Cij)* = impedance function

Using the cumulative opportunities measure, *f (Cij)* is defined as 1 if *Cij* < T and 0 otherwise. T is the travel time threshold for which we will compute the number of activities that can be reached.

2. Worker-weighted accessibility

To compare accessibility of different level of geography, Owen and Levinson provide worker-weighted accessibility. Accessibility is averaged across all subzones with each subzones’ contribution weighted by the number of workers in that block.

*Apw* = worker-weighted average accessibility of all subzones

*Pi* =population in subzones i

3. Weighted accessibility ranking

Metropolitan area rankings are based on an average of worker-weighted job accessibility for each metropolitan area over the six travel time thresholds. In the weighted average of accessibility, destinations reachable in shorter travel times are given more weight. Here time is differenced by thresholds to get a series of “donuts” (e.g., jobs reachable from 0 to 10 minutes, from 10 to 20 minutes, from 20 to 30 minutes, from 30 to 40 minutes, from 40 to 50 minutes, from 50 to 60 minutes).

*aw* = = Weighted accessibility ranking metric for a single metropolitan area

*at* = Worker-weighted accessibility for threshold t

*β* = -0.08 (calculated through survey data)

**Evaluation:**

This study use the number of destinations reachable within a given travel time to measure accessibility. This accessibility is a travel time-based and opportunity-based accessibility indicators. The chief advantage of the cumulative opportunities measure is its simplicity to interpret, while it cannot give overall picture of land use/transportation system.

Opportunity-based accessibility has two major limitation. First, cumulative opportunities and weighted opportunities measures of accessibility do not account for differences in preferences among individuals—they imply that all people living in the same analysis zone will experience the same level of accessibility. In reality, individuals have different criteria for evaluating potential destinations, and destinations satisfy these criteria to varying degrees. Second, cumulative opportunities and weighted opportunities measures of accessibility assumes that people have unlimited amount to time available for travel in a day. However, in reality, most people have constrains. For example, most people have a set of mandatory activities— most notably, work—that take place at specific times and locations.

Further, compared with TCI project, this study has some limitations. First, this study does not differentiate income groups. Accessibility and value of travel time of different income group people are different. Second, it only measures the accessibility of jobs. Other types of opportunities are not investigates, such as shop, recreation and others. And it only calculate accessibility by transit and auto. Other modes are not investigates.

The methodology of this study have some limitations.

First, the binary nature of the measure creates artificial distinctions between destinations that may have almost equivalent access costs. For example, in a 30-minute accessibility analysis a destination 29 minutes away would be counted while a destination 31 minutes away would be completely excluded.

Also, the measure’s reliance on travel time thresholds increases the amount of data points and illustrations required to convey a comprehensive assessment of accessibility. Publishing figures and maps which show 30-minute cumulative employment opportunities over- and under-represents the accessibility experienced by individuals who can afford only 20 minutes, or up to 40 minutes, of 3 travel time. Data for additional travel time thresholds can be published, but reaching a balance between concision and a comprehensive representation of accessibility requires trade-offs.

Third, this approach requires choosing an exponential coefficient to use in the weighting function, and this choice is not straightforward. Access to Destinations researchers used survey data to estimate the most appropriate exponential coefficients and found that they vary significantly with both mode and trip purpose.

**Rerences**

Owen, A., and D. Levinson. 2012. *Annual Accessibility Measure for the Twin Cities Metropolitan Area*. Technical Report 2012-34, Minnesota Department of Transportation.

Owen, Andrew, and David Levinson. 2013. “Access Across America: Auto 2013.” *University of*. http://www.access.umn.edu/publications/.

Owen, Andrew, and David Levinson. 2014. “Access Across America: Transit 2014.” *University of*. http://www.access.umn.edu/publications/.