



# RESEARCH SERVICES

OFFICE OF POLICY ANALYSIS,  
RESEARCH & INNOVATION

## TECHNICAL SUMMARY

### Technical Liaisons:

Brian Gage, Mn/DOT  
Brian.Gage@state.mn.us

Paul Czech, Mn/DOT  
Paul.Czech@state.mn.us

### Administrative Liaison:

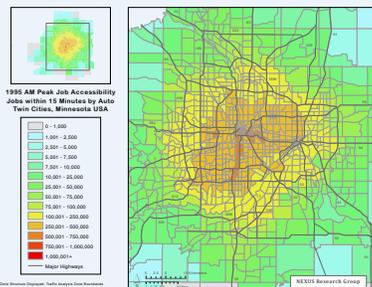
Linda Taylor, Mn/DOT  
Linda.Taylor@state.mn.us

### Principal Investigator:

David Levinson, University of Minnesota

### PROJECT COST:

\$186,000



Maps like the one above show the number of jobs or workers accessible within a designated time from every location.

# Access to Destinations: Measuring Accessibility by Automobile

## What Was the Need?

Traditional congestion measures capture how quickly people can travel from one place to another, whereas accessibility indicates how well travelers are able to reach desired destinations, such as work, shopping, education and recreation. Mn/DOT's Access to Destinations research effort consists of 11 studies aimed at developing measures of accessibility for the Twin Cities region over a 10-year period. The first 10 studies focused on accessibility by walking, bicycle and transit, and on the collection of data ultimately used in this final report on accessibility by automobile. A better understanding of accessibility in the Twin Cities metro area will aid in evaluating and improving land use practices and development alternatives as they affect the transportation system.

## What Was Our Goal?

This phase of the Access to Destinations project focused on determining the number of opportunities accessible by automobile from different locations throughout the region. The goals of the study included:

- Using actual measured travel and delay times—as opposed to strictly modeled or assumed figures—as inputs to create accessibility measures.
- Analyzing how accessibility in the region changed from 1995 to 2005.
- Evaluating how land use changes and improvements in the transportation network affected accessibility.
- Creating an interactive Web module that permits users to view accessibility measurements by time, location and desired destinations.

## What Did We Do?

Researchers first created a travel time matrix that shows how long it takes to travel by auto from any one place in the region to another. These times were determined using freeway travel time estimates based on freeway loop detector data and ramp delay estimates as well as arterial travel time estimates generated from estimated traffic levels.

Researchers then collected land use data from census records; Longitudinal Employer-Household Dynamics employment records; and Metropolitan Council estimates of the number of jobs, persons and households in the region.

These travel times and land use data were then used to create measures of accessibility, or opportunity for interaction. In this analysis, the cumulative opportunity was calculated as the total number of jobs, residents and workers reachable from each point at a given time. Measurements were made for travel times ranging from five to 60 minutes.

Researchers then used measurements from 1995 and 2005 to analyze the causes of observed changes in accessibility, separating out the network and land use factors to estimate what accessibility measures would be if land use had not changed or if the transportation network had not changed.

Finally, a Web-based interface to the Access to Destinations maps used in the final report was developed. Using the MapServer program, researchers created a custom map

*Researchers analyzed accessibility measures—which indicate proximity to opportunities like jobs, not simply travel times—for the Twin Cities area between 1995 and 2005. Overall, the region is becoming more accessible due to land use changes and network improvements.*

*continued*

*“The concept of accessibility allows us to measure the efficiency of the city in its primary role, enabling people to reach other people and things.”*

–David Levinson,  
Associate Professor,  
University of Minnesota  
Department of Civil  
Engineering

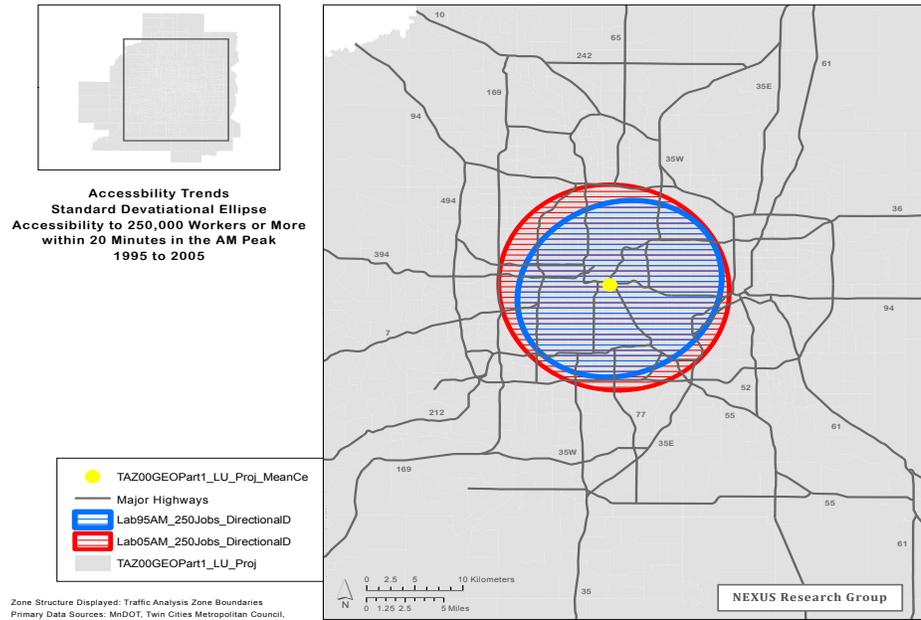
*“This study brings together transportation and land use. Instead of looking at how much time it takes to get from point A to point B, it measures the number of opportunities people have within a designated drive time.”*

–Brian Gage,  
Access Management  
Engineer, Mn/DOT Office  
of Capital Programs and  
Performance Measures

**Produced by CTC & Associates for:**

Minnesota Department  
of Transportation  
Research Services Section  
MS 330, First Floor  
395 John Ireland Blvd.  
St. Paul, MN 55155-1899  
(651) 366-3780

[www.research.dot.state.mn.us](http://www.research.dot.state.mn.us)



Researchers used Standard Deviation Ellipse measurements to show accessibility trends from 1995 to 2005. Above, the red 2005 ellipse is larger and completely encloses the blue 1995 ellipse, demonstrating the increasing and flattening of accessibility throughout the region.

file that allows users to display and query eight of the most pertinent maps: access to jobs and to workers by car in 20 minutes for both a.m. and p.m. peak traffic periods in years 1995 and 2005. (The interface is at [http://nexus.umn.edu/mapserver\\_demos/access](http://nexus.umn.edu/mapserver_demos/access); click “Initialize” at the link to display and query the different maps.)

### What Did We Learn?

A key finding of this research project is that accessibility measures for nearly every area in the region increased over the time period studied. The greatest growth was observed in faster-growing suburban parts of the region, suggesting that both households and employers were decentralizing. In addition to an overall increase in accessibility, the study showed that these changes led to a “flattening” of accessibility, evidenced by a reduction in the disparity of accessibility among different areas within the region.

Investigators attributed the causes of these changes both to changes in the location of opportunities—land use—and the structure of the transportation network. Increases in population density of existing activity centers generally increased access to jobs in those locations, while specific travel network improvements led to improved job access in the areas where those improvements took place.

### What’s Next?

The University of Minnesota Center for Transportation Studies has designed a Web interface incorporating study results that will enable users to view accessibility by mode, destination and time period. To display and query the different maps, go to [http://nexus.umn.edu/mapserver\\_demos/access](http://nexus.umn.edu/mapserver_demos/access). A more advanced version of this interface is in progress. Mn/DOT now needs to determine how best to use this tool to develop performance measures and guide decision making. Mn/DOT is evaluating a new proposal that would use the interface to analyze the effects of proposed land use or transportation network changes in the region.

*This Technical Summary pertains to Report 2010-09, “Access to Destinations Phase 3: Measuring Accessibility by Automobile,” published March 2010. The full report can be accessed at <http://www.lrrb.org/PDF/201009.pdf>.*

*This study concluded work begun in Phase I, Report 2007-35, “Access to Destinations: Travel Time Estimation on Arterials,” and Phase II, Report 2010-12, “Access to Destinations: Arterial Data Acquisition and Network-Wide Travel Time Estimation (Phase II),” published August 2007 and March 2010, respectively. These reports are available at <http://www.lrrb.org/PDF/200735.pdf> and <http://www.lrrb.org/PDF/201012.pdf>, respectively.*