

## Asking the Right Questions About Transportation and Land Use

Access to Destinations Study Research Summary No. 1

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CENTER FOR TRANSPORTATION STUDIES

## PREFACE

The Access to Destinations Study is an interdisciplinary research and outreach effort coordinated by the University of Minnesota's Center for Transportation Studies, with support from sponsors including the Minnesota Department of Transportation, Hennepin County, the Metropolitan Council, and the McKnight Foundation. A full description of the study is available at: [www.cts.umn.edu/access-study/studyframework](http://www.cts.umn.edu/access-study/studyframework).

The research discussed here takes a new approach to understanding how people use the transportation system, and how transportation and land use interact. At the heart of this approach is the concept of accessibility: the ability of people to reach the destinations that they need to visit in order to meet their needs.

Research activities in the Access to Destinations Study include three major research components:

### I. Understanding Travel Dimensions and Reliability

This research focuses on improving our understanding of travel within urban transportation systems. Current travel measures are informative but are of limited use in helping us understand what is happening in specific locations and across a spectrum of different transportation modes.

### II. Measuring Accessibility

This research uses detailed data on land use, travel behavior, and population demographics over the past ten years, in combination with the research findings from Component I of the study, to develop methods for describing how our accessibility is changing.

### III. Exploring Implications of Alternative Transportation and Land Use Systems

The work undertaken in Components I and II will contribute to the development of an alternative approach to evaluating and planning our transportation system—one which takes into account all travel modes and land use decisions.

## Acknowledgments

This research summary incorporates findings from the research report *Access to Destinations: Development of Accessibility Measures* by Ahmed El-Geneidy and David Levinson, available at [www.cts.umn.edu/access-study/publications](http://www.cts.umn.edu/access-study/publications).

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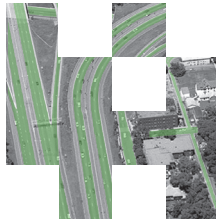
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# Asking the Right Questions About Transportation and Land Use

ACCESS TO DESTINATIONS STUDY RESEARCH SUMMARY NO. 1



What if solid research showed that even as congestion is getting worse, most people in the Twin Cities are finding it easier to get where they need to go? That's one of the provocative prospects receiving a first-ever look in new research at the University of Minnesota's Center for Transportation Studies.

Building on the findings of the University of Minnesota's Transportation and Regional Growth Study (summarized in *Market Choices and Fair Prices*, 2003, available at [www.cts.umn.edu/trg/reports](http://www.cts.umn.edu/trg/reports)), this new research series shifts the focus to a different set of questions: what is the level of access that Twin Cities area residents have to their most valued destinations? And is that access measurable? Can changes be systematically tracked over time? Do access measures offer new and better means of evaluating the performance of transportation and land use systems? Asking those questions certainly complicates the most common ways of thinking about the performance of the transportation system, but research suggests the answers may provide valuable new insights.

Once a year, along with their morning coffee, the nation's traffic-weary metropolitan residents get a radio or newspaper story on the latest congestion report card from the Texas Transportation Institute. This urban mobility report always makes headlines, especially in places with worsening congestion. Minnesota's Twin Cities region has so far not been anywhere near the top of the most-congested list, but in recent years the region has been notable for the rate of its congestion increase—sometimes in the top three.

Congestion is a serious issue. But counting cars and clocking speeds fails to tell enough about the transportation and land use characteristics of the region. Besides, people who travel the roads of the Twin Cities already know congestion has gotten worse. Those who can plot to avoid

*Congestion is a serious issue. But counting cars and clocking speeds fails to tell the whole truth about the transportation and land use issues facing the region.*

the routes where the capacity is strained by too many motorists trying to use the same stretch of road at the same time. State officials do what they can to offset growing congestion by redesigning bottlenecked zones, adding roads where possible, more aggressively managing incidents, and pushing for more transit. (In fact, the rate of congestion increase has flattened somewhat recently as a result of these strategies).

But people do more than just change their routes or the times they travel. Many of them make changes in where they live, or where they work, in some rough calculation of improving the daily odds of getting to the places they want to go. They pay more for housing in some locations, a decision based in part on their

tolerances for commuting. These calculations are not simply a matter of avoiding congestion; people—when they can—make arrangements to improve their access to key destinations. And while most people would not know, for example, the average speed of automobiles at 7:30 A.M. on the Crosstown Freeway, they do know what they must do to be sure they will arrive at work on time, or get to the day care center before surcharges kick in.

Meanwhile, people locating factories and offices use surveys and studies to improve their own access to workers—particularly the employees they already have. Retail and service businesses have always picked locations for proximity to customers; as congestion increases and some labor markets shrink, they must also pay attention to where their workers come from.

As partial evidence that people and organizations

are making these choices, researchers remind us that the average to-and-from-work commute time went up no more than five minutes across the entire decade of the 1990s. Of course people trapped in necessary but highly congested routes may protest that averages deceive. But those averages do suggest that a lot of people must have made whatever arrangements were

necessary to take less time than before to get to primary destinations—at least to work.

The past decade has seen an explosion of townhouses and condos in urban centers, bringing many new residents into activity-rich zones, such as the two largest downtowns. Those relocations have dramatically increased the

number of destinations that are easily accessible to those residents, even though the density of activities and people virtually ensures that no one moves around these zones very fast. By contrast, one can rip right through the commercial and residential areas that lie along University Avenue in Fridley at a lawful 50 miles per hour—passing a much smaller number of primary destinations.

So it is this complex interaction of the choices people make and the opportunities and incentives in the transportation and land use systems that is the subject of the Access to Destinations Study. The overall goal is to generate a dynamic matrix of accessibility—one that examines the major destinations people value and tracks over time improvements in access to those places by all the existing travel modes.

*Minnesota's Twin Cities region has so far not been anywhere near the top of the most-congested list, but in recent years the region has been notable for the rate of its congestion increase.*





## RESEARCH PROJECT #1 – TEST-DRIVING THE METRICS

The first Access to Destinations research project, completed in 2006, focused on the level of access people have to jobs and, conversely, the access of employers to a supply of workers, presuming the automobile as the mode of travel. Beginning with an examination of previous scholarly findings, the project then explored statistical and analytical techniques for measuring access with the aim of picking the best measures to track the performance of land use and transportation systems.

There is no “right” way to measure accessibility. But over the four decades in which this concept has been studied, several techniques stand out prominently.

One of the earliest, Cumulative Opportunity, basically counts the number of potential opportunities that can be reached within a certain distance or travel time. Counting is useful but conclusions drawn from counting are limited. This method accounts neither for costs (time, fuel) nor for differences in “attraction” power across destinations. People may strongly prefer to get to some places that are difficult to access.

The most widely used measure is Gravity-Based. This measure considers destinations of interest along with the costs of travel (by any mode), and it incorporates more complexity into the calculation of “opportunities” (another way of describing a valued

### Making a Metro Matrix

By the time the last of a likely dozen interrelated research projects is complete, people who travel or make transportation and land use decisions in the Twin Cities region should find they have a tool not available today: a region-wide “accessibility matrix” that captures variations in accessibility to different types of destinations for travelers using several common modes of travel.

For each origin area, a matrix can be created with columns representing types of destination activities—such as employment, shopping, and entertainment—and rows representing different travel modes—such as driving, bicycling, and walking. Each cell in this matrix tells how easy it is to reach the specified destination activity using a chosen mode. By computing separate matrixes for different years, it becomes easy to see how accessibility has changed over time.

Travel time is a key input for calculations of accessibility. The definitions and measures developed in the first research project will serve as the foundation for a set of research projects focused on travel time. The second project will look at accessibility using non-automotive modes such as transit, bicycling, and walking; a third project will focus on travel times along the region’s arterial street network; and a fourth will focus on the freeway network.

Turning next to land use issues, the Access to Destinations Study will test common assumptions about development and density. One prevalent idea, for example, is that

“mixed-use” development—combining a variety of destination types in a close-knit grouping—will attract residents and lead to reductions in automobile use. Advocates of new urban development models often cite a “quarter-mile rule” to explain how far people will ordinarily walk to a destination. Is that assumption valid?

And what about trips by bicycle?

Land use research will include a project investigating recent historical changes in land use across the Twin Cities region

in order to model their effects on transportation. Following that, researchers will attempt to drill down to the level of individual land parcels and ask questions about the influence of land use changes on transit use and non-motorized transportation.

In its final stage, the study will seek to integrate findings about travel times, land use practices, and mode choice in order to produce a coherent picture of access to destinations throughout the region. A pair of coordinated research projects will develop accessibility measurements for automotive and non-automotive travel modes. Using Geographic Information Systems (GIS) techniques, researchers will produce detailed data sets for the base years of 1995 and 2005, making it possible to analyze and display changes in accessibility over time.

The end result will be the most comprehensive evaluation ever produced of destination accessibility in the Twin Cities region.

		1995				
		Jobs	Schools	Parks	Shopping	
2000						
		Jobs	Schools	Parks	Shopping	
2005						
	Automobile					
	Transit					
	Bicycling					
	Walking					

destination). So, frequency of bus service could be a value factor in calculating access to transit. But this method also has limitations. It assumes that everyone in a measured zone has the same level of accessibility, thereby ignoring all the individual preferences that characterize human behavior. For example, everyone wants access to a grocery store, but for some people that means finding a Cub Foods, while for others only a gourmet food store will fit the bill.

A new method developed in this study—Place Rank—may meet this need. Its logic is similar to that used by the Google search engine. Google measures the importance of any web page by the links connecting to it, and calibrates the power of those links by ranking the importance of the websites they come from.

Place Rank calculates the number of people commuting to a zone to reach an opportunity, and calibrates the weight of these decisions by the attractiveness of the zone of origin, i.e., where the

*Place Rank, a new measure of accessibility developed in this study, may meet the needs of planners and policymakers.*

commuter lives. So if someone travels from a job-rich zone to reach employment in another zone, that decision has greater weight. Now that data sources are more robust than ever before, it

is possible to conduct an analysis that regards each zone as both a point of origin and a destination, and considers the individual trip pattern of every commuter in the Twin Cities region.

Mapping the number of jobs within 10 minutes of travel at peak hours by auto, the simplest Cumulative Opportunity measure produced a ranking of accessibility with the city of Minneapolis at the top and a close second tier comprising Saint Paul, Edina, and Bloomington—a pattern that was reproduced by all the measures, but with each weighting the places differently.

The results of this first research project will help to create an accessibility matrix for the Twin Cities region, capturing changing levels of accessibility for a variety of locations and travel modes.

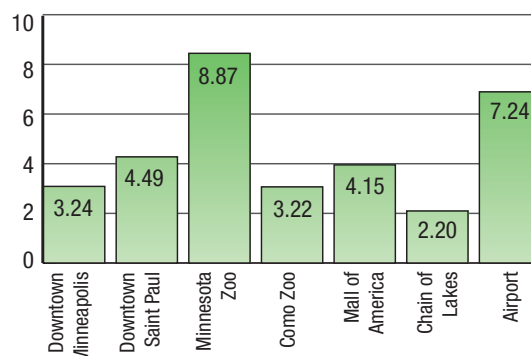


## ACCESSIBILITY AND HOME PRICES

This first research project also asked whether accessibility to jobs and to a supply of workers has a measurable effect on the value of homes. Everyone who has bought and sold homes can recall all the advice about the value of more bedrooms or bathrooms, fireplaces, garage stalls, or water views. And of course the overall characteristics of a neighborhood and the reputation of schools and the city or town matter too. Researchers gathered those factors and asked if accessibility belonged on this hard-nosed list of economic considerations.

From a comparison of the competing methodologies for measuring accessibility, Cumulative Opportunity offered the clearest results explaining the variance in sale price: a home would yield an additional 25 cents per job (or \$1,000 for every 4,000 jobs) located within 20 minutes of a residential origin. And paradoxically, people seem to value the opportunity to live away from concentrations of workers (those zones had lower relative home values) even while preferring to work near where they live. Place Rank measures yielded a similar result.

Percentage increase between 1990 and 2000 in number of people within 20 minutes auto travel time of selected Twin Cities destinations





## ACCESSIBILITY – GETTING BETTER OR NOT?

So as researchers tested metrics, what did they find? If the overarching purpose of this research series is to generate reliable ways to evaluate the performance of the transportation and land use systems, then obviously those metrics must track changes over time.

The data generally show that the number of jobs and the number of workers reachable within 30, 45, and 60 minutes of travel time by automobile have increased in almost all the studied transportation analysis zones. In addition, access to special destinations—the Mall of America, or the downtowns, and by even larger margins to the Minnesota Zoo and the airport—actually increased over the study period. Compare these findings then with the now-familiar data showing that motorists in the Twin Cities region experienced more than a 100 percent increase in delays from congested traffic between 1990 and 2000 (from an average of 19 hours annually to 43).

How can one explain these contrasting sets of data? Is it possible that people have gained greater access to destinations they value even while congestion on major roads has become worse? Did transit play any role in this? Research so far shows very little effect from transit, largely because during the period 1990–2000 the only increases in transit service were to downtowns and a few specialty zones.

A better explanation may lie in decisions by employers to move closer to where their base of preferred employees live, just as retailers move to

where people with disposable income live. A look back over the past decade or so shows a marked decentralization of employment locations, with employment becoming increasingly suburbanized. And many households apparently implemented their own relocation strategies to maintain or shorten their travel times.

Just imagine someone electing to commute to work from, say, Burnsville to the Richfield zone where Best Buy’s headquarters now sits. In 1990 that may have

been a 15-minute drive. Congestion, as it has increased, has tightened the circle of jobs within that 15-minute span. But the overall expansion of jobs, along with their steady decentralization, results in more jobs available inside that circle. And while this

first study focused on just jobs and workers, and just the commute trip, and just the automobile mode, the preliminary metrics do seem to suggest that access may increase along with congestion.

Over the course of this research series the remaining elements of a matrix of access opportunities will evolve—covering myriad destinations and modes of travel. This matrix will reinforce the logic that transportation and land use are overlapping, interdependent systems. Meanwhile, this first study by itself breaks new ground and raises a critical if controversial question: whether it is possible to engineer through proactive public policy a steady increase in access to destinations even as every effort is made to combat congestion.

*Is it possible that people have gained greater access to destinations they value even while congestion on major roads has become worse?*

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