

Access to Destinations

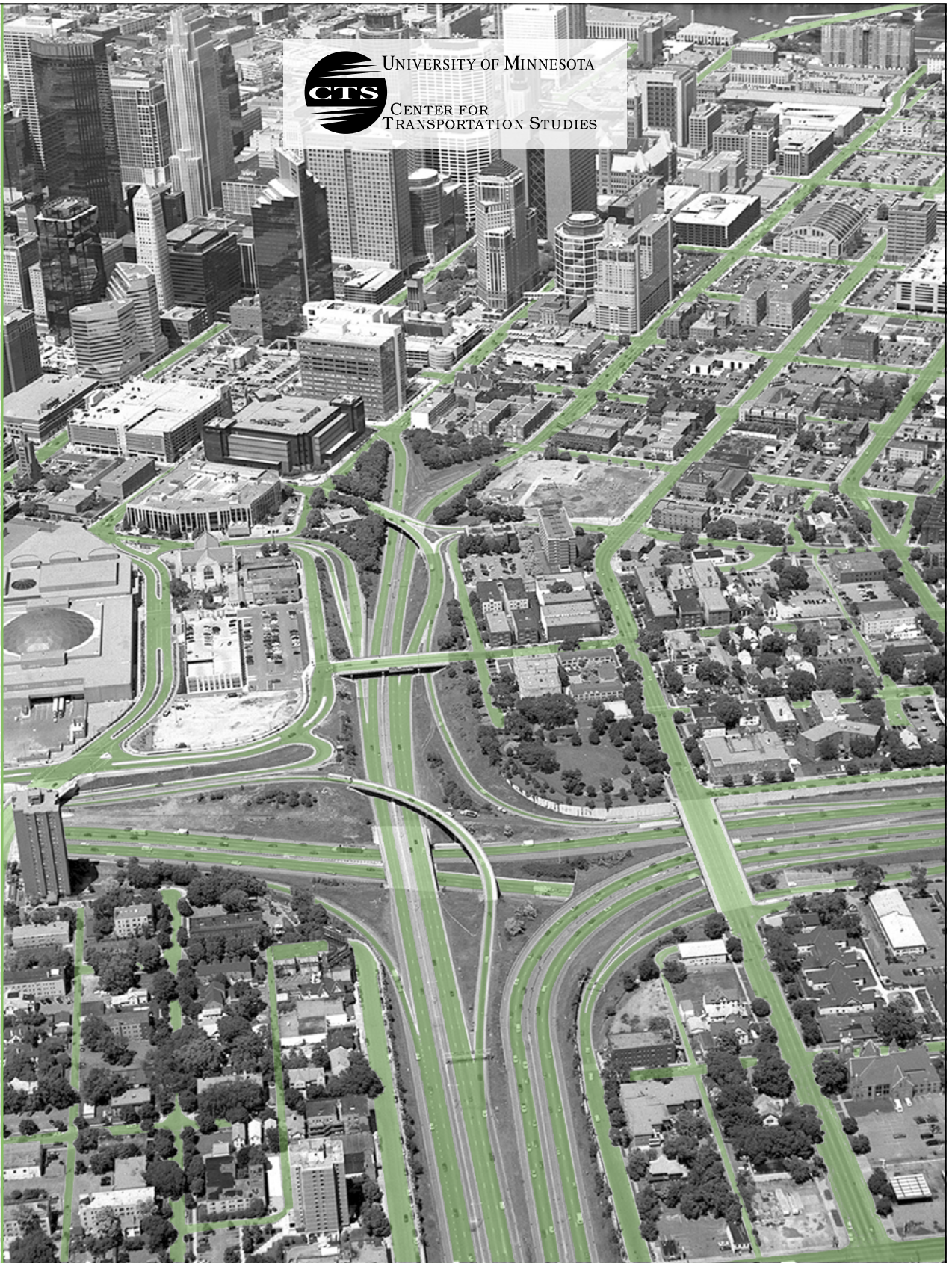
Rethinking the Transportation Future of our Region

Proceedings



UNIVERSITY OF MINNESOTA

CENTER FOR
TRANSPORTATION STUDIES



President's
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In cooperation with:
Center for Urban and Regional Affairs,
College of Continuing Education,
Humphrey Institute of Public Affairs,
Institute of Technology,
University of Minnesota

November 8–9, 2004
Coffman Memorial Union
University of Minnesota,
Twin Cities


Published by the Center for Transportation Studies, University of Minnesota
May 2005

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Design: Elizabeth Wolfe, Cadie Wright

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Access to Destinations: Rethinking the Transportation Future of our Region

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November 8–9, 2004 • Minneapolis, Minnesota

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"The ideas generated from the conference will lead to new approaches and applications that improve transportation."

—Robert Johns, *Director, Center for Transportation Studies*

Introduction

By all accounts, traffic congestion is a growing concern around the country. In 2002 alone, congestion is estimated to have cost motorists roughly \$63 billion in 85 metropolitan areas, or \$829 per person. And in the Twin Cities metro area, congestion has grown at one of the fastest rates in the nation. But is congestion truly the best measure of how well the transportation system is meeting our needs?

A new approach, which looks at the access people have to a range of destinations, is now gaining ground. Researchers from the University of Minnesota and other national and international universities presented their findings in this new field of study at a conference held in Minneapolis November 8–9, 2004.

“Access to Destinations: Rethinking the Transportation Future of Our Region,” was part of University of Minnesota President Robert Bruininks’ 21st Century Interdisciplinary Conference Series. The conference was sponsored by the Center for Transportation Studies (CTS) in cooperation with the Center for Urban and Regional Affairs, the College of Continuing Education, the Humphrey Institute of Public Affairs, and the Institute of Technology.

Welcome and Opening Remarks

Robert Johns, Director, Center for Transportation Studies, University of Minnesota

Robert Jones, Senior Vice President for System Administration, University of Minnesota



Robert Johns

Robert Johns opened the conference with welcoming remarks to the audience of more than 150 researchers and practitioners from around the country and from Europe and Asia. The event, he explained, marks the kick-off of a new University of Minnesota research program studying accessibility in the Twin Cities area. The study, building on the ideas generated from this conference, will translate this knowledge into new approaches and applications that can improve transportation decision making. Assistant professors David Levinson (Civil Engineering) and Kevin Krizek (Humphrey Institute of Public Affairs) are lead researchers in the program, and helped plan and moderate the conference.

He then introduced Robert Jones, who welcomed conference participants on behalf of University president Robert Bruininks. “This is truly an academic conference,” Jones said, “and it will stimulate a new course of inquiry.” An important part of the president’s strategic direction is to develop more ways to take advantage of the many disciplines at the University, bring them together to discover new knowledge, and address the problems of our time. “Another priority for us,” Jones added, “is to strengthen our public role and public service and bring our expertise and knowledge to bear on society’s challenges.” These two strategic directions influenced the president’s decision to set aside resources to develop conferences such as this.

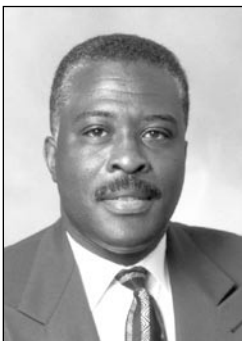
Johns then returned to the podium to explain the background for the conference and set the stage for the upcoming sessions. A previous University of Minnesota interdisciplinary research program—the Transportation and Regional Growth Study—raised questions that this new research will address. One of them is the consistency in individuals’ daily total travel time, regardless of mode, since 1950. During these decades—marked by tremendous land development and transportation investment, along with increased travel speeds and distances—Americans have maintained a “travel budget” of about 70 minutes per day. “That tells you that there are some adjustments going on out there, perhaps on the land use side,” Johns said. “We want to learn more about that.”

In the new study, researchers will develop measures to gauge how accessible a certain area is to destination activities. The outcome, Johns said, will be a set of tools and methodologies that will enable policymakers to evaluate the accessibility of a wide range of destinations using different modes of transportation—whether in a fast-growing exurban community or a downtown area. “But maybe more important,” Johns said, “it will tell us what’s happened between 1990 and 2000, and we hope, beyond. It will also be very helpful for planning future transportation investments.”

Access has been studied for decades, Johns noted, but this research can make a significant contribution, especially by focusing on all modes and by using the much better data and tools we have today.

Academic conferences present many ideas, and not all of them will agree with each other, Johns added. The conference won’t produce the “one right answer” to plan transportation systems or a brand new tool for immediate use. But it will bring forth many ideas and contribute to the literature on accessibility and on transportation and land use. “Those ideas will be built on, further debated, interpreted, and translated, and we think they will lead to new approaches and applications that will improve transportation,” he said. Building this new knowledge is what research universities do best; translating it, applying it, and turning it into practices are often done best by others, he added.

Johns reminded the audience that despite the highly theoretical nature of discussions at academic conferences, the interchange of ideas has the potential to profoundly influence public policy. He then recalled the words of economist John Maynard Keynes: “The ideas of economists and political philosophers [or transportation researchers, Johns interjected], both when they are right and when they are wrong, are more powerful than is commonly understood.” This conference will present a range of academic thought on accessibility, Johns said. “We think over time it will be powerful.”



Robert Jones

Defining the Issues

Moderator: David Levinson, Assistant Professor, Department of Civil Engineering, University of Minnesota

Congestion and its Extent

Robert Bertini, Associate Professor, Department of Civil and Environmental Engineering and School of Urban Studies and Planning, Portland State University

Robert Bertini began the session with some background on congestion: how it is defined and measured, how reliable and accurate these measurements are, and how congestion—and the perception of congestion—has been changing.

The years between 1980 and 2000 were a time of growth in this country, he said. Vehicle-miles traveled (VMT) rose 44 percent; number of vehicles, about 40 percent; population, 24 percent; and real GDP, 90 percent. But the total number of lane miles grew just 2 percent. Since the completion of the Interstate Highway System, he said, “we’re just not adding widespread capacity.”

To better understand congestion, Bertini recently conducted an online survey of transportation professionals around the country. Most defined congestion as either speed/travel time or delay—in other words, “being able to get to my destination in a reasonable time.”

Bertini found, however, that there is no absolute definition of congestion. To some respondents, congestion is anything below the posted speed limit—which means congestion is a perception judged by community standards. “It depends on what you’re used to,” he explained. In Minnesota, for example, freeway congestion is defined as speeds below 45 mph during peak weekday periods. California, however, has defined freeway congestion as an average speed below 35 mph (although there is a proposal to change it to 60 mph), while the Washington DOT focuses on travel time reliability and predictability.

What’s more, just half the survey respondents believe current congestion measurements are at least somewhat accurate; some said congestion measurements are really a “snapshot in time.” Even so, about 80 percent of the respondents agreed that congestion has gotten worse, although some pointed out that it is localized in some cities

and has actually decreased in other places. Others suggested drivers have become conditioned to tolerate more congestion.

Several other factors feed into an understanding of congestion. First is the distinction between recurrent congestion caused by too many vehicles—about half the total—and nonrecurrent congestion due to construction, incidents, and weather. Second, the whole trip must be considered in any calculation, Bertini said, not just the freeway portion, which may be a relatively small fraction of a given trip.

And third, despite the rise in VMT and congestion, journey-to-work time has remained stable, with some typical commutes actually becoming *shorter*. “Total daily travel time has not changed that much over 20 years, and some would even argue over hundreds of years,” he said. Improvements in technology have allowed people to travel longer distances within this time budget.

Although congestion continues to rise on the nation’s highway system, Bertini concluded, there is a difference in some ways between the reality and the perception of congestion, and no general agreement on what congestion is or when it exists. At the same time, he believes environmental awareness means “we’re not able to build our way out of congestion anymore.” One implication of this is that we need new methods to measure system performance. “We can no longer simply evaluate the aggregate effects of road expansion projects, but instead must assess how changes to the system will affect individual users and individual trips. We have to know who is on the congested highways and how and why they’re traveling, the trip characteristics that are important to them, and data to estimate these important trip characteristics,” he said.



David Levinson



Robert Bertini



Rachel Weinberger

Land Use Development and Decision Making

Rachel Weinberger, Assistant Professor, Department of City and Regional Planning, University of Pennsylvania

Rachel Weinberger turned the discussion to the connection between land use development and the location decisions made by firms and households.

In economic theory, firms are thought to locate based on access to three markets: material input, labor, and consumers. This suggests firms will locate closest to the commodity that is the most expensive to move to some hypothetical port or market. Thus, heaviest industry should be closest to the port, followed by commercial districts, then residential areas. Households also look to maximize utility but seek other amenities as well, such as high-quality schools and safe neighborhoods.

What's wrong with this picture? It's quite oversimplified and may even be obsolete, Weinberger answered. Most cities no longer have a single center, which implies the market "has not sorted itself in order to protect residences from the negative externalities of industry." The sorting we do have is based more on zoning than on markets. Still, Weinberger said, the model gives us valuable insight into what the dynamics can be.

And these dynamics are complex. Households often have multiple wage earners at different stages of their lives traveling to different destinations, and they don't move every time someone changes jobs. Joining two households, splitting households, starting a family, buying a home, retiring: these are the main times when people move to another location. Other factors—including affordability and product differentiation—limit their choices.

Given this complexity, some researchers believe the transportation and land use connection may not even be intact, she said. As evidence they point to today's excess commuting that wouldn't be predicted in a standard model, mixed results from large infrastructure investments, and low VMT reduction in alternative land use scenarios. Others believe transportation facilities

are so broadly available that improvements don't influence location decisions, she said, weakening the connection to the "point of irrelevance."

In her recent study of Santa Clara County, California, Weinberger found no advantage from proximity to a highway, suggesting that the complete coverage of the highway system in that area gave no differentiation over other locations. "That's something to think about when we look at what kind of transportation investments we're making," she said.

Other research, though, indicates density does matter. Many price models show there is a premium for rental and sales rates along light-rail transit systems. Weinberger's Santa Clara County research using the same property set showed commercial properties closest to the light-rail system rented at a higher rate than other properties in the county.

In addition, land is most expensive in big cities, a clear reflection of people's demand for and desire to live in that kind of a land use situation, she said. Also, the "New Urbanist" projects have been relatively successful.

And in a different twist, low-density dispersed land patterns are credited by some for the decreased journey-to-work travel time in some areas. If reducing journey-to-work travel time is the key objective, she said, "then that may be a direction to go."

To Weinberger, then, location still matters, and transportation matters. "The more we invest in transportation, the more we facilitate the dispersion of our activities," she stated. "That is a decision we make, and we need to make it an informed way."

The connection between location and transportation also matters. Transportation investments in general will extend the urban boundary and redistribute development. "It also turns out that certain high-capacity infrastructure improvements in the right place can serve in the long run to concentrate development," she said.

Place-based versus People-based Accessibility

Harvey J. Miller, Professor, Department of Geography, University of Utah

Harvey J. Miller began by defining accessibility as a multifaceted concept that centers on an individual's ability to conduct activities such as shopping, education, healthcare, employment, and recreation. It is fundamentally a spatial concept: the ability to be "present" at an activity location. In the past, this meant a physical presence, Miller said. Increasingly, however, accessibility will be a "telepresence" through the use of cell phones and other technologies that allow us to "project our presence virtually and still participate in activities," he explained.

While still viable and useful, place-based accessibility measures are increasingly incomplete, he said, for a number of reasons. First, place-based theory is an aggregate phenomenon that doesn't look at individuals. Thus, it ignores individual activity constraints, even though these constraints at the household level may not be the same for every person who lives there. "This problem becomes even larger the more you aggregate the data," he noted. In addition, place-based theory assumes simple travel (single-stop, single-purpose trips).

What's more, in place-based theory it is difficult to capture the effect of information and communication technologies (ICTs), which are "place-less" to some degree. Perhaps the most profound experience of humanity over the past few centuries, Miller posited, has been the *space-time convergence*, or the collapse of space with respect to travel time due to transportation technologies. Innovations such as the stagecoach, clipper ship, railroad, automobile, and airplane have reduced the amount of time required to be exchanged for a unit of space.

ICTs mean an even more dramatic collapse of space with respect to time, Miller said, allowing essentially instantaneous exchange of information. ICTs also can fragment traditional geographies: they allow some activities to be disconnected from space. "There is no clear connection anymore between work and physical place for more and more people," he said.

At the same time that technologies are changing human activity in space and time, they are also increasing researchers' abilities to

collect and analyze activity data. Geographic information systems (GIS) provide detailed geo-representations, while location-aware technologies (LATs) such as global positioning systems (GPS) provide high-resolution space-time data. "In the next five years we'll see the rise of location-based services provided in real time," Miller predicted. "For example, users will be able to ask their cell phones for the closest café or current public transit schedules."

This increasingly complex relationship between people, place, space, and activities suggests that the place-based approach to accessibility should be enhanced with measures that are directly tied to the individual in space in time. These people-based theories and tools look at the "where and when" of people and activities, Miller said, and focus on the constraints on activity participation.

Miller has been working on the mathematical foundation for *time geography*, a major theoretical framework for conceptualizing people-based accessibility. "It answers a simple question," Miller said. "How does being in this place and time affect my ability to be in another place and time?"

The existence of *fixed* activities—which may include work and many types of family activities such as sleep and child care—means that individuals have a limited time budget to allocate among *flexible* activities, such as shopping or recreation. In time geography, the combination of *space-time anchor points* (fixed activity locations and durations), the time budget, and the ability to trade time for space using technologies, determines an individual's accessibility to resources and opportunities.

Preliminary empirical results indicate that people-based measures provide different portrayals of accessibility than place-based measures, Miller noted. However, additional research and development is required to provide practical people-based accessibility measures for researchers and practitioners.

A strong privacy advocate, Miller also called for spatio-temporal masking of data to protect individual privacy.



Harvey J. Miller

Policy Alternatives and Their Effectiveness

Moderator: Kevin Krizek, Assistant Professor, Urban and Regional Planning, Hubert H. Humphrey Institute of Public Affairs, University of Minnesota



Kevin Krizek

Capacity, Operations, and Demand Strategies

Jonathan Gifford, Professor, Public Management and Policy, George Mason University School of Public Policy.



Jonathan Gifford

Congestion is nothing new, Jonathan Gifford began, nor are attempts to solve it. Urban areas in the early 1900s saw an explosion of congestion with the arrival of the auto, and proposals to increase capacity followed. By 1939 the federal government proposed a vision for a nationwide system of metropolitan highways to deal with urban congestion.

The postwar boom and rising demand for autos culminated in the Interstate Highway Act of 1956. The act's planning philosophy was simple: predict and provide. "The notion was, let's forecast traffic for 20 years and then build a system to accommodate that," he explained.

In urban areas, the design philosophy was to build high-speed highways, reflecting the system's need to serve both interregional and local needs. High speeds require long acceleration and deceleration lanes, which are valuable for long trips, Gifford said, but less valuable for short trips—which constitute most traffic in these areas (90 percent plus).

The act, then, added capacity but did not solve the congestion problem. Traffic soon exceeded forecasts substantially in most situations, and since the system's length was fixed in law, the response was to increase the number of lanes. "The consequence was intense," he said, "and because many facilities had been located disproportionately in poor and minority areas, we got the predictable backlash that we are all so familiar with." This led to landmark legislation forcing policymakers to consider alternatives to expansion, historic preservation, and environmental quality.

Today's efforts to increase capacity fall into two main categories: transportation demand management (TDM) and improved transportation operations, Gifford said. TDM is a "basket of tools and policies" that can include value pricing, ridesharing, park and ride, high-occupancy vehicle (HOV) and toll (HOT) lanes, employee commuting incentives, telecommuting, and more.

In 2000, roughly 1,200 HOV lanes nationwide provided 12 percent of commute trips, down from 19.7 percent in 1980. There has also been a big decline in large vanpools, but recent growth in three- to four-person vanpools. Overall, however,

there is limited national data on the effectiveness of TDM, Gifford said.

Selected case studies shed some light on TDM effectiveness and trends. In a Central Puget Sound study of 14 TDM measures, the most effective were found to be parking pricing and infill and densification. HOT lanes are helping to keep lanes free flowing in Los Angeles and San Diego and are under consideration in Washington D.C. and Minneapolis. And London's implementation of congestion charging has meant 60,000 fewer car trips/day, traffic delays down 30 percent, and reliability up 30 percent.

Gifford defined transportation operations as better incident detection and better response to planned and unplanned events (crashes, breakdowns, weather). It has been made possible in the last the 15 years thanks to technology improvements in detection, cell phones, and communications systems.

On surface streets, it also involves better signal coordination of real-time traffic conditions among many organizations. "When you have this technical capability, you suddenly realize how many cats and dogs are involved in the transportation operations business," he noted. Getting city, county, state DOT, police, fire, and emergency medical to collaborate effectively is a big challenge, he said, and regional partnerships are emerging as the best response.

What have we learned over the years? First, Gifford said, congestion arises primarily from affluence and is not entirely a bad thing: "Chernobyl has no congestion." People choose to live and work in areas where they experience congestion on a daily basis. If they are willing to avoid congestion through strategies such as toll lanes, he suggested, "we might be better off if we gave them that choice."

Also, governmental units don't match the scale and the scope of our functional problems. This is not surprising, Gifford believes, and we should learn to live with it, because these structures are designed to last forever while our technical and policy problems are transient. "Collaboration strategies may be more appealing than trying to come up with a new government approach," he advised.

The Transportation–Land Use Policy Connection

Gerrit-Jan Knaap, Professor, Urban Studies and Planning, and Executive Director, National Center for Smart Growth Research and Education, University of Maryland

The central question is this, Gerrit-Jan Knaap began: Can land use *policy* be used to alter transportation behavior? This is an important concept because if so, then land use policy can be used to address the complex transportation problems facing metropolitan areas. If not, then land use policy may still be important, but it is of little use for addressing transportation problems.

To answer this question, Knaap said, it is necessary to look at three underlying conditions: Does transportation infrastructure affect land use? Does land use affect transportation behavior? And third, does land use *policy* (e.g., regulations, incentives) significantly affect land use? “The last point is the main focus,” he said.

Research into the first question has focused on two areas: whether transit stations spur transit-oriented development, and if new highways produce sprawl. According to leading authorities, Knaap said, transit can be important, but it is not the only factor in development. Likewise, road building can cause sprawl, but *not* building roads may not prevent sprawl. It seems clear, Knaap summarized, that both highways and transit can have land use impacts, but both effects are conditional on other policies.

Second, does land use affect transportation behavior? There remains considerable debate, Knaap said, but there does appear to be a trade-off between high-density urban living and automobility. Thus, it appears possible to design neighborhoods in ways that reduce automobile travel. “Still, the effects are marginal and may lead to greater congestion and air quality degradation,” he cautioned. “What’s more, there are many who would choose not to live in such environments even if forced to bear the full social costs of driving a car.”

This sets up the third condition: the land use policy–land use connection. Knaap reviewed three approaches: land policy “regimes” (e.g., governance frameworks and private property rights), regulations such as zoning and urban growth boundaries, and incentives.

In market economies, transportation technology determines accessibility, which determines density. The higher density land closer to city centers is the most expensive—in other words,

where accessibility is high, land prices are high, and urban densities are high. Regimes that rely on these market forces rather than on more “invasive” planning are better able to coordinate land use with transportation, Knaap said. “Land use policy regimes can and do make a significant difference.”

Specific policy instruments provide further evidence of this, Knaap said. Zoning has been shown to have significant effects on land markets and land allocation, but it can only limit, not stimulate, density. In Portland, for example, transit corridors are zoned for high density, yet excess development capacity remains along them.

Urban growth boundaries can serve as an effective tool for framing metropolitan planning, but also have limited ability to increase urban densities. Subdivision regulations, on the other hand—such as road width and connectivity, setbacks, and sidewalk requirements—can affect street network patterns at the neighborhood scale but not at the regional scale.

The effectiveness of incentives—a common vehicle of “smart growth” approaches to land use planning—is no more encouraging, he said. While markets appear to react to such plans, the reaction is typically small. One example, in Maryland, created priority funding areas to encourage residents to live near their jobs. For a variety of reasons, these incentives have not yet worked well: the subsidies are too small relative to housing prices, plus the state has faced a budget crunch and changed administrations.

So can land use policy be used to shape transportation behavior? Yes, Knaap answered, but with several qualifications:

- Supportive land use policy is a necessary but not sufficient condition.
- Markets have an important role to play.
- Local land use policies are often counterproductive, and our institutions are not well suited to the problem we face. Success at the regional scale will require regional institutions with the capacity to design integrated land use and transportation plans and the regulatory capacity to assure their implementation.



Gerrit-Jan Knaap



Randall Crane

Accessibility Strategies

Randall Crane, Director, Institute of Transportation Studies, University of California-Los Angeles

Auto travel is increasing faster than population growth, and suburbanization, sprawl, and car subsidies are to blame. This is a common argument, Randall Crane said, but is it true?

Common sense and some previous research indicate that more roads and “mobility” do not relieve congestion, but “accessibility” (i.e., increased densities and transit access) does, for several reasons: induced demand fills up roads as fast as they are built; higher residential densities reduce car ownership, trips per person, and VMT per person; and transit-oriented development and mixed land uses increase transit use, reduce parking, and reduce VMT.

But, Crane countered, we don’t know two key research questions: Will accessibility reduce VMT, and will accessibility shorten commutes?

Regarding the first question, Crane said unresolved modeling issues limit the credibility of earlier work. “The problem with that research is that empirical strategies for estimating and evaluating the impacts of accessibility on travel behavior were primitive,” he asserted; these approaches also did not take into account variables such as pedestrian friendliness and demographics.

Because of these limitations, Crane said, a new research strategy was needed to understand how each neighborhood and community design feature, along and in conjunction with others, influences travel behavior. This strategy would model travel demand but make the built environment explicit.

Using such an approach, Crane recently studied accessibility and found that compact development, mixed uses, and open circulation patterns do reduce the length of a typical trip. “But shorter trips are taken more often, so VMT could rise—or fall,” he said. If the cost per trip falls, individuals make more of them. Thus, “there is no clear evidence that higher densities will systematically change travel patterns beyond increasing congestion,” he said. Results must be determined empirically on a case-by-case basis.

Mode choice evidence is also complicated, with countervailing forces, Crane said. “Evidence that compact development or transit-based housing improves [transit] ridership at the margin is weak.”

The conventional wisdom for the second question—Will accessibility shorten commutes?—is that people are driving more hours because of sprawl. However, Crane said, there is little evidence to show if houses and jobs are growing farther apart or which industries and occupations are dispersing most.

In the traditional monocentric model, suburban workers drive further to reach centrally located jobs, but today many jobs are suburbanizing. Individual commutes are a function of household demand/supply factors (e.g., resources, dual earners, travel costs, tastes, etc.), plus regional employment deconcentration and individual occupation and life-cycle factors.

Using survey results from across the country, Crane’s research found that the more employment was decentralized, the *shorter* (in distance) the commute was. What’s more, job sprawl is not as simple as it seems but varies with industry: the commute is shorter for construction and wholesale jobs but has grown for manufacturing and government jobs and stayed the same for retail and service.

Regarding commuting, then, there are no definitive answers. “There is some support for the argument that both firms and workers value shorter commutes and locate accordingly,” Crane said, “but results differ by industry. We need better detail on employment sprawl.”

In summary, Crane said, “built-environment measures of accessibility certainly influence transportation behavior, but we do not have confidence about the details.” The uncertain impact of higher densities on total travel, mode choice, congestion, and air quality, he argued, “makes it courageous to make strong policy recommendations.”

On a positive note, better data and better empirical methods in understanding the interaction of urban design and transportation are on the way. “In the mean time, one-size-fits-all accessibility strategies are wishful thinking,” he concluded.

Implications for Practice

Moderator: Robert Johns, Director, Center for Transportation Studies

Panelists: Lance Neumann, President, Cambridge Systematics; Steve Lockwood, Vice President, PB Consult; Alan Pisarski, independent consultant

This session, featuring three nationally known transportation experts, began with reactions to the morning’s presentations.

Lance Neumann said the presentations convinced him “we can’t build our way out of congestion, or operate out of congestion, or change travel behavior to get out of congestion, or most discouraging of all, shape land use or regulate to get us out of congestion.” Where does that lead us? If the congestion problem can’t be solved, accessibility should become the focus instead.

He then posed a number of questions to consider: Can we get more productivity out of the transportation system, and if so, does that help or hurt in terms of land use and the kinds of communities we want to create, and the kind of activity patterns we want to have access to? Is it possible to coordinate transportation and land use policy, and if so, in what direction do we want to influence it? Where do other values come in, such as the sense of community, the environment, and social equity? A choice of options is good—but at what cost, with what range of options, for whom? Is the market a better way to reach our goals?

Two themes need more focus and attention, Neumann said. First, to what extent does the private market provide opportunity or represent constraint? And second, what are the implications of the huge demographic change as the baby boom generation retires, and are we able to respond?

Steve Lockwood said three top-level issues impressed him: first, how little is known about congestion and sprawl and how slowly research in this field has moved ahead, perhaps reflecting a scarcity of research funds. “The state of practice is still primitive on informing decision makers on a reasonable basis,” he said.

Second, it’s very difficult to subtract the influence of “value-loaded” terms from the dialogue. While congestion and sprawl are considered pejoratives, some of the phenomena in metropolitan areas can actually be defined in less normative terms. “I always wonder if underlying the dialogue is a nostalgia for a past that never was—the village of the 1950s,” he mused. Third, while we can’t build our way out of congestion, transportation management tools can help improve reliability. In addition, many of the traditional assumptions about the relationship between land use and personal behavior are

being “dissolved or modified or complexified by technology,” he noted. “That’s an extremely important feature we’re only beginning today to truly understand.”

To Alan Pisarski, the most important part of the morning was hearing these terms used objectively, “with the respect they deserve. It is immensely important that we do so,” he said.

He also stressed the need to understand “the immense power of affluence” in the future. Affluence is strongly related to mode choice, vehicle-miles traveled, trip generation, and trip length. “It’s critical to recognize that all these things don’t operate in a rarefied atmosphere—they operate very directly at the level of human purposes,” Pisarski said. “We need to recognize human purposes.”

The preferences of skilled workers will also become a key factor, and Pisarski predicted a shortage of workers and too few commuters. “Where [skilled workers] want to be, what their interests are, and how we serve them, will be central to how we operate in the future,” he said.

Moderator Johns then asked the panelists to share their implications for practice.

Focusing on broad national policy, Lockwood said that to a certain degree, the transportation and land use nexus is too complex for strong policy initiatives. “We don’t know enough to take aggressive action even if we could, and we’ve learned actions may have marginal impact on these problems.”

In the short term, he believes better traffic management can reduce the impacts of congestion. About half of congestion, he said, is due to incidents, construction, and weather. “There is an enormous potential for wringing a substantial portion of the unreliability out of existing systems and making congestion more bearable.”

In the long term, technology is providing many substitutes for the need for place-to-place access. “Much of the access issue may in fact be dissolving under the impact of information and communication and technology,” he said

Lockwood also stressed the need for some kind of pricing to “unleash the market when it comes to people understanding the true costs of their behavior, whether in [land] development or transport.” And while it is important for researchers to think globally about these issues,



Robert Johns



Lance Neumann



Steve Lockwood



Alan Pisarski

regions must think locally to find accessibility strategies that work for them. “What works in Los Angeles may not work in the Twin Cities,” Lockwood said.

Pisarski said it is important to see if system performance matches the users’ perspective. “They are not necessarily the same thing,” he explained. “There are times when the system is doing very badly and the people are doing just fine, so we need to recognize that and integrate it into public discussions.”

While Neumann agreed that demand strategies can wring more operational efficiency out of existing systems, he believes some land use policies, in some cases, can have an impact, and some areas will invest in new capacity. So the question isn’t which strategy to use—since all strategies will be considered—but what is being accomplished in terms of system performance, people performance, and economic performance. “You can have a lot of investment in transportation and a lot of land use regulation and observe five years later similar or worse congestion and yet be in a much stronger economic competitive position, supporting a much broader and larger array of people as well as goods movement—and that may be a very good thing.”

All the tools have a place, Neumann continued, but the effectiveness of different strategies is going to vary widely from place to place, based on current circumstances, infrastructure, geography, institutions, and financing. “There are no national prescriptions or ability to generalize,” he said.

Johns then asked how the accessibility concept could influence transportation agencies as they plan new investments and facilities.

Pisarski suggested two possibilities. One is that accessibility terminology could be used to help communicate with the public, perhaps to describe the effects of new capacity or other alternatives. The second option would be to introduce accessibility into the planning process more directly. For example, agencies could set accessibility performance goals, such as a percentage of residents that could reach a hospital within a certain time. “Those kinds of accessibility rules, even if you don’t meet them, give the public and legislators a metric,” he said.

Neumann said different levels of government must maximize the leverage of significant

capacity investments by carefully managing access not just on trunk lines but on local roads as well. New mainline capacity affects the whole network, he noted.

Lockwood urged that new facilities be designed and constructed with new technologies to permit operations management in real time. “Too often we add lanes without thinking where technology is going.”

One of the ways this relates to accessibility is that real-time roadway data are close at hand. This will allow service providers to give travelers trip-specific information 24/7, most likely by turning every vehicle into a “probe,” Lockwood said. New vehicles will be equipped with communications capability and tracked in real time, allowing DOTs to monitor speed, delays, and problems on the entire roadway network. “We’ve been talking about it as sort of science fiction for as long as I can recall, but there is active dialogue between the USDOT and states and the six major auto manufacturers to bring it about in the next decade,” he said. Mn/DOT is very much involved in these conversations and is likely to be an important leader, he added.

An audience member then asked the experts to name the biggest myth that planners and engineers could put aside.

To Lockwood, it is that the relationship between transportation and land use is simply a “two-variable problem solved by building transportation or designing a land use scheme.”

The important issue to Pisarski is the sense of disapproval of what the American public wants. The attitude of some professionals, he speculated, is that the public doesn’t “want what we want them to want.” Americans are pretty good at knowing what they want and acting in their own best interests, he argued, and we need to understand that better and respect it more.

Neumann said the biggest myth is that either transportation or land use policy will have a substantive impact on economic trends and conditions. “If we are smart planners,” he said, “we will spend a lot of time understanding the... market, and plan with respect to it.”

Noting that the U.S. population grows by 30 million every decade, Pisarski added one more myth: “The notion that transportation investment is done is ludicrous.”

Technical Sessions

Following the half-day of public sessions, invited attendees took part in a series of six technical sessions where researchers presented their recent work on accessibility. These sessions included discussion and debate on topics ranging from methodologies for measuring accessibility to guidelines for the development of sustainable transportation systems. The research papers presented during these sessions will be incorporated into an academic conference proceedings.

Frameworks

Moderator: Tom Scott, Director, Center for Urban and Regional Affairs, University of Minnesota

The Frameworks session provided an opportunity to compare and contrast different theoretical approaches to the study of accessibility. This discussion highlighted several challenges facing accessibility researchers and suggested possible applications of accessibility analysis to current debates on land use and transportation funding debates.

Planning for Accessibility: In Theory and In Practice

Susan Handy, Associate Professor, Environmental Science and Policy, University of California-Davis

Susan Handy's presentation focused on framing the issue of accessibility vs. mobility in transportation planning. She noted that the terms "accessibility" and "mobility" appear in many regional transportation plans today, often without definitions or any way of differentiating between them. Handy said she believed that the two words indicated very different concepts that have different implications for planning; she explored this issue by evaluating several regional transportation plans from the San Francisco Bay area.

To understand the theoretical difference between accessibility and mobility, Handy referred to the definition used by Walter Hansen in his seminal 1959 paper, "How Land Use Affects Accessibility," in which mobility is defined as the potential for movement and accessibility is the potential for interaction; Handy expanded "interaction" to include the ability for people to get what they need, without being restricted to a single mode of transportation. She pointed out that it is possible to have good accessibility without good mobility in cases where people do not have to travel to get what they need (as explained in Harvey Miller's presentation during the public sessions); likewise, good mobility with poor accessibility can be seen in situations where freeways are free of congestion, but people are unable to satisfy their needs by driving, due to restrictions on when activities are available.

Handy defined the issue of accessibility vs. mobility in transportation planning as follows: in most places in the United States, accessibility depends on mobility, and mobility in turn depends on the automobile. This situation has equity implications for those who are unable to own cars

or drive, as well as quality of life implications for drivers. For the past several decades, Handy continued, we have been planning for mobility instead of accessibility—focusing on the means, rather than on the end. This focus on mobility, making it easier and more necessary to drive, has opened the door to greater amounts of travel and higher levels of congestion, creating a cycle in which we are forced to continually plan for mobility and expand the capacity of the road system.

As an alternative, she proposed planning for accessibility, focusing on the end rather than on the means. Essentially, this approach would focus on planning for the needs of the people, rather than on the needs of the system. The goal should be to maximize human interaction and the satisfaction of needs, rather than to maximize the ability to travel. In Handy's view, such an approach would help encourage alternatives to sprawl, but would require the development of new performance measures and tools in order to be implemented.

In the second part of her presentation, Handy offered an analysis of four regional transportation plans from around the San Francisco Bay area. In general, she found that accessibility had not replaced mobility, but appeared to be an additional area of concern, demonstrating a widespread recognition that the two concepts could be compatible in planning. Although accessibility and mobility appeared in all four plans, her analysis uncovered significant inconsistency between plans in how the terms were used. She concluded that this reflects a fundamental problem for planners: absent an understanding of the distinction between accessibility and mobility, planners may be trying to achieve different and

Accessibility and mobility are distinct concepts that have very different implications for planning.

Location-based measures are just one part of an accessibility framework that considers the ability of individuals to access a variety of activities.

conflicting goals within their planning documents. A clear understanding of the different planning implications of accessibility and mobility, she

concluded, should result in more effective transportation plans.

An Accessibility Framework for Evaluating Transport Policies

Frank Primerano, Research fellow, and **Michael Taylor**, Director, Transport Systems Centre, University of South Australia

Frank Primerano described an experimental framework for accessibility analysis, which he used to evaluate the effects of a new highway constructed near Adelaide, Australia in 2000 to connect the city with surrounding suburbs. His goal in developing the framework, he said, was to create policy-sensitive accessibility measures based on models of the travel patterns of individuals.

Regarding the best way to define accessibility, Primerano stressed the necessity of moving away from strictly location-based measures to include the access of individuals to activities. Location, he said, should not be discounted entirely, but rather seen as part of a bigger picture; accessibility measures should consider differences between individuals and between the activities they are accessing, the properties of locations where the activities take place, the transportation network that connects them, and the impact of time on accessibility. The benefits of using an accessibility framework, Primerano said, included bringing together the strengths of different accessibility measures, and using those strengths to compensate for the measures’ individual weaknesses. He described the incorporation of topological, spatial, temporal,

behavioral, and consumer-surplus measures into the framework.

Primerano described how his framework, based around several behavioral choice models, is designed to reflect impacts of transportation choices or constraints, such as available modes of transportation, on the activities available to users. Data were derived from a metropolitan Adelaide household travel survey conducted in 1999, as well as several spatial data sets for land uses. Primerano developed what he termed “accessibility webs” to examine how the new highway changed area residents’ ability to access various types of activities, including education, shopping, and recreation.

In future work, Primerano said that considering safety benefits and incorporating qualitative data such as a stated preferences survey would be important components. He also hoped to use more sophisticated models of behavior than the current discrete choice models (multinomial and nested logit models), because they are fundamentally limited in their ability to realistically model travel behavior. However, he said that more sophisticated models made it difficult to generate inclusive values that show the benefits accruing from different travel choices.

Accessibility and Freight: Transportation and Land Use—Exploring Spatial-Temporal Dimensions

Clarence Woudsma, Associate Professor, School of Planning, University of Waterloo, Canada, and **John F. Jensen**, University of Calgary, Canada

Clarence Woudsma’s presentation shifted the focus of accessibility analysis from movement of people to the movement of goods. His research, he said, was motivated by trying to understand the development of Calgary, Canada’s fifth largest city, over the last 100 years. Woudsma and collaborator John F. Jensen examined connections between accessibility measures and land use, exemplified by the location of freight and logistics businesses.

Woudsma and Jensen hypothesized that freight and logistics firms would tend to make location decisions as a result of several considerations:

they would seek to maximize their access to all points within a city, because demand for their services is spatially dispersed; at the same time, as part of global supply chains, they also require good accessibility to external markets and suppliers; in addition, they need to locate where they can access a sufficient labor pool. Location decisions based on these accessibility criteria, the researchers thought, would shape the land development patterns of the urban area.

Woudsma’s research methodology involved the construction of transportation system variables that reflected the influence of congestion

on accessibility and the responsiveness of a development intensity measure to these variables. Average weekday traffic volumes on major routes, in conjunction with detailed information on link characteristics, were used to establish the relative accessibility of locations identified by parcel or by grid area. This framework allowed the researchers to analyze spatial and temporal relationships between land development and

transportation system performance.

The analysis showed that distribution and logistics development patterns have a significant relationship with traffic conditions five to 10 years in the past. This result in turn suggests that it may be possible to get a sense of future land use patterns by looking at current accessibility conditions.

Discussion: Frameworks

Speakers: Ann Forsyth, Director, Metropolitan Design Center, University of Minnesota, and Jonathan Gifford, Professor, Public Management and Policy, George Mason University School of Public Policy

Ann Forsyth, director of the University of Minnesota Metropolitan Design Center, said the papers raised and refined several issues related to accessibility, including the difference between accessibility and mobility; how accessibility can be different for different types of activity; and the importance of understanding accessibility for the movement of commodities as well as for people.

Forsyth identified several points of connection between the presentations and papers, including:

- The idea of thinking in terms of access to what the individual requires, i.e., activities—which is not necessarily the same as mobility or travel.
- Access to activities by preferred travel mode, and the importance of having options to use different modes that can serve different personal and public interests.
- The possibility of going beyond conventional one-to-one accessibility relationships, as in cases where a single activity is split across multiple locations, or one location serves multiple functions, making the relationship between accessibility and mobility more complex and idiosyncratic.

Jonathan Gifford began his remarks by pointing out difficulties in identifying the destinations to which individuals and groups require access. Mobility, he said, is a “neat and orderly” concept because it can be easily observed, and it is not necessary to understand the purpose of the movements that are observed. In measuring accessibility, on the other hand, researchers have to ask what factors are motivating the travel they are observing. Gifford said this brought to mind the work of William Whyte on mechanisms underlying the formation of crowds.

In addition, Gifford commented that “access when open” was an important issue when dealing with commercial activities and users. Regulations

and social norms play a part in this issue, he said, offering the example of Berlin a decade or more ago, where opening hours of different types of stores and businesses were strictly regulated by the government, and this in turn affected accessibility patterns.

Turning to the specifics of each paper, Gifford posed the question of whether different outcomes really emerged from using plans that were more focused on accessibility rather than mobility. He stressed the importance of the coding scheme used to identify accessibility-related measures and outcomes in both Handy’s and Primerano’s work. He agreed with Primerano that figuring out how to move from research analysis to the development of a useful tool for planners is a big challenge. On Woudsma’s work, Gifford expressed surprise at the time dynamics (lag) discovered in the analysis, because of the emphasis on strategic thinking in the commercial logistics sector. The effects of truck traffic generated by freight and logistics firms on the levels of congestion and delay in the road network, he said, were also worthy of further study.

The first audience member to offer a question for discussion was Thomas Gladwin of the University of Michigan, who asked whether it was possible to have a valid framework for understanding accessibility absent a consideration of natural resources issues and sustainability, and pointed out that he “hadn’t heard the phrase ‘climate change’ all day. He used the Minneapolis-St. Paul metropolitan area as an example, asserting that the area is currently operating beyond the carrying capacity of its energy resource base and beyond its capacity for environmental absorption of carbon.

Woudsma responded that he had addressed environmental issues in relation to freight transportation explicitly in earlier work, and that

Measuring accessibility requires us to ask what factors are motivating the travel that we observe.

sustainability is at the heart of his research on freight transportation. Understanding the location decisions and activities of freight businesses, he said, will make it possible to plan for smart growth and increased efficiency not only in the sense of reducing costs but of reducing environmental impacts to sustainable levels.

Handy said that her key point about how accessibility in America is mobility-dependent, and mobility in turn is automobile-dependent, implicitly addresses the issue of sustainability. If accessibility as we are providing it today is not sustainable, she said, we should think about other ways of providing it.

A second audience member asked the panelists to comment on the phrase “too much accessibility,” which she had noticed in the morning presentations as well as the current technical session.

Primerano explained that in his view, there has to be a balance between accessibility and environmental impacts, so that overall transportation system use does not reach unsustainable levels. Handy pointed out that there are ways in which providing accessibility can increase travel; her own work has found situations in which having more activity choices results in people traveling more to take advantage of those choices. The issue of how to distribute accessibility, she continued, is also important; rather than any individuals or groups having “too much” accessibility, she suggested that the issue should be understood as certain people or groups having more accessibility than they need, while others lack accessibility.

Gifford, building on the explanation given by Primerano and Handy, suggested that the issue could be thought of in economic terms

as a question of rivalrous or non-rivalrous consumption. Is accessibility rivalrous or non-rivalrous, he asked, observing that some types of access (such as access to large, empty spaces) are definitely rivalrous in the sense that an individual’s ability to access such a resource impedes the ability of others to access it.

A third audience member questioned how much, given the different options available to them, individuals actually think through accessibility issues before setting out on a trip to a selected destination.

Woudsma, in a position he described as “perhaps overly cynical,” stated that, in his experience, individuals seldom if ever thought about how long it would take to get somewhere—as in the case of his own family, he said, who simply “schedule our lives around the activities we want to do.”

Forsyth noted that all the papers presented had touched on the fact that individual variations and preferences have a strong impact on accessibility, and that these factors had not yet been incorporated into models for analyzing accessibility.

Gifford added that he was aware of recent work in psychology on the cognitive processes of way-finding, based on the notion of finding a “satisfactory” route rather than identifying the optimal route. This approach, he said, factors in the cognitive costs of finding better information and results in people tending to go with the familiar route unless it is identified as unsatisfactory. He suggested that much interesting work in the area of individual preference is still waiting to be done.

Finance

Moderator: Peggy Reichert, Director, Statewide Planning and Analysis, Minnesota Department of Transportation

The Finance session featured a discussion of several alternative approaches to financing transportation improvements, with a focus on increasing accessibility and equitably allocating the costs of transportation systems.

Transport Funding and Justice

Dave Wetzel, Chair, The Labor Land Campaign, England

Dave Wetzel's presentation focused on the potential of taxing land ownership to finance transportation improvements, an approach that he asserted would be more equitable than taxing property investments or business operations. Taxing the value of land directly, Wetzel said, would discourage speculation on empty or unused parcels, and encourage development. Wetzel stressed the connection between land value and transportation improvements, saying that transportation systems actually add value to property. As an example, he cited the Canary Wharf development project in the Docklands of London, England, where 60,000 people work; without the public money invested in transportation serving the area (including roads and light rail), he said, it would be impossible to get a tenth of that number into the area each day.

The work of Nobel laureate economist William Vickery, Wetzel said, also supported the idea

of land pricing. Wetzel noted that Vickery is well known for supporting the idea of road use pricing as a way of maximizing the efficiency of road use; however, Wetzel said, Vickery also supported taxation of the land surface to pay for public improvements such as transportation infrastructure. Wetzel also examined the theory of rent developed by David Ricardo, in which rent (or taxes) imposed on a parcel of land are based on the parcel's value, as determined by intrinsic characteristics such as agricultural fertility. Wetzel argued that the accessibility provided by publicly constructed transportation systems adds economic value to land parcels, and this added value should be taken into account when determining how the parcels are taxed; revenue generated through such taxation, in turn, serves as a source of funding for constructing transportation systems and other necessary utilities.

The Calculus of Congestion Pricing

David King and Mike Manville, University of California-Los Angeles

David King countered that land values are "not the place to get the money" for transportation system financing. Instead, he said, the highway system itself should serve as a source of revenue through the mechanism of congestion pricing. King's presentation focused on new approaches to implementing congestion pricing, aimed at overcoming the political obstacles that have hampered the practice by turning municipalities into congestion-pricing "champions."

Although congestion pricing is widely recognized as a good solution for improving the efficiency of highway use, King said, congestion pricing projects are often derailed by objections centered on opposition to paying for road use. However, he said, this political opposition could be overcome by a politically motivated entity with a legitimate claim to the revenue generated by the pricing scheme.

King outlined previous work by transportation researchers focused on finding ways to make congestion pricing more politically palatable by distributing the revenues. However, he said, this

strategy does not create an advocacy group to fight for congestion pricing. King stressed the need to change the debate surrounding congestion pricing from a question of who will be affected by having to pay, to a question of "who wants the money" that congestion pricing can generate. This change could be effected by identifying a group or entity with a legitimate claim to the revenue generated by congestion pricing.

Drivers, he said, have been suggested as a potential claimant group, via mechanisms that return excess revenue generated by pricing to road users. However, King said, drivers are not a viable claimant group for several reasons: they are dispersed and politically unorganized, and the dispersal of benefits among the extremely large population of drivers does not create an advocacy group. In addition, he said, drivers' justification for receiving revenue is weakened by the fact that they are already enjoying a benefit from congestion pricing in the form of reduced congestion and delay. Instead, King said, the cities through which freeways run are

suitable recipients for revenue from congestion pricing: they are politically organized, and they bear many of the costs associated with traffic congestion, including loss of the land on which freeways are built, concentration of air and

noise pollution along freeway corridors, and the presence of a locally unwanted land use that disrupts neighborhood communities and street networks.

Potential for Rail Infrastructure Funding from Associated Land Value Uplifts in Dublin, Ireland

James Muldowney, Legal Planning Advisor, Dublin Transportation Office, Ireland

James Muldowney remarked that while he agreed with many of the ideas put forward by Dave Wetzel, he thought it unlikely that they could be implemented. Muldowney’s presentation outlined finance strategies used in Dublin, Ireland’s, regional transportation planning process.

Ireland, and in particular the capital city of Dublin, has experienced significant economic and social changes in the past 10 to 15 years, Muldowney said. Rapid economic growth has contributed to greatly increased levels of congestion, placing new demands on the transportation system. Automobile ownership is now much more common than it had been previously. Although Dublin has a highly concentrated central area, the city is subject to sprawl as surrounding areas are quickly developed. Finally, recent changes to the Irish constitution opened up new possibilities for financing transportation improvements. These factors were taken into account in developing a new regional transportation plan for the Dublin area.

The plan, he continued, involved two prongs: infrastructure provision and demand management. In addition, the plan included a section on land use that has come to the forefront. Financing for transportation improvements included contributions from land owners, based on the principle that land in close proximity to improvements such as rail stations were likely to

experience significant land value uplift; therefore, Muldowney asserted, it was reasonable to expect those who benefit the most from infrastructure improvements to make a reasonable contribution to infrastructure costs. He described the result as a “win-win scenario” in which developers and society both benefit, and noted that the Dublin plan excluded benefits to existing development, and only attempted to recover costs that applied to new development.

Muldowney gave an overview of the key tests for an effective contribution scheme, as developed by the Dublin planners. These included provisions for maintaining accountability and transparency in collecting and using funds, as well as predictable methods for determining contribution amounts, and benefit tests to determine benefits to property developers.

Muldowney pointed out what he called an “economic fallacy put forward by vested interests” in opposition to financing strategies such as the one used by Dublin: that costs imposed to pay for improvements will eventually be passed on to buyers. In fact, Muldowney asserted, every developer seeks to maximize profits by selling units at the maximum feasible price, regardless of internal costs; internalization of infrastructure contributions at an early stage of development, he said, means that contributions will not have an inflationary effect.

Discussion: Finance

Discussants: Randall Crane, Director, Institute of Transportation Studies, University of California-Los Angeles, and Steve Lockwood, Vice President, PB Consult

Randall Crane commented that the three presentations exhibited many similarities, especially their focus on combining efficiency and equity issues. All three considered equity particularly in the context of the political feasibility of finance proposals, recognizing that transportation policies typically have both winners and losers associated with them.

Crane outlined several specific themes that he saw running through the three finance presentations:

- Identifying beneficiaries and measuring the benefits of accessibility-oriented projects, particularly for the purpose of financing.
- Developing political processes to incentivize and enforce contributions from beneficiaries.

- Searching for ways to improve the equitability of the financing system, using tests based on different ideas of equity.
- Planning for the distribution of any financial surplus, so as to avoid “distortions” in the management of the transportation system such as congestion and unwise investment policies.

Steve Lockwood asserted that an ideal finance strategy for accessibility would take into account three types of issues: equity, efficiency, and externalities. He noted that current financing schemes generally follow one of two approaches, focusing either on user beneficiaries (such as drivers, transit riders, and others who travel on the transportation system) with the presumption that charges are being set according to costs incurred by the transportation agency, or on non-user beneficiaries (typically businesses and land owners), in which case costs are presumably set according to benefits received.

In the United States, Lockwood continued, the current state of the practice in transportation financing follows an indirect user beneficiaries approach through motor vehicle and fuel taxes on the highway side, supplemented by fares and taxes on the transit side. Meanwhile, he said, the rest of the world has moved toward direct user charges in the highway arena.

For federal legislators, Lockwood explained, there is currently a strong sense that it is necessary to raise additional capital for transportation, but that such efforts are not politically viable in the near future (four to eight years). This view is driving increased interest in toll-type finance schemes like direct user charges to maintain facilities, congestion pricing to maintain congestion at a specified level, or “true-cost pricing” to cover external costs associated with transportation system use—three completely different and to some degree incompatible motives for user charges. He said this multiplicity has led to confusion “inside the Beltway” about what finance options are on the table, and stressed the necessity of being clear on what strategies are appropriate in order to make progress.

The present discussion, Lockwood said, reflected prevailing confusion over financing strategies; even among the three presentations, significant differences were evident when talking about beneficiaries and charges. Furthermore, Lockwood said, the problem of how to deal with surplus revenue remains difficult, especially because raising use prices sufficiently to cause

a significant reduction in congestion will generate considerable excess revenue, which must be disbursed equitably, according to the view of equity held by the constituency which supports congestion pricing. He noted that the public is reluctant to direct more money to transportation institutions unless the use of the money is reasonably transparent. These issues, he said, continue to stand in the way of developing constituencies that support changes in transportation finance practice.

Crane, in a question directed at King and Manville, asked why their proposal seemed to draw such a strong connection between equity issues and political feasibility. King replied that equity issues are frequently used as a “cudgel” by opponents of pricing plans, even though the parties raising objections are not necessarily those who, in practice, would be significantly disadvantaged by road user pricing. Crane then asked how King and Manville envisioned such a system being accepted by the state transportation agencies that generally own and operate freeway systems; the states, he asserted, would probably be unwilling to turn over revenues to local governments, despite the proposal’s appeal in other areas.

Lockwood expressed his belief that such a system could work in Minnesota; in the case of the I-394 HOT lanes project, he said, the solution was to split the revenue between transit improvements and other transportation improvements within the selected corridor. Giving a portion of revenue back to local governments, Lockwood continued, relates back to the issue of local consent, without which it may be impossible for the state agency to push through a new project. Politically, he said, the idea of local governments as claimants for at least a portion of revenue made sense, if that money could be used to deal with issues around a freeway corridor.

King responded that his team’s paper specifically acknowledged the need for state government approval; it would be impossible to implement such a plan, he said, without “someone getting their fingers in the cookie jar.” However, he continued, cities, and communities are becoming increasingly active on transportation issues. As they pay for more local construction and facilities maintenance, they are also organizing against locally undesirable projects, as in the case of the Hollywood Freeway in Los Angeles. Although getting 100 percent of revenues back to the city after expenses was a practical impossibility, he

The public is reluctant to direct more money to transportation institutions unless the way the money is used is reasonably transparent.

concluded, “at this point we might as well shoot for the sky.”

An audience member asked for comments on the idea put forward by Vernon Smith of George Mason University to auction off the interstate freeway system and bring revenues back into a common pooled fund to be distributed directly to citizens. King replied that he and Manville had discussed privatization extensively, but in the final analysis, did not see that privatization offered any advantages that could not be realized within the public sector.

Muldowney offered an observation on the hypothecation (earmarking) of funds in King and Manville’s proposal. Following that principle, he said, all taxes collected on cigarettes (for example) should go to recover the costs of smoking-related diseases; however, one of the principles

underlying democratic societies is that elected representatives make decisions about how to allocate resources. In the case of Ireland, specific constitutional provisions against hypothecation are in place to preserve the responsibilities of elected officials. An audience member asked whether the Dublin plan for transit development was not, in fact, an example of hypothecation. Muldowney replied that small-scale exemptions were available for specific projects, but the current discussion seemed to be dealing with large-scale hypothecation. Lockwood responded that the United States has traditionally used dedicated trust funds for a few major government functions, of which transportation is one, but that approaches to hypothecation were not uniform at the state level.

Measurements

Moderator: Gary Erickson, Assistant County Administrator, Hennepin County, Minnesota

The Measurements session highlighted the diversity of quantitative and qualitative measurement techniques currently being applied to accessibility. Issues explored in this session included the influence of measurement technique on the picture of accessibility that emerges, and the policy implications of different measurement methodologies.

Parcel-level Measure of Public Transit Accessibility to Destinations

Brian Ho-Yin Lee, University of Washington

Brian Ho-Yin Lee began his presentation by enumerating the special characteristics of transit that affect how accessibility is measured: a sparse network of fixed routes, with service based on a repetitive pickup/drop-off model (excepting demand-responsive transit services); in addition, he noted, it is important to consider the fact that transit is a multimodal travel option for most users, because it is necessary to walk to and from transit stops. Lee said that most current measurement techniques are focused on measuring access to and from transit networks, with the fundamental assumption that access to a network is equivalent to access to a range of specific destinations. However, he continued, this assumption may only be true for very large and/or dense networks, such as those found in New York City or London, and that even in these locations, where users live determines what types of destinations they can access.

This limitation of current techniques, he said, is partly due to the fact that they focus only on spatial aspects—i.e., the spatial connection between origins and destinations, which he described as “the lowest level of accessibility”—while ignoring temporal considerations. In addition, he said, measuring transit accessibility using zonal aggregation (as is commonly done when measuring vehicle-based accessibility) can lead to overlooking variations in people’s ability to access stops and stations, if the aggregation zones are too large. The implications of these current measurement practices include the potential for

exaggerating the accessibility benefits of transit networks—in fact, mere proximity to a transit stop does not mean users can get where they need to go during the time period they need to be there. This in turn leads to an incomplete picture of travel behavior and choices. In the policy realm, this can lead to exaggerated ridership projections and insufficient knowledge about people’s real choices between transit and other modes.

Lee went on to demonstrate his transit accessibility measurement technique, which he described as tying together previous work by several other researchers in a single package. The procedure is based on parcel-level measurement, using the concept of network buffers, and incorporates geographic barriers, walking network characteristics, variations in residential population density, and modeling boundary conditions such as maximum trip time, number of transfers, and restrictions on departure and/or arrival times. To illustrate the distinctions between different measurement procedures and the resulting effects on measures of accessibility, Lee showed a comparison of three different techniques applied to his data set. He said that commonly used spatial methods showed what appeared to be a lot of coverage, but that they did not reveal important information because they did not take temporal factors into account. Overall, he said, he believed that his method was somewhat more conservative and realistic than non-temporal methods.

Evaluating Measures of Job-Housing Balance: Boston and Atlanta, 1980–2000

Joseph Ferreira, Professor, and **Jiawen Yang**, Department of Urban Studies and Planning, Massachusetts Institute of Technology

Jiawen Yang introduced his work by asking if current methods of measuring accessibility actually characterize the aspects of accessibility that researchers and decision makers need to understand. In order to explore this question, he and Joseph Ferreira compared different methods of measuring job-housing proximity to see how these methods characterized the relationship

between job-housing proximity and commuting behavior. Yang noted that this work was motivated by reported increases in commuting time in many major metropolitan areas.

Yang said that he and Ferreira divided measures of job-housing proximity into three categories for the purpose of their evaluation: those based on the ratio of jobs to employed residents; those based on

Qualitative and quantitative research techniques can play complementary roles in analyzing accessibility.

job or labor accessibility; and those based on the idea of minimum required commuting. He noted that although many studies had provided reasons why a particular measure was preferred, none of the work they reviewed had undertaken a careful comparative evaluation of different measurement types. Yang and Ferreira found that the different types of measurement resulted in very different maps of job-housing proximity given the same journey-to-work data. Further analysis was carried out to attempt to correlate the measures

of job-housing proximity with commuting time. The results of this analysis led the researchers to further study the impacts of land development patterns on commuting. Overall, he said, the minimum required commuting method seemed to yield measurements that most accurately characterized commuting behavior, and could easily aggregate to the regional level for region-to-region or year-to-year comparison; however, some weaknesses were also identified.

Exploring Institutional Effects on Accessibility: A Qualitative Examination of Transit Planning

Jessica Mefford, College of Social and Behavioral Sciences, Ohio State University, and **Mark Horner**, Assistant Professor, Department of Geography, Florida State University

Jessica Mefford’s presentation shifted the focus of discussion from purely technical to the human side of accessibility. She described research carried out with Mark Horner of Florida State University that attempted to connect quantitative geographic analysis of transit-based accessibility with qualitative information on the transit planning process. Mefford asserted that qualitative research could give an important perspective on accessibility, because transportation planning encompasses interactions between the physical environment and the socio-cultural environment. The researchers conducted a spatial analysis of accessibility to employment via bus transit using a geographic information systems (GIS) approach, taking into account socio-economic and demographic characteristics of transit users as well as employment types; this analysis, she said, revealed significant variation in accessibility provided to different groups. The researchers also conducted in-depth interviews with transit planners and communications specialists to

explore several key themes in regards to the planning process, including perceptions of planners regarding the role and value of mass transit; perceived characteristics of transit patrons; public involvement in the transit planning process; and geographic disparities in service.

Mefford said she and Horner found that groups who were not dependent on transit as their only mode of transport to work exerted significantly greater influence on transit planning than did their transit-dependent counterparts. This, she said, translates to lower measures of accessibility for minority and low-income workers than non-minority and professional workers. She suggested that changes could be made to the public involvement process for transportation planning to address this inequity, including greater efforts to involve low-income workers and minority communities in the planning process. For planners, she said, it would be helpful to have more emphasis placed on the public involvement process during university education.

Paving New Ground: A Markov Chain Model of the Change in Transportation Networks and Land Use

David Levinson, Assistant Professor, and **Wei Chen**, Department of Civil Engineering, University of Minnesota

David Levinson’s presentation addressed the relationship between transportation network growth and land use changes. He began by outlining perspectives commonly attributed to planners and engineers: he said planners argue that transportation policies and investments in networks drive land use, thus building more networks leads to higher levels of network use and ultimately to increased congestion (“induced demand”); engineers, on the other hand, typically

argue that the construction of new transportation networks is carried out in response to changes in land use, so if urban sprawl and other undesirable use patterns could be controlled, there would be no need to construct new roads. These viewpoints contribute to a “chicken or egg” debate about which factor is ultimately responsible for sprawl and congestion. While the two perspectives are usually seen as conflicting with each other, Levinson said, in fact both are correct—the

forces of land development and network growth influence each other. Trying to “untangle” the issue of transportation network growth and land use change is probably the wrong way to approach the question, he said; it would be more productive to look at the issue as an example of an interconnected system.

Levinson went on to describe his work with graduate student Wei Chen on modeling the interconnectedness of a transportation-land use system using Markov chain techniques. Markov chain models, he explained, are based on the idea that a cell (such as a particular location) within the model has a set of attributes that define its state at a given time, and that the state of a cell changes over time according to specific rules; this evolution process depends solely on the state of the individual cell, ignoring the state of surrounding cells. Levinson noted that cellular

automata modeling, in which the evolution of a cell’s state is affected by the states of surrounding cells as well as its own state, will be the basis of future work in this project. In the current research, the Markov chain approach was applied to the Minneapolis-St. Paul metropolitan area, using data from 1958, 1968, 1978, and 1990, in order to look at the co-evolution of land use and transportation networks. The data set included information on highway types and land use types (but not land use density), producing a possible 20 states for each of the more than 30,000 cells in a grid covering the entire metropolitan area. He described the results of experiments comparing the model’s predictions to observed growth patterns, and using the model to estimate the probable form of future changes in land use and road construction.

Discussion: Measurements

Discussants: **Harvey Miller**, Professor, Department of Geography, University of Utah, and **Lance Neumann**, President, Cambridge Systematics

Harvey Miller commented that Lee’s work illustrated the power of GIS to give a detailed representation of accessibility. By carrying spatial disaggregation to the lowest logical level, he said, Lee was able to derive a very different picture of accessibility than that produced by standard approaches, which tend to overestimate transit accessibility. He noted that Lee’s methodology still assumes that the household is a unit, with all members having the same travel needs; in practice, he said, individual constraints are important in understanding travel patterns. Miller also emphasized the importance of information constraints—the difficulty of obtaining route and schedule information, which contributes to uncertainty about projected travel time—in understanding transit use patterns. In addition, he said, the fact that timing restrictions on certain uses may not mesh with transit schedules could be taken into account in expanding this work.

Lance Neumann agreed that Lee’s work demonstrated that the choice of measurement technique has a great influence on the conclusions that can be drawn from accessibility research. While the high level of disaggregation is the work’s greatest strength, he said, it could also be its greatest weakness because the level of detail may make extending the technique to more locations or uses difficult.

Turning to Jiawen Yang’s presentation,

Neumann again noted the importance of measurement technique on conclusions. In light of the variety of techniques available, he raised the question of whether the selection of a particular method was as significant as consistently using any single method. In regard to the minimum required commuting method favored in Yang’s analysis, he noted that the method assumes that commuting costs play a dominant role in decision making, but that as income rises, it is likely that commuting costs will be less important. In addition, he suggested that the importance of commuting costs will be reduced as housing costs rise, and that ultimately it is minimization of housing costs (rather than commuting costs) that will be the key element in the decision-making process.

Miller addressed several technical aspects of Yang’s paper. First, he said he was intrigued by the policy implications of the observed distribution of commute times around the mean: while average commute time overall was observed to rise only slightly from year to year, a greater mean distribution seemed to indicate growing inequality in commute times, which could have implications for transportation policy. He then noted that gravity accessibility models of the type used in the evaluation are highly sensitive to distance impedance, so this parameter must be calibrated, not assumed. Also, he said, the scale

of analysis is critical. Finally, he pointed out that regressions used to analyze spatial data must be spatial regressions.

On Jessica Mefford's presentation, Miller praised the combination of qualitative and quantitative methods, which presented a spatial structure and a sense of the institutional process that led to the creation of that structure. Geographic information systems, he said, would be an excellent vehicle for merging qualitative and quantitative information to an even greater degree, for example through the creation of georeferenced multimedia that connect text, video, interview recordings, or other audiovisual sources to geographic locations. Decision makers, he continued, could use such a system to explore both qualitative and quantitative issues on a single platform.

Neumann said that Mefford and Horner's incorporation of qualitative methods allowed them to reach for policy conclusions; but he cautioned that, due to the small number of interviews conducted, they should be cautious in drawing conclusions as to the motives for policy decisions. In the larger world of urban governance, he said, transit planners may not have the final say—transit spending is influenced by more than their perceptions and biases. Regarding the suggestion that increased public involvement offers the potential to redress transit service inequities, Neumann said that additional efforts beyond the scope of public involvement may be necessary. Finally, he noted that questions exist as to where agencies should focus their efforts to increase ridership—while some studies have suggested that populations who choose to use transit represent the largest opportunity, work by his own firm suggests that agencies should focus on those who use transit by necessity.

Wrapping up with a brief discussion of Levinson and Chen's paper, Neumann expressed doubts about the Markov chain's assumption that the only factor affecting the state change of

a given cell is the cell's current state, in effect removing time dependency from the analysis. He also speculated that there might be other factors besides the highway network that would help explain the shifts over time. Miller inquired why Levinson had chosen to employ a purely temporal Markov chain approach instead of using the spatiotemporal cellular automata technique, given that neighboring land uses are known to affect the evolution of land use in a given area. Responding to Neumann, Levinson asserted that previous states (going back two time periods) were in effect encoded in the current state of each cell in his model; in a Markov model dealing with shorter time intervals, or in a cellular automata model, such temporal dynamics might be more significant. Levinson continued that cellular automata would be used in a future phase of research, but that with 30,000 cells in the present model, the incorporation of neighboring cell states represented a significant computational challenge.

An audience member asked Levinson if his and Chen's work could be extended to incorporate density measurements. Levinson replied that this was another possible extension of the research, requiring the development of more complex methodologies and the incorporation of additional data sets such as census tract data.

Another comment from an audience member, directed at Mefford and Horner, suggested that their method may be understating accessibility due to the use of average travel time as a limit on the model. Instead, he suggested, it might be advisable to consider a sensitivity test at the 90 to 95 percent level of travel times. For both the Mefford-Horner and Lee papers, he continued, care should be taken in how initial wait times are used in modeling; although it is easy to calculate half the frequency of transit service as a wait time, riders who are using transit for the journey to work are typically more aware of schedules and therefore have lower wait times.

Behavior

Moderator: *Connie Kozlak, Manager, Transportation Systems Planning, Metropolitan Council*

Human decision making and the psychology of personal preference were the subjects of the Behavior session. Researchers from the Twin Cities and Bangkok shared their understanding of how people value accessibility in different spatial and economic contexts.

The Effect of Accessibility on Mode Choice for Shopping Trips

Sittha Jaensirisak, Department of Civil Engineering, Ubon Ratchathani University, Thailand

Sittha Jaensirisak led off the technical session on traveler behavior with a presentation on a research project to evaluate the potential effect of a new elevated walkway linking a shopping center in central Bangkok, Thailand with a rail station. The shopping center is currently accessible by car (the main mode of transport for customers) as well as by bus or privately operated elevated rail system, dubbed “Skytrain”; however, the Skytrain station is located at some distance from the shopping center, requiring riders to make their way through the congested streets to reach their destination. Jaensirisak and collaborator Sompong Paksarsawan focused on determining how installation of a raised walkway directly connecting the station to the shopping center would affect shoppers’ transportation mode choice, specifically whether the walkway had the

potential to shift car users to the rail system. In addition, their research investigated the attitudes of shopping center customers to the proposed walkway.

The researchers administered a survey to Skytrain riders and shopping center customers, discovering a high percentage of respondents believed that a raised walkway would provide an accessibility benefit to the shopping center. Based on these results, a discrete choice model was used to predict mode share changes, revealing a surprisingly large potential shift from car to train. Based on the results of the study, Jaensirisak said, the shopping center decided to invest in the construction of the walkway. The researchers believe that such facilities have the potential to encourage greater use of transit, he said.

The Value of Trail Access on Home Purchases

Kevin Krizek, Assistant Professor, and **Paul Mogush**, Humphrey Institute of Public Affairs; **David Levinson**, Assistant Professor, Department of Civil Engineering, University of Minnesota

Kevin Krizek introduced Paul Mogush’s presentation by situating the researchers’ analysis of bicycle path access within the larger issue of accessibility. In essence, Krizek said, this work represents an attempt to quantify the value of accessibility to different consumers. Accessibility, he continued, is analogous to a quasi-public, non-market good, which is not bought and sold directly; however, if accessibility is understood to possess a positive utility, then it should be possible to say how much it is worth. To do this, the researchers looked at home sale values in an attempt to discern the influence of different types of bicycle accessibility.

Mogush described the team’s application of hedonic regression modeling, in which the price of a house is understood as a function of its various attributes. These include structural qualities, neighborhood characteristics, and environmental considerations such as the presence of parks and bicycle facilities. The team’s analytical model combined data from a Mn/DOT trail mapping project with data on home sale values and geospatial information. Because trail location

often correlated with the location of parks and open spaces, procedures were developed to control for this factor. To increase the model’s explanatory power, additional controls were added to account for fixed effects, such as neighborhood reputation, which are not accounted for by other modeling parameters. Realtor-defined housing market areas served as the basis for this analysis, and variations were considered within each of the 104 study areas.

At the beginning of the study, Mogush said, the researchers had assumed that all bicycle trails were equivalent. However, they soon discovered that different classes of trails—on-street lanes, off-street roadside, and off-street non-roadside—had to be considered differently. In addition, the research uncovered significant differences in the valuation of environmental amenities between urban and suburban residents, as noted by previous researchers, leading (in some cases) to park proximity being considered a disamenity.

One of the primary findings emerging from this research, Mogush said, was that the type of trail matters in how it is valued by homeowners. He

said that significant differences between urban and suburban areas were also highlighted, and concluded by noting that bicycle trail accessibility appears to have mixed effects on housing value across the metropolitan area. In suburban areas, for example, on-street bicycle lanes appear to be a disamenity, even when controlling for the proximity of the busy street itself; off-street,

non-roadside trails appeared to be valued by city residents but not by suburbanites, and “black sidewalks” (off-street, roadside trails) were not valued by either group. Mogush outlined several possible reasons for suburban aversion to bicycle facilities, ranging from underspecification in the model to various factors influencing public perception.

Discussion: Behavior

Discussants: **Gerrit-Jan Knaap**, Executive Director, National Center for Smart Growth Research and Education, University of Maryland, and **Alan Pisarski**, Independent Consultant

Alan Pisarski commented that he had ridden on the Skytrain discussed in Sittha Jaensirisak’s presentation, and noted that the extreme levels of traffic congestion in central Bangkok would make a raised walkway connecting transit to a shopping center a significant benefit to users. Pisarski said he was surprised by some of the data presented, in that interviewees seemed to be very consistent in perceiving a high level of potential benefit from the walkway. He also found it surprising that the analytical model showed such dramatic shifts in terms of transit ridership after construction of the walkway; he speculated that this may be due to the “extraordinary elasticities” present in the central Bangkok area. Finally, Pisarski said he was delighted that the research had led to a decision to construct the Skywalk, and looked forward to seeing how changes in mode shares and transit volumes played out in the real world.

Gerrit-Jan Knapp remarked that Asia is an increasingly important area of study for transportation planners, and that the pace of change there often outstrips that of Europe and North America. He, too, was surprised by some of the research results, including the extent of mode split changes and the gender split among users of the facility. Interesting potential extensions of the research, he suggested, include investigating induced demand resulting from the construction of the elevated walkway; this could serve as the basis for a comprehensive cost-benefit analysis on behalf of the shopping center.

Turning to Krizek and Mogush’s paper, Pisarski said he found the methods used very interesting, particularly the stratifications employed. These methods, he said, were important to the overall exercise, and would be helpful in creating a typology that could be employed in other areas. He urged the researchers to provide further discussion of their findings in order to make certain aspects of their argument more clear.

Both Pisarski and Knaap commented on the researchers’ surprising finding that the presence of bicycle trails could be viewed as a disamenity by home buyers outside the city center. Pisarski pointed out that, among all the attributes valued by home buyers, bike paths would be “pretty far down on the list,” making it difficult to detect their impact on decision making. Also, he said, the apparent ubiquity of bicycle paths in the Twin Cities area may lead residents to value them less highly overall. Finally, he pointed out that in a suburban context where an on-street bicycle path does not represent a real refuge for bicyclists (as it would in the more congested urban context), these paths might be viewed as more of an intrusion. This, he continued, brings up a potential parallel with the way freeway access is valued by homeowners, i.e., access is desirable at a reasonable distance, but few people want to live right next to a freeway onramp.

Knaap said that when hedonics research yields counterintuitive results, researchers are generally faced with a choice of either arguing that the phenomenon being analyzed is more complex than originally thought, or delving more deeply into the specifications of their model in search of factors that could distort the output. He suggested that showing the process of arriving at results is an important component of such work.

Regarding the distinction between city and suburb, Knaap questioned whether the fixed effects modeled for different sub-markets might be interacting with the city-suburb component of the model, resulting in a confounding of effects. He also felt that spatial disaggregation between “active” and “passive” land uses could be handled more effectively. The real issue, he said, was trying to get at what bicycle facilities provide and how that “something”—and, by extension, accessibility itself—can be specified and modeled. Using a buffer system, or calculating the density

of trails in a given area, rather than taking the distance to trails as a continuous variable, offer potential for experimentation. Capturing which areas of the city have better “bicycle friendliness,” he suggested, might yield different results. The idea that bicycling is an emerging mode of travel, the value of which should be capitalized in land values, is important.

Pisarski and Knaap commented briefly on the paper by Moon Jeong Kim and Hazel Morrow-Jones of Ohio State University, who were unable to attend the session. Pisarski noted that the two papers that were presented take a “micro” approach to behavioral issues in that they focused on very explicitly defined activities and events; the Columbus researchers’ paper, in contrast, takes a more “macro” approach.

The data set used in the Columbus project, Pisarski said, was limited in that it contained data only on former homeowners selling their houses, and no data on first-time buyers or shifts from rental to ownership; even so, he said, it was a viable and attractive data set. He commented that, although he had used Columbus and other small cities as examples of metropolitan areas with strong central orientation and relatively little multi-nucleation, the findings of the Columbus research seemed to argue against that characterization. The phenomenon of jobs following workers, he continued, needs to be recognized in many metropolitan areas; the use of national housing survey data as a parallel data source could address this issue. Finally, he suggested that following the changes in housing patterns of workers at a large employer following corporate relocation within a metropolitan area could be an interesting project in this vein.

Knaap said that the Columbus paper demonstrated a good description of how people are moving out of the center to the suburbs. He expressed concern, however, about what he perceived as the paper’s framing as a test of the basic urban model developed by Alonzo, Muth, and Mills; despite the paper’s argument that empirical data in the Columbus area do not support the model, Knaap asserted, a different interpretation could lead to a conclusion that in fact supports the Alonzo-Muth-Mills structure.

An audience member asked Jaensirisak whether Skytrain riders, who were shown to be

predominantly members of the middle and upper economic classes, were paying the full cost of the system, or if instead public tax moneys were being used to subsidize it. Jaensirisak replied that the Skytrain was built by a private company without the use of any public funds or subsidies; this is the reason, he said, that Skytrain fares are relatively high.

Lance Neckar of the Department of Architecture and Landscape Architecture observed that, in the case of both papers presented, he would have found it illuminating to see a discussion of the morphology of connections, i.e., where people were beginning and ending their trips. He said that the question of what is being connected to what is significant, particularly in the case of the bicycle trail network, because of different monetary and social values attached to land in urban and suburban settings. Understanding this connection morphology, he concluded, would enable the researchers to develop a typology that speaks to intrinsic values.

Kevin Krizek responded to comments on the bicycle trails research, first noting that the study had aimed to capture an extremely subtle phenomenon, as noted by Alan Pisarski in his discussion. Krizek asserted that the measurement issues encountered in this research were not restricted to bicycle facilities, but could be applied to monetizing the value of other factors such as neighborhood retail or sidewalks—though he acknowledged that he saw some heads shaking in the audience as he said this.

Taking up the thread of Knaap’s comments on methodologies for measurement, Krizek asserted that even though bike trails are fairly ubiquitous in the study area, there should be some subtle differences if they indeed are a positive utility. This, it follows, should be discernable in the distances that people are willing to travel or to live near them. Krizek acknowledged Knaap’s suggestion of an alternative methodology focusing on trail density, including building various buffer distances into the model. A third methodology, as mentioned by Lance Neckar, would be to evaluate the destinations that are connected by a trail. All three methods had been tried, Krizek concluded, but the distance-based methodology had been found to yield the best results.

Asia is an increasingly important area of study for transportation planners—the pace of change in Asia often outstrips that in Europe and North America.

Models

Moderator: Mark Filipi, Transportation Forecast Analyst, Twin Cities Metropolitan Council

The Models session featured a discussion of three different approaches to accessibility analysis, and the implications of each approach for policy-making. Land use patterns, transportation network topologies, and factors influencing individual travel decisions were among the topics covered.

Accessibility and Spatial Development in Switzerland During the Last 50 Years

Martin Tschopp, Philip Fröhlich, and Kay Axhausen, Professor, Institute for Transport Planning and Systems, Swiss Federal Institute of Technology

Martin Tschopp’s presentation covered work carried out under the auspices of the European Union research program known as “COST 340—Toward a European Intermodal Network: Lessons From History,” which seeks to analyze the history and integration of European transport networks since 1945 in order to support the development of future intermodal networks.

Tschopp described how the research team digitized information on Switzerland’s road and rail networks for each decade between 1900 and 2000; these data were combined with information on spatial and demographic structures at the municipal level to form the core data set for their study. Analysis of the data, he said, focused on themes of population growth, accessibility development, and the influence of accessibility on spatial development. The research group employed a definition of accessibility formulated in 2001 by researchers Karst Geurs and Jan Ritsema van Eck of the Netherlands: “...the extent to which the land-use transport system enables [groups of] individuals or goods to reach activities or destinations by means of a [combination of] transport mode[s].” In other words, he said, “What can be reached and how much effort is required to

get there?” The researchers’ analysis showed that accessibility to some areas outside major cities—especially inter-urban connections—improved tremendously between 1950 and 2000; however, these gains were not uniformly distributed, and accessibility in alpine areas remained low.

To get at the influence of accessibility on spatial development, Tschopp continued, the researchers used a hierarchical regression model that compared population development with accessibility levels. This enabled the team to compute a regression line for each of Switzerland’s cantons (administrative units roughly analogous to U.S. states); differences between the slopes of the regression lines showed that urban and rural areas differed in the extent to which accessibility appeared to influence development and population growth. In urbanized areas today, Tschopp said, high accessibility no longer appears to be driving development—possible evidence of a “saturation” effect. However, areas between cities are experiencing rapid development, and outlying rural areas show evidence of population loss as development shifts to cities and towns with relatively high accessibility.

Accessibility in the LUCI2 Urban Simulation Model and the Importance of Accessibility for Urban Development

John Ottensmann, Associate Director, Center for Urban Policy, Indiana University-Purdue University, Indianapolis

John Ottensmann described his work as dealing with questions similar to those covered in the previous presentation, but approaching them from a somewhat different angle. Although the LUCI (“Land Use in Central Indiana”) simulation software was not developed to explore the relationship between accessibility and urban development, he explained, he realized that the simulator was able to address these questions as well. The second generation of the project, LUCI2, is more generalized than the first and aims for applicability to different regions.

The LUCI model, Ottensmann said, simulates growth through forecasting employment change by ZIP code area for major employment

categories, and forecasts changes in land use related to employment patterns. The process of estimating equations within the LUCI2 model, Ottensmann said, provided evidence that accessibility plays an important role in shaping various aspects of development. The model is based on eight predictive equations; accessibility to employment or to workers—or change in levels of accessibility—was found to be a significant predictor in five of these equations and accounted for more variation than any other predictor in four of those five, Ottensmann said. One of the notable aspects of the LUCI model, Ottensmann explained, is that it looks not only at levels of accessibility but at changes in accessibility.

LUCI2 allows users to create and compare scenarios reflecting policy choices and assumptions about future development, Ottensmann said. One option in using the model is to change the relative importance of different elements of the model, such as accessibility. He described experimental results of increasing and decreasing the importance of accessibility to

work, reflecting increased costs of commuting due to rising energy prices, or decreased significance of commuting costs due to widespread adoption of telecommuting and work-from-home policies. The development patterns generated in each case were substantially different from “current-trend” scenarios, confirming predictions about the importance of accessibility on development.

Modeling Accessibility in Urban Transportation Networks: A Graph-Based Hierarchical Approach

Ahmed Abdel-Rahim, Assistant Professor, Department of Civil Engineering, University of Idaho, and **Ayman Ismail**, College of Engineering, Ohio State University

Ahmed Abdel-Rahim presented an approach to accessibility modeling that was very different from the one used by Tschopp and Ottensmann. Rather than modeling a land-use grid, he and collaborator Ayman Ismail used a graph-based approach in which locations are represented as nodes on a network of roadway links. This approach, he said, is more closely connected with transportation operations than with land use or urban planning.

Graph networks, Abdel-Rahim explained, are a simple abstraction of real transportation systems. Such models can be used to model connections at any scale, from intersections to census tracts; they can also be applied to particular groups of users or to specific activities or modes of transportation. Abdel-Rahim said that the graph-based model used in his research focused on availability of service (the existence of a link) and cost of travel (in this case door-to-door travel time), represented in the model by weighting the connecting links differently. The connectivity of the model may be measured by several indices; in addition, he explained the model incorporates functionality-based measures representing demand between origins and destinations using specific modes of travel.

The shape of the model in Abdel-Rahim’s research was based on Sixth of October City, an area near Cairo, Egypt, developed over the last 25 years with the intent of easing congestion

in the Cairo metropolitan area. In response to Gerrit-Jan Knaap’s remarks about the pace of change in Asia, Abdel-Rahim noted that Sixth of October City was begun more than two decades ago with a target capacity of 600,000 residents, yet today only 50,000 live there—a situation largely attributable, he said, to the accessibility problems plaguing the area.

After mapping the area’s transportation network, Abdel-Rahim and Ismail used their graph-based model to evaluate four alternative proposals to improve transportation accessibility: maintaining existing services, adding a new transit line, adding a new highway, and carrying out an improvement program to improve service to all links and nodes. Each scenario was evaluated in terms of both automobile use and transit use. The model, he said, enabled the researchers to see not only what would happen to the network’s overall level of accessibility, but to examine it on a node-by-node basis to determine which zones would benefit most from each scenario. Results indicated network-wide measures tended to yield consistent results; however, benefits to sub-areas differed depending on the type of improvement carried out. This shows, he concluded, that the basic approach can be used as a decision-making tool by agencies that need to evaluate policy alternatives. If cost information were available, he noted, the approach could support cost-benefit analysis as well.

Discussion: Models

Robert Bertini, Associate Professor, School of Urban Studies and Planning, Portland State University, and **Susan Handy**, Associate Professor, Environmental Science and Policy, University of California-Davis

Robert Bertini made a brief opening statement intended to set the stage for discussion among the presenters. He said that he wanted to focus the discussion on two points: how applicable each

model would be to the needs of practitioners, and what implications each had for future research. For the researcher, he said, key questions should include:

Models are simplifications of our complex world, but they can be very useful if used with a balanced perspective. Modeling is a powerful tool for analyzing “what-if” scenarios.

- What aspects of the experimental results were surprising, and why?
- How could these approaches to modeling be used to influence policy?
- Are there any metrics that could be incorporated into accessibility modeling?

Susan Handy had some general comments for the presenters before turning the floor over to them. First, she pointed out what she saw as two risks inherent in using models—taking them too seriously, or not taking them seriously enough. Models, she said, are obviously simplifications of the world, and so it is easy to “pick them apart”; but if they are used with a balanced perspective, they can be very useful. If they don’t yield the answers directly, they can help raise questions that can be answered in other ways, she continued, noting that models also have the important ability to allow users to play with “what-if” questions.

Handy said it should be noted that the models discussed in the current session are aggregate models, looking at the sum total of individual decisions rather than the underlying behaviors. However, each of the models looks at a different set of relationships: while Ottensmann’s and Tschopp’s models cover different aspects of accessibility and its impact on development, the work of Abdel-Rahim and Ismail examines the potential impact of transportation investments on accessibility. This, she said, raises the issue of the circularity of such relationships, and calls to mind the questions posed by David Levinson in his earlier presentation regarding the “chicken-or-egg” nature of land use and transportation issues.

Finally, Handy said, the diversity of the models contributed to the continuing discussion of what “accessibility” means. For example, emphasis on network connectivity in Abdel-Rahim’s model might be seen as indicating a focus on mobility rather than accessibility; however, she continued, combining network connectivity and land use information could get closer to the roots of accessibility. Conversely, given the inherent focus on land use in Ottensmann’s LUCI2 model, she said, it would be interesting to bring the transportation network more explicitly into the picture and examine issues such as travel times and the impacts of transportation infrastructure investments. In the case of the Swiss model, which focused primarily on population-population accessibility, Handy suggested it would be interesting to see other measures incorporated—such as access to employment by population.

In response to the questions posed by Bertini,

Martin Tschopp explained that although the differences between urban and rural areas were known, the researchers had not expected to see such a clear division. For Swiss policymakers, he said, the existence of such a deep division has implications for the ongoing debate over resource allocation—specifically, whether it is better to spend money to improve access to mountainous areas, or to focus instead on urban and interurban zones where congestion is becoming increasingly problematic.

John Ottensmann said that, in terms of estimating equations for LUCI, what surprised him most was how well the model seemed to work given the large land area that included eight metropolitan zones. Despite initial concerns that the Indianapolis area would dominate and unbalance the model, he said he was pleasantly surprised by the results after testing. He said that the goal in creating LUCI and LUCI2 was to give non-specialists a tool to help understand the consequences of policy choices, so that they could better understand issues like accessibility—not to provide specific answers to questions such as how best to preserve agricultural lands.

Abdel-Rahim said that he was most surprised by the agreement between connectivity-based and functionality-based measures in his team’s model. He speculated that this consistency might be due to the fact that the network under examination was small, and the two types of measures were highly dependent; it would be interesting, he said, to test the graph-based model using a larger transportation network. He stressed that while defining accessibility was a difficult issue for researchers, it was even more difficult in the context of a public meeting, so tools like LUCI could be helpful in supporting informed debate. Models should be flexible enough to incorporate different definitions of accessibility, he concluded.

Alan Pisarski commented that commute choices, and travel behavior in general, are affected by both supply and demand components; different classes of workers are likely to find different amounts of travel necessary to reach their jobs. High-income commuters, he said, have greater ability to optimize not only their travel origin (where they live) but their destination (where they work).

Lee Munnich, director of the Humphrey Institute’s State and Local Policy Program, observed that many commuters are able to perform useful activities while traveling. This, he

said, should be considered as a factor in analyzing the cost of travel to and from work.

Rachel Weinberger agreed with Pisarski that commuting behavior is affected by both supply and demand components; she noted that in many large urban areas, high-income workers are willing to pay more to live in downtown areas with high levels of amenities. In addition, she said, different considerations come into play during different phases of people’s lives—as seen in the fact that concerns over school quality cause many parents to leave the urban core for the suburbs. Personal and social considerations are complex, she said, and decisions are made within this social and regulatory structure.

Kevin Krizek urged the attendees to look beyond the commute trip, noting that Handy had done previous research on the positive utility of travel not related to commuting and why people might desire travel patterns that involve some longer trips. Handy, in turn, cited Pat Mokhtarian for her finding that a commute of 14 minutes is preferred as an alternative to no commute at all; in many areas, she said, commute preferences are extremely complex. On the non-work side of the travel picture, Handy continued, she had recently been looking at the issue of how the geographic organization of communities—as opposed to personal choice—influences travel patterns.

In reference to the concept of “excess commuting,” Jiawen Yang commented that it is important to consider the spatial context of

travel along with the issue of personal preference. One spatial issue to consider, he said, was the changing distribution of jobs and housing from a monocentric to a spatially dispersed pattern. The ways in which job-housing distributions are utilized by commuters, he said, are largely a function of the specific characteristics of that distribution; in a more spatially dispersed setting, he asserted, there is more flexibility in terms of individual commuting choice because geographic conditions impose fewer restrictions on the commute decisions of residents.

A member of the audience suggested that differences between the travel preferences of different members of a single household should also be taken into account; moderator Mark Filipi agreed that this was an important consideration for developing models in a world where families with multiple wage earners are increasingly common.

Another audience member suggested that the high initial capital costs associated with automobile ownership could influence car owners to drive more, because given the low out-of-pocket costs of driving, they had in a sense already paid for their travel.

Finally, a third audience member suggested that cultural factors are also important in travel decision making; for example, American culture seems to encourage driving much more than European culture.

Sustainability

Moderator: Lance Neckar, Associate Dean, Department of Landscape Architecture, University of Minnesota
In the final technical session, researchers and attendees examined the place of accessibility in developing transportation systems that meet human needs in the long term. Issues including natural resource use, environmental protection, and social justice were presented and discussed.

A Complex Systems Approach to Sustainable Accessibility: The University of Michigan “SMART” Project

Thomas Gladwin, Professor, School of Natural Resources and Environment, **Douglas Kelbaugh**, Professor, College of Architecture and Urban Planning, and **Carl Simon**, Professor, School of Public Policy, University of Michigan; and **John Sullivan**, Ford Motor Research and Advanced Engineering

As a researcher in the field of sustainable development, Thomas Gladwin said, the previous technical sessions had been something of a “wake-up call” for him to get connected to the current academic discourse on accessibility. Although the worlds of transportation accessibility and sustainable development are currently very different, he said, a marriage between them is ready to happen and could be glorious—if we can figure out how to accomplish it.

Looking at the issue of accessibility from a sustainability perspective, Gladwin said, brings to the fore a range of issues that have not been systematically investigated in the past. He enumerated several issues included in this range: loss of wildlife habitat, global climate change, automotive fuel efficiency, increasing air travel, conversion of agricultural land to urban uses, and the impact of air pollution on public health. The difficulty in addressing these issues, he said, points to the challenging nature of interdisciplinary research initiatives in which contributors speak different disciplinary “languages.”

In the case of the University of Michigan’s Sustainable Mobility and Accessibility Research and Transformation (SMART) program, he said, the goal is to get at the roots of unsustainable mobility. The unsustainable nature of much current human activity, he continued, is seen in the fact that many natural systems worldwide are in decline, resulting in a shrinking supply of the resources that support any accessibility system at the same time that demand is rising “exponentially.” Only innovative systems—not marginal or incremental changes—will take humanity through these transitions, Gladwin argued. Therefore, he said, the Michigan program is focused on radical discontinuities and large-scale changes, such as modeling the development of a hydrogen-based economic infrastructure in the United States, or transitioning to biofuels.

Gladwin observed that some conversations and presentations during the conference seemed

to make accessibility an end in itself, calling it a public good or a public right. But he argued that, instead, accessibility should be seen as merely a means to an end—human welfare—constrained by the “ultimate means” of the provision of natural resources, and by the rules of justice. Placing accessibility in this context, he suggested, leads one to ask questions about the normative design of an accessibility system that truly optimizes human welfare, subject to maintaining the health of humans and natural systems while also ensuring a just and equitable process for using the system.

Turning to the conceptual vision of the Access to Destinations Study, Gladwin suggested that in addition to considering the accessibility of various destinations using different modes of transportation, attention should be paid to the impacts of these mode-destination pairs on nature, the economy, and human society. In the end, he asked, isn’t it the consequences of these facts and figures that matter most to urban and transportation planners? By studying this “third dimension” of the mode-destination matrix, Gladwin argued, it would be possible to understand critical sustainability questions such as the origins of greenhouse gas emissions and the impacts of social justice movements. For the planning community not to pay attention to these issues, he continued, is tantamount to declaring that the living conditions of our descendants or of current economically disadvantaged populations are not important to the planning process.

Many factors make it difficult to introduce sustainability issues into the traditional planning process, Gladwin said. These include the complexity of questions being asked and the long-term nature of sustainability issues. Nonetheless, he said, the SMART program is attempting to address sustainability questions through modeling, focusing in particular on intersections of “coupled systems” such as human behaviors and the natural world, or the natural world and

Looking at accessibility from a sustainability perspective brings to the fore a range of issues that have not been systematically investigated.

institutional structures. The traditional approach to sustainable transportation, Gladwin said, demonstrates an obsession with transportation technology—a belief that advances in technology constitute the only possible solutions to the problem of unsustainable resource use. But technology is far from the only factor that matters to the future of human movement, he said; human behavior, which has received little attention from transportation sustainability researchers in the past, is also capable of making significant contributions to solving sustainability problems.

Gladwin described the complex-systems methodology employed by the Michigan researchers. This includes agent-based modeling, in which the actions of agents following sets of decision rules are studied to see what behaviors “emerge”; in addition to this “bottom-up” approach, he said, the researchers also use “top-down” methods based on system dynamics analysis, looking at the consequences of feedback and incentive structures in large coupled systems.

The Michigan researchers’ goal, he explained,

Access and Accessibility, Sustainable Development, and Transport: How to Measure Efficiency in Transportation?

Udo Becker, Chair, Transport Ecology, Dresden University of Technology, Germany

Udo Becker began his presentation by introducing the field of transportation ecology, describing it as situated at the intersection of transportation and environmental issues. This includes, he said, ordinary environmental effects such as pollution as well as complex-systems issues as described by Thomas Gladwin. Becker noted that his remarks would exemplify a European perspective on transportation issues, and also that his presentation took a broad perspective on the question of sustainability. Becker praised previous technical session presentations by Susan Handy and Thomas Gladwin, saying he subscribed completely to their conclusions regarding the importance of considering both ends and means in transportation planning, and the need to resolve current confusion surrounding multiple definitions of “accessibility.”

In addition to the concepts laid out by Handy and Gladwin, he said, he wished to draw attention to the distinction between “accessibility” and a concept he characterized as “true access”—meaning the realized access of someone actually going to a destination and satisfying a human need, as opposed to merely having the potential to

is to get a grip on a large set of variables operating in a system of extraordinary dynamic complexity. Simple modeling approaches, he argued, are insufficient for finding answers in such a system; even procedures such as multiple regression analysis may not be powerful enough, because the reality of economic and social issues surrounding sustainable transportation has become so complex that new methodologies are needed. However, he noted, complex-systems theory currently has many detractors as well as supporters. The unusual concentration of academics versed in complex-systems theory at Michigan, he said, is a unique resource for the SMART program’s research agenda.

The future of the Minneapolis-St. Paul region, Gladwin concluded, represents an intellectual challenge for the local researchers in attendance. Whether goals for the future can be reached by incremental efforts, or by implementing more radical solutions, is a question that must be answered.

access that resource. To illustrate this, he proposed a vision of accessibility in which human needs create the demand for accessibility, while options and restrictions (such as available modes, land use systems, and costs) define the supply; actual travel behavior—the result of individual choices concerning supply and demand—constitutes true access. A crucial feature of this vision, Becker said, is that the possibilities and limitations of transportation supply affect transportation options. He emphasized that this is a dynamic system, in which changes to one mode of transportation affect accessibility via other modes.

Becker then discussed the economic concept of the objective function as applied to accessibility, and gave an overview of various accessibility effects produced by market-based transportation planning policies. Due to the interconnected nature of a multimodal transportation system, he explained, these planning decisions can lead to unintended and undesirable consequences—such as reductions of accessibility for certain groups—if careful analysis is not performed to understand true access patterns. Becker asserted that planners today are faced with a need to find

Changes to one mode of transportation can have far-reaching implications for accessibility via other modes.

a balance between true access and accessibility, between needs and means, between transportation objectives and the costs of reaching them. He advocated applying the concept of input-output

efficiency to transportation planning in order to reach equitable and sustainable solutions, and noted that sustainable development should be viewed as a process, not a state.

Can We Plan to Reduce Traffic Congestion? Transportation Concurrency in Florida and Washington State

Ruth Steiner, Associate Professor, Department of Urban and Regional Planning, University of Florida

Ruth Steiner’s presentation turned from the global and abstract perspectives of Gladwin and Becker to a more practitioner-focused point of view, dealing with institutional issues in implementing policies intended to foster sustainable transportation. She compared “transportation concurrency” legislation and its effects in the states of Florida and Washington. These laws are intended to ensure that adequate public facilities are constructed to serve new development, in order to help manage growth and discourage sprawl. She noted that many differences exist in the two states’ implementation of concurrency; in general, Florida’s system has been considered “top-down” while Washington’s is characterized as a “fusion” system based on coordination among the local, regional, and state levels. In both states, concurrency measures were conceived with two major goals: providing funding sources for transportation systems by shifting the burden from the public to the private sector, and establishing a link to coordinate land use with transportation planning. However, she observed, both states have struggled with these goals.

In Florida, Steiner said, concurrency is intended to mean that infrastructure is built concurrently with the impact of development. In the case of transportation concurrency, this means that roads, public transportation, and other facilities should be made available to serve the population of newly developed areas so that they enjoy a

predetermined standard of accessibility. When concurrency provisions were introduced, Steiner said, they were widely seen as the “teeth” of growth management legislation—a way to control the location and timing of development, and make it pay for itself by requiring adequate infrastructure. Today, she continued, there is greater concern about multimodalism and community design, and a corresponding perception that concurrency requirements have produced wider roads at the expense of overall community livability.

In both states, Steiner explained, the existence of exceptions and loopholes has hampered the implementation of concurrency. Florida, for example, allows jurisdictions to change the target level of accessibility for an area—in effect, weakening the concurrency requirements. Large portions of Florida’s major cities are also covered by exemptions from concurrency requirements. She also noted that, due to characteristics of the road system in urbanizing zones, some areas had ended up with relatively high levels of service but poor connectivity.

While “the jury is still out” on transportation concurrency, Steiner said, some lessons appear to have emerged. Among these is the need to customize tools to the specific context of development. In urban areas, for example, it may be impossible to expand roads, and therefore multimodal solutions are necessary to move people without more cars.

Discussion: Sustainability

Discussants: **Rachel Weinberger**, Assistant Professor, City and Regional Planning, University of Pennsylvania, **Barbara Lukermann**, Senior Fellow, Humphrey Institute of Public Affairs, University of Minnesota

Rachel Weinberger commented that the three presentations offered an interesting range of perspectives on sustainable accessibility: Gladwin providing a global context for the discussion, Becker giving a comprehensive picture of the issue, and Steiner filling in the picture of actual on-the-ground implementation issues.

Weinberger said she agreed with Becker that

it was important to make the difference between potential accessibility and the act of accessing resources explicit in considering accessibility issues. Regarding the SMART project, she praised the ambitious attempt to bring together many disparate aspects of development and transportation; large-scale urban models had been essentially “declared dead” 35 years ago,

she noted, but new ways of thinking coupled with advances in computer technology have made them viable tools again. Turning to Steiner's presentation, she said that concurrency planning appeared to be the next logical step beyond the environmental impact statement process, because it provided a mechanism for dealing with impacts identified in an EIS.

It was also particularly instructive, Weinberger said, to consider the unintended consequences of our actions in planning for accessibility—a point that was well made by both Becker and Steiner. She acknowledged that she would be going away from the conference with many questions to think about and many new ideas for looking at issues raised by the presenters. Finally, she called on the attendees to recognize Susan Handy's contributions to the event, noting that Handy's work had been cited in a large number of plenary and technical presentations.

Barbara Lukermann pointed out that the institutional structures within which resource allocations are decided had been kept “under the table” in many discussions of accessibility and sustainability, but if we want to create sustainable systems, it is crucial to recognize that policies are developed within political structures and legal systems. Steiner's presentation, she noted, spoke directly to the ways communities are able to operate and achieve their goals in this context.

Lukermann recalled that as part of the multi-year Transportation and Regional Growth Study coordinated by the Center for Transportation Studies, researchers had attempted some holistic, systems-based approaches; the presentations by Gladwin and Becker, she said, supported the holistic conclusion that no actions take place in a vacuum—any changes are going to produce side effects, both intended and unintended. If planners and researchers can take a whole-systems perspective in their analysis, Lukermann said, they will be able to provide better assistance to policymakers. However, she cautioned, actions in the real world are generally incremental in nature, rather than revolutionary transformations of entire systems. Therefore, she continued, if our goal is to achieve sustainable transportation systems, we need to determine what the leverage points are, both politically and institutionally. The papers presented in this session, Lukermann concluded, were particularly useful in this regard.

In advising policymakers, Weinberger noted, planners play an important role as “guardians of the commons” who influence the allocation of

resources for all people. When communities come together to set goals and make decisions, it is the task of planners to bring ideas and knowledge to bear on difficult questions such as the ones raised by this conference.

Lee Munnich, director of the State and Local Policy Program at the University's Humphrey Institute of Public Affairs, observed that different fiscal constraints exist in all states, and that these constraints affect the development of transportation concurrency measures and other policies aimed at creating sustainable transportation systems. For example, he said, neither Florida nor Washington has a state income tax. He asked Ruth Steiner if she had observed any unusual effects that could be attributed to the states' tax systems. Steiner responded that future research on that subject was currently being discussed. She said the lack of tools for local governments in Florida to raise taxes appears to be a significant problem in managing growth there, which could be addressed through the use of development impact fees.

Steve Elkins, a city council member in the suburban community of Bloomington, Minnesota, commented that demand for developable land in suburbs around Minneapolis and St. Paul is creating a “huge crunch” for communities struggling to finance necessary infrastructure; however, impact fees are not allowed in Minnesota and are strongly opposed by the development community. Elkins asked Becker and Gladwin to comment on the impacts of “big-box” retail stores in suburban settings, observing that these uses are dependent on the retailers' ability to attract a large number of customers from around a region. Although the negative effects of big-box retail are often decried, he said, these stores are often utilized by low-income and middle-income shoppers who come to take advantage of low prices made possible by the stores' economies of scale. Therefore, Elkins said, it appears that there is some increased standard of living brought about by the high levels of accessibility to these particular retail uses; likewise, high levels of access to employment produce efficient labor markets and similar benefits. However, he concluded, if increasing congestion causes the big-box retail paradigm to collapse, the retail industry will have to adjust to that change.

In response to Elkins' remarks, Gladwin observed that many people in transportation fields seem confident that market-based “libertarian” approaches can solve accessibility problems,

Tools and policies to promote accessibility must take local conditions and political systems into account.

a view he heard expressed during the previous day's luncheon discussion. Gladwin described capitalism, the foundation of big-box retail, as an extraordinary invention for rewarding risk takers and bringing about efficient allocation of resources—for those who have money to spend. However, he said, capitalism was never intended to produce a just society or one that is optimally scaled in terms of environmental carrying capacity. He argued that relying only on market-based mechanisms without taking care of distribution and scaling issues is in fact only a third of the job of planning, and stated that his preference, from a systems perspective, would be to optimize the flow of energy and materials through the community first, and then “let capitalism rip.” This, he concluded, was not a popular position within the University of Michigan's business school.

Continuing the thread of Gladwin's argument, Udo Becker agreed that benefits may be created by high levels of big-box retail access, but said the important question was who was really receiving those benefits—whether profits were shared equitably through mechanisms such as taxation or were accruing disproportionately to one party. He

noted that cities supporting accessibility to big-box retail have to invest in providing additional infrastructure. In addition, he said, the effect of large suburban retailers driving smaller, centrally located retailers out of business creates additional travel costs for lower-income people who have to pay a high percentage of their income to own a car. Finally, he said, the costs of fuel consumption, pollution, noise, and other negative effects must be taken into account. Becker said he supported letting each city council decide what is best for its community, provided it has a true cost pricing scheme—however, he asserted, we are hampered today by incomplete knowledge. CTS director Robert Johns commented that calculating the full costs of transportation had been the subject of significant research in the Transportation and Regional Growth Study.

Moderator Lance Neckar thanked the discussants and presenters for “remarkable syntheses” emerging during the session, and said that he had gained a working definition of sustainable access: “a spatial incarnation of an economy, the institutional structure of which affords access as it protects the ecology that affords it.”

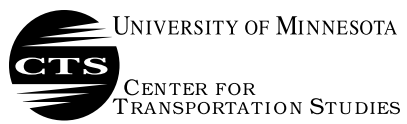
Closing comments

CTS director Robert Johns, bringing the conference to a close after the conclusion of the final technical session, called the event “a remarkable two days.” Johns then asked David Levinson and Kevin Krizek to comment on the conference and on future work planned for the Access to Destinations Study.

The Access to Destinations conference, said **Kevin Krizek**, endeavored to take on an ambitious task and speak to multiple audiences. The conference organizers wanted to explain patterns of transportation and land use, show how they were related and how they interacted, as well as how to measure that interaction, and how to use that knowledge to address policy issues. As a result, the conference agenda was deeply interested in empirical issues, but also in the policy implications of those issues. Whether or not the conference was a success on those terms, Krizek said, was still unknown. But the conference did provide a forum for discussion, building on 40 years of research in accessibility.

David Levinson underscored the difference between accessibility, which he characterized as the ease of reaching a destination, and mobility, the ease of movement around a network; he noted that neither of these definitions said anything about the travel mode being used. Levinson said that using consistent definitions was important to the success of research in accessibility, and that losing consistency would mean losing the ability to create systems that improve accessibility rather than merely increasing mobility. Although this distinction between mobility and accessibility has a long history in academic discourse, Levinson said, it is often lost in the planning process. He called on researchers to help end this confusion, saying that he hoped the present conference would help in this endeavor.

Bringing academics and professionals together to create dialogue on transportation issues is one of the goals of the Center for Transportation Studies, said **Robert Johns**. The Access to Destinations conference was particularly significant because it brought such a wide range of academic research to a discussion with professionals and policymakers. In doing so, he said, the conference demonstrated one of the most important functions of a land-grant research university—contributing to the public discussion of socially significant issues. Even in raising more questions than can be immediately answered, Johns said, this process is valuable because the dialogue helps define research directions and ultimately leads to more relevant research. Events such as this, Johns concluded, foster innovation by generating a range of divergent ideas that stimulate the development of new approaches with far-reaching benefits.



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