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A New Planning Template for Transit-Oriented Development

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16. Abstract: The Mineta Transportation Institute (MTI) at San José State University assigned a project team to design a planning template for transit-oriented development (TOD) that incorporates an understanding of nonwork travel, that is, trips for shopping, eating out, and engaging in recreational and cultural activities. Nonwork trips are growing in signifigance and now account for four of every five trips. At the same time, TOD has become a popular planning response to the impacts of metropolitan growth. Some planners believe that TOD will induce more pedestrian and transit trips and will reduce the average length and frequency of household auto travel. This effect is assumed to result from improved accessibility to employment and nonwork venues located in compact, mixed-use centers. Planning professionals in many MPOs also suggest that if multiple centers are linked by high quality transit, such as light or heavy rail, access is enabled to the broad range of nonwork activities.

The project arrived at these essential findings: (1) Venues for nonwork activities are very numerous and geographically dispersed. (2) The spatial environment for nonwork activities is the result of growing prosperity, technical innovation, and a dynamic, competitive marketplace. (3) The consumer marketplace will provide many more places to go than mass transit can cost-effectively serve. (4) Current metropolitan planning methods and modeling tools focus on the work trip and do not adequately account for the complexity of nonwork trips and their linkage to work trips.

These findings support the need for a new regional planning process to complement current methods. One recommended approach is that metropolitan communities establish a Nonwork Travel Improvement Planning Process using a multidisciplinary expert advisory group interacting with a core, Internet-enabled, professional transportation planning staff. An iterative interaction across varied but relevant skill sets could be achieved through a Backcasting Delphi process. The focus of the interaction would be on understanding the ramifications of consumer and retail industry behavior for TOD and other new transportation strategies, and then assessing the available strategies for cost-effectiveness in reducing the impacts of growth and automobility in a complex and uncertain metropolitan market.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY..... 1
Project Overview..... 1
Nonwork Travel: Implications for Transit-Oriented Development.... 2
Summary of Findings..... 3
Recommendations..... 4
Project Reports..... 5

1. CHAPTER ONE
TRANSIT-ORIENTED DEVELOPMENT: A POPULAR PLANNING PARADIGM..... 9
Introduction..... 9
The Concept..... 10
A Rising National Paradigm..... 11
Federal and Private Sector Encouragement of Transit-Supportive Land Use..... 13
Actual Experience and Growing Critique..... 16

2. CHAPTER TWO
IMPORTANCE OF NONWORK ACTIVITIES AND TRAVEL IN REGIONAL PLANNING..... 25
Introduction..... 25
Nonwork Travel Demand..... 26
Discussion..... 31

3. CHAPTER THREE
RETAIL ENVIRONMENT AND NONWORK TRAVEL TRENDS.33
Introduction..... 33
New Store Formats..... 34
New Consumer Services..... 37
Growth of Out-of-Home-Dining..... 38
Growth of Leisure Activity..... 41
Spatial Organization of Retail Structure..... 42
Other Spatial Pattern Changes..... 44
Developer, Retailer, and Consumer Decision Dynamics..... 46

4. CHAPTER FOUR
NEEDED: PLANNING METHODOLOGIES THAT ACCOUNT FOR URBAN COMPLEXITY AND UNCERTAINTY..... 59
Introduction..... 59
Characteristics of Complex Systems..... 59
Factors Causing Complexity in Urban Transportation and Land Use Planning..... 60
Complexity and the Current Planning Process..... 60
Limitations of Current MPO Modeling..... 64
Current Major Premise: Government Action Shapes Urban Form.... 65
Key Elements of a Nonwork Travel Planning Process..... 67

5. CHAPTER FIVE
BACKCASTING DELPHI: A PLANNING TOOL FOR A COMPLEX PRESENT AND AN UNCERTAIN FUTURE..... 77
Introduction..... 77
The Delphi Method..... 77
Previous Applications of Delphi Method To Transportation and Land Use..... 79
Scope of the Proposed Method..... 79
Advantages of Backcasting Delphi..... 81
The Template: Implementing Backcasting Delphi in a New Planning Process..... 82
Components, Phases, and Tasks of the NWTIPP..... 83
Further Detail on the Tasks of the NWTIPP..... 85
Additional Considerations..... 90

6. CHAPTER SIX
CONCLUSIONS ABOUT PLANNING FOR TOD..... 91
Growing Popularity and Critique of TOD..... 91
Importance of Nonwork Travel..... 91
The Ever Changing Retail Marketplace..... 92
Planning that Addresses Complexity, Risk, and Uncertainty..... 92
A New Metro Planning Tool: Backcasting Delphi..... 92
Final Considerations..... 93

BIBLIOGRAPHY..... 95

APPENDIX A: REVIEW OF SELECTED TOD LITERATURE.... 103
Bibliography for Appendix A..... 119
APPENDIX B: GLOSSARY OF ACRONYMS..... 123

APPENDIX C: ABOUT THE RESEARCH TEAM..... 125

PRE-PUBLICATION PEER REVIEW..... 127

LIST OF FIGURES

Figure 1-1. Schematic of the Transit-Oriented Development (TOD) Planning Concept 10

Figure 2-1. Percentage of Work and Nonwork Trips by Time of Day 30

Figure 3-1. Relative Growth of Grocery "Supermarkets" and Population, 1958-1997 37

Figure 3-2. Shopping Center Trends 43

Figure 3-3. Locations of "Superstores" Relative to the Proposed TOD Structure of the Puget Sound Region 47

Figure 3-4. Locations of Major Nonwork Trip Generators Relative to the TOD Structure of the Puget Sound Region 48

Figure 3-5. Hypothetical Household Nonwork Travel Patterns 55

Figure 4-1. Urban Transportation Planning Process 74

LIST OF TABLES

Table 1-1. Generations of Urban Rail Transit Systems 12

Table 1-2. FTAL and Use Criteria for New Starts 14

Table 1-3. New Federal Transportation-Land Use Initiatives 15

Table 1-4. Simplified TOD Regional Cost-Benefit Accounting 17

Table 1-5. Factors Determining the Success of TOD 18

Table 1-6. Empirical Studies of the Travel and Land Use Impacts of Transit-Oriented Development and Related Design Elements 20

Table 2-1. Trip Purposes as Percentage of All Person Trips, 1995 27

Table 2-2. Percentage Change in Vehicle Travel and Trip Length by Trip Purpose, Per Person, 1969-90, and 1990-95 27

Table 2-3. Percentage of Daily Person Trips by Mode and Selected Trip Purpose, 1995 29

Table 2-4. Percentage of Men and Women Who Stop on Work-to-Home Tour 30

Table 2-5. Trends in Average Vehicle Occupancy for Selected Trip Purposes 31

Table 3-1. Selected Examples of the Rapid Growth of Mass Retailers 34

Table 3-2. The New “Discount” Mass Retail Formats 35

Table 3-3. Superstores in the Puget Sound Region 36

Table 3-4. New Consumer Services 38

Table 3-5. Restaurant Market Share by Major Market Segments 45

Table 3-6. Growth of Cuisine Restaurants in Seattle Metropolitan Area 39

Table 3-7. Participation in Arts Events and Other Leisure Activities 42

Table 3-8. Types and Spatial Characteristics of Shopping Centers 43

Table 3-9. Key Retail Location Decision Factors 49

Table 3-10. Key Consumer Behavior Factors 52

Table 3-11. Major Trends in Retail Structure 54

Table 4-1. Sources of Complexity, Risk, and Uncertainty 61

Table 4-2. Limitations of Four-Step Transportation Modeling Applied to Nonwork Travel 65

Table 4-3. The TOD Paradigm: From General to Specific 68

Table 4-4. Policy Paradigm Choices and Strategies in Government Actions that Address Growing Urban Automobile Usage 70

Table 4-5. Comparison Between the Proposed Transportation System Improvement Planning Process, and the Current Metropoolitan Transportation Planning Process (MTP) 73

Table 5-1. The Components of Delphi Backcasting 78

Table 5-2. Areas of Expertise for the Expert Advisory Group 80

Table 5-3. Attributes of Backcasting Delphi 82

Table 5-4. Components of the Nonwork Travel Improvement Planning Process 83

Table 5-5. Phases and Tasks of the Nonwork Travel Improvement Planning Process 83

EXECUTIVE SUMMARY

PROJECT OVERVIEW

The purpose of this project is to improve the planning methodology for Transit-Oriented Development (TOD) by bringing into sharp focus the dynamics of the retail marketplace and nonwork travel demand. TOD involves increasing the density of housing, offices, stores, and services around mass transit stations in an urban region, and making pedestrian access very easy, in order to encourage more use of transit and a reduction in automobile driving. TOD is intended to influence both travel to work (commuting and business travel), as well as all of the other reasons for local travel (so-called nonwork trips, including shopping and leisure travel). Specifically, the project has sought to:

- Analyze nonwork travel demand as influenced by retail market dynamics on a national and regional level.
- Review the state-of-the-art in regional transportation planning by Metropolitan Planning Organizations (MPOs) with respect to nonwork travel.
- Create a planning template for regional transportation and land use planners who are pursuing TOD that encompasses nonwork travel.

The central Puget Sound region of Washington State (four counties making up the Seattle-Tacoma-Bremerton-Everett metropolitan area) was used as a case study for the development of the template. The nonwork travel environment of the region was mapped and analyzed, and the findings generalized to other large metro regions. Of particular interest were the myriad “retail” activities from which consumers choose their shopping and recreational destinations. As a group, these activities generate more than half of all person trips: shopping for goods and services, eating out, entertainment, recreation, culture, and other leisure pursuits.

A basic planning template was designed that generates three new kinds of data: specification of the major nonwork venues that generate travel demand and that should therefore be mapped and spatially analyzed, listing of the forces shaping urban form that need to be monitored and understood for travel generation and land-use implications, and the identification of the factors that will determine the regional (not just station-area) success of TOD in stimulating a shift from driving to mass transit patronage.

The framework for measuring the success of TOD that we use throughout this project is comparing public costs to public benefits. According to this cost-benefit framework, a necessary part of the regional planning process is comparing the estimated future benefits from TOD to the benefits from alternative investments. The most critical regional public benefits come from the expected market share shift from automobile to public transit: increased transit ridership, reduced average travel times and vehicle congestion, and measurable environmental gains such as improvement in air quality. In order for a TOD plan to be judged as successful in our framework, the plan's level of expected future benefits must be commensurate with the level of capital investments made to implement TOD. Those investments include new transit facilities and the financial incentives and other public costs incurred to shape private real estate development toward the more compact and mixed land use forms required to make TOD successful.

NONWORK TRAVEL: IMPLICATIONS FOR TRANSIT-ORIENTED DEVELOPMENT

Travel to nonwork activities has grown steadily over the last three decades in the United States. It now accounts for about three-fourths of all household vehicle trips and four of every five person trips. Nonwork is the major travel purpose even in weekday peak periods, both morning and afternoon. As people strive to make efficient use of valuable time, nonwork trips are increasingly linked into trip chains or tours involving several stops. This is true for travel to and from work as well as for travel to purely nonwork activities. More than half of all trips from work to home involve a stop to shop, pick up a family member, or conduct personal business.

The observed growth of nonwork travel is directly related to the relentless progression of changes that have occurred in the retail and consumer services marketplace. Technological innovation, combined with increasing wealth, has produced a greater variety of business opportunities and consumer choices.

Nonwork travel, because of its magnitude, has important implications for transportation and land use policy, particularly transit-oriented development. TOD is a policy response to the impacts of metropolitan growth and its effects, including traffic congestion and travel-related environmental impacts, and to the concern that growth patterns threaten the livability of American communities.

As TOD has been implemented, it has come to mean compact, mixed-use centers made up of residential units, offices, and stores, supported by and, in turn, supporting new rail transit investments. Pedestrian movement is emphasized, and parking is limited. The number of metro areas, large and

small, that have embraced this approach to managing growth has increased over the last two decades to the point that it can be said that rail-TOD is one of the most important urban planning paradigms in the United States. Federal policies, especially the land-use criteria that must be met to qualify for "new starts" fixed-guideway transit funding, encourage TOD.

These efforts are motivated by the belief that TOD will induce more pedestrian and transit trips and will reduce both the average length and frequency of household auto travel. This is assumed to result from improved accessibility to work locations and to better proximity to nonwork venues. Further, it is suggested that if multiple centers are linked by high quality transit, access is enabled to a broad range of nonwork activities across a metropolitan region.

SUMMARY OF FINDINGS

The research arrived at a number of key findings that support the initial project premise of a need for a new regional planning process to complement current methods.

- Although support for transit-oriented development is based, in large part, on the assumption that when venues for nonwork activities are located at TOD station areas more people will use transit, there has not been a careful analysis of the actual spatial environment for nonwork activity and the travel patterns it engenders.
- The consumer marketplace for goods, services, eating out, and leisure activities in a metropolitan region is exceedingly large, varied and geographically dispersed. For example, a map prepared by the authors (Figure 3-4) indicates the locations of approximately 1900 major nonwork destinations in the Puget Sound region, overlaid on the 21 urban centers around which TOD will be emphasized.
- The number and location of, and the spatial relationships for, the myriad nonwork venues is the result of growing prosperity, technological innovation, and a highly adaptive entrepreneurial market that seeks to satisfy consumer needs and wants.
- Nonwork activities, which now account for approximately two-thirds of all personal travel, will continue to grow in variety as wealth and prosperity spread, and as the nation becomes more ethnically diverse.
- Since the consumer marketplace for goods and services will inevitably provide many more places to go than mass transit can effectively serve, the success of TOD as measured by less automobility cannot be taken for

granted.

- Even the choice of mode for the work trip is determined in large measure by nonwork activities, as people make stops during the commute to shop, drop off and pick up family members, and conduct personal business.
- For the purpose of gauging the success of TOD, it is important to distinguish between local (station-area) benefits and costs, and corridor or regional benefits and costs.
- Academic research to date suggests that neotraditional forms of development in a station area, such as grid street patterns and compact, mixed-use centers, alone will not have a significant impact on personal travel patterns.
- A benefit-cost ratio for the TOD paradigm that is superior to other investments that increase transit market share may not be an *a priori* possibility in every metropolitan region. Regions differ greatly from each other in their existing land use pattern, travel pattern, transit corridor availability, topography, political culture, and governmental structure. One size does not fit all.
- Metro regions may discover greater net public benefits by exploring a wider range of paradigms that encompass other strategies for dealing with the large growth in automobility associated with nonwork activities.
- The current metropolitan planning process is focused on the work trip and produces a limited set of strategies that do not bracket the range of possible cost-effective alternatives that are needed to address the variety and volume of nonwork travel.
- If a broader search for cost-effective alternatives is to be carried out, a new complementary planning process is required, one that involves a much wider and deeper knowledge base and range of expertise than is typically included in the current process.
- Unlike the current process, the new planning process must be able to account for the inherent complexity of human behavior and associated land use and travel patterns, and it must address the large uncertainty attached to the prediction of future patterns and the impact of government actions on these patterns.

RECOMMENDATIONS

In response to these findings, we recommend:

- Development and testing, in a few metro areas, of an explicit augmentation

to the metropolitan planning process that responds to complexity and uncertainty, and that deals with nonwork travel in the context of transit-oriented development.

- In response to the realities of and reasons for consumer behavior and retail industry practices as seen now and as predicted for the future, the new process should strive to specify ways that TOD can be strengthened so that consumers more often use mass transit and walking to shop and recreate. This specification would describe how and to what extent the market economy can be influenced to support TOD land use patterns.
- If, on the other hand, the recommended augmentation to the process reveals that transit investments and government policies cannot realign the market to yield a larger transit market share in the urban travel market, then the planning process should direct attention to the specification of paradigms other than TOD.

A Backcasting Delphi process, previously used to predict the efficacy of transportation and land use strategies outside the US, can be a useful supplement to the current method. It is expected that each metro region that uses the process will elaborate on the basic template to meet their specific circumstances and needs. The process would have the following key characteristics and elements:

- Defining the problem in terms of desirable behavior change to be achieved as measured by actual improvements in transportation system performance and environmental externalities, as opposed to simply providing options for behavior change.
- Focusing on choice of mode for travel to nonwork activity.
- Creating a knowledge-based understanding of nonwork activity and travel trends in the region, including new trends that are difficult to quantify but that may affect future travel and land use patterns.
- Designing the process to be carried out either by the MPO as an augmentation to existing procedures, or else by a civic organization acting in parallel to complement the existing MPO process.
- Recruiting and using multidisciplinary professionals in a structured, interactive process in which they share ideas and learn from each other and educate the regional leadership and populace.
- Employing an iterative process (Backcasting Delphi) of designing feasible transportation investments and strategies with costs and risks that are justified by the likely transportation performance to be achieved.

Although the focus of the research leading to the above recommendations was on nonwork travel, we suggest that the supplementary planning process examine the growing geographic dispersion of employment sites, the diverse requirements of journeys to work and work-related travel, and the increasing linkage of work and nonwork trips in complex trip chains. In other words, all trip types in a metropolitan area should be covered in the planning process we have sketched in this report. The planning template would be useful whether or not the metro region has embarked, or plans to embark, on TOD.

The U.S. DOT should support the refinement and testing of the new planning tool through its grant process, just as it now supports conventional regional planning.

Several actions should be taken to provide empirical data and other information in support of TOD planning, whether or not it is undertaken with the recommended planning process**.**

- Federal and local government consumer surveys should be structured to shed more light on the reasons people choose to live in a TOD. This would help in understanding whether TOD attracts people other than current transit users.
- Similarly, surveys should identify the locations for nonwork stops on the commute trip to assist in understanding the malleability of these locations, i.e., can they be induced to relocate to station areas?
- Studies should be undertaken of how well older neighborhood commercial areas and central business districts have adapted to the changes that have occurred in the larger retail marketplace.
- Research should be conducted to identify and catalog existing and emerging retail goods and services business strategies that have demonstrated synergy with the public policy requirements (for example, floor space and parking limitations) of locating facilities within transit-oriented developments.
- Other nonwork, nonretail activities may involve personal choices that result in trips outside the household's immediate neighborhood even though there are closer opportunities. The travel patterns associated with these activities, such as visits to the family doctor, and trips to school and church, should be investigated.

PROJECT REPORTS

During the course of the project, the authors produced five documents that are referenced in this final report. These documents, summarized below, are available for access and review at http://www.globaltelematics.com/mineta/

Report One, The Growing Importance of Nonwork Travel: The first report summarizes national trends for nonwork activities and travel patterns. Growth of nonwork travel is related to the changes that have occurred in the retail and consumer services marketplace, particularly in shopping for goods and services, eating out, and engaging in leisure activities. The travel impacts of these activities estimated by aggregating four of the trip purposes in the Nationwide Personal Transportation Survey (NPTS): shopping, eating out, recreation, and other kinds of personal business. In the NPTS of 1995, these four categories encompass 54 percent of person trips. Report One also assesses the state of the art in the modeling of future nonwork travel behavior.

Report Two, Preliminary Template Design: In the second report, the TOD paradigm and the impetus for its widespread adoption is described. The report reviews the limited experience of TOD's effect on travel and land use patterns, and it summarizes the growing critique of TOD's benefits compared to its costs as measured by changes in regional transportation systems performance and development patterns.

A new Nonwork Travel Improvement Planning Process (NWTIPP) is proposed that would provide additional guidance to metropolitan decision makers beyond the traditional transportation planning protocol that focuses on journey-to-work and four-step demand modeling. The NWTIPP centers on aggregating diverse expert opinion, and is intended to cope realistically with considerable complexity in the present and with much uncertainty about the future.

Report Three, Prototype Nonwork Database: The third report presents an example database of maps, tables, and commentary that would serve as a key input to the Nonwork Travel Improvement Planning Process sketched in the previous report. The central feature of this database (covering for purposes of illustration, the Seattle metropolitan region in western Washington State) is a series of maps that illustrate key elements of the retail and consumer services environment that generate nonwork travel. Other parts of the database include information on residential and employment conditions, transportation system performance, land use planning status, current planning tools now used in the region, and a summary of exogenous forces potentially shaping activities, land use, and travel.

Report Four, Revised Template Design: This document revises the template in Report Three based on a more thorough review of the literature for the Backcasting Delphi procedure and recent research on transit-oriented development, and the completion of the prototype nonwork database assembled in Report Three.

Report Five, Final Template Design: The fifth report sets out the final template design that was arrived at after submitting the revised design to a peer review of transportation and land use planners.

CHAPTER ONE

TRANSIT-ORIENTED DEVELOPMENT: A POPULAR PLANNING PARADIGM

INTRODUCTION

Low-density, separated-use development has become the predominant land use form across much of urban America in the post-World War II period. This form's connection to the large growth in personal and commercial travel in the same time span is well recognized, if not fully understood. Concerns over the impact of land use and personal transportation on the human and natural environment have been voiced in rising and falling crescendos over the last fifty years. Recently, interest has risen anew in response to the continuing growth and spread of urban development, ever higher rates of personal travel, and to the linkage between increasing travel and the greenhouse gases responsible for the suspected warming of the earth's atmosphere.

Public concern over growing congestion is the most tangible manifestation of problems linked to current urban form. In reaction, the federal government, states, local jurisdictions, metropolitan planning organizations, and transit agencies have adopted policies and strategies directed at reshaping development into more compact, mixed-use patterns. These efforts have been encouraged by numerous non-governmental organizations and individuals who view our current land use patterns as both environmentally and socially damaging.

One policy that has gained wide acceptance is transit-oriented development. TOD has, over the last decade, become a leading urban planning paradigm in the United States. Proponents of TOD envision dense, mixed-use activity centers connected by high quality transit systems. Metropolitan planning organizations, local governments, and public transit agencies have launched major efforts to direct growth to existing centers, infill sites, and new suburban communities, and in some cases to constrain growth from leap frogging and spilling into adjacent jurisdictions. These efforts are motivated by the belief that new urban forms, which in some ways replicate older forms, will produce significant transportation benefits. Planners assume that TOD will induce more pedestrian and transit trips, and reduce both the average length and frequency of household auto travel.

THE CONCEPT

Figure 1-1 depicts TOD's hypothetical spatial environment. Calthorpe (1993) provides a detailed delineation of the TOD concept. He defines a TOD as a center with a mix of high-density residential, retail, office, public, and open space uses. Retail shops and services are in a commercial core within an easy walk of homes (600 meters or about ten minutes). A transit station is at the center of the core. Uses in the core are "vertically integrated"—apartments and offices rise above ground-floor stores.

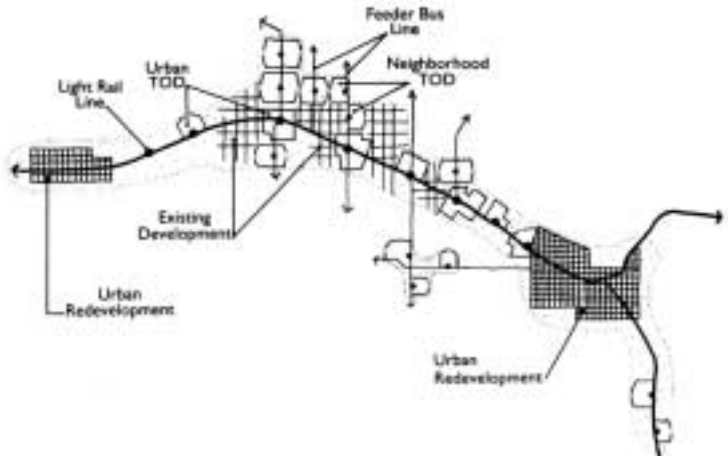

Figure 1-1. Schematic of the Transit-Oriented Development (TOD) Planning Concept (Calthorpe 1993)

Secondary areas for lower intensity uses surround the core to a distance of 1,600 meters. These areas might be locations for single-family housing in a range of sizes, small parks, schools, and light industry. Housing design emphasizes "neo-traditional" features: front porches, shallow setbacks from the street, and alley access to off-street parking. Streets largely conform to a grid pattern and provide direct walking and biking access to the core.

Calthorpe explains that the number and mix of commercial establishments in each TOD would vary depending on the size, location, and overall function of each center, whether servicing nearby residents or an entire community.

Linkage of Centers

Proponents of TOD acknowledge that in order for significant numbers of people to be persuaded to switch from driving their cars to riding transit, centers must be linked by a high quality regional transit system. The centers and the transit linkages between them must be sufficiently numerous and dense to form a "transit metropolis" (Bernick & Cervero 1996). This kind of

metropolis would cause significant numbers of people to switch from using automobiles to riding transit because both their homes and their work locations would be well-served by transit stations. Aside from support of commuting to work, the regional transit linkages of a transit metropolis would also enable access to a range of goods, services, and recreation unavailable in a community center.

Types of Centers

Calthorpe distinguishes two types of TODs—urban and neighborhood—depending on their articulation with the transit system and the intensity of their development.

- Urban TODs are located at stations on a trunk line of the regional system, which could be light rail, heavy rail, or express bus. Their locations are determined by station spacing and are typically 0.8 to 1.6 kilometers apart. Urban TODs have high commercial intensities, employment clusters, and moderate to high residential densities. If urban TODs are located in established neighborhoods, Calthorpe recommends that they be developed at the mix of uses and densities allowed or required under current planning rules.
- Neighborhood TODs are located on a local or feeder bus line within three miles (no more than ten minutes) of a trunk line transit station. They are developed at moderate residential densities and provide for retail, service, entertainment, recreation, and civic uses. Neighborhood TODs can be closely spaced to form a “corridor” of activity nodes.

Proximity of Competing Retail

Since a TOD depends, in part, on retail uses to attract pedestrians and transit riders, nearby auto-oriented retail centers can compete with and diminish its utility. For this reason, Calthorpe (1993, p.82) proposes that new competing retail uses should be strictly limited within one mile of the core commercial area through zoning amendments within the TOD market area.

A RISING NATIONAL PARADIGM

So numerous are the metropolitan planning organizations across the United States that have embraced transit-oriented development (TOD), that it would not be inaccurate to describe it as the key national transportation-land use planning paradigm. Its genesis goes back at least to the rail systems built just after WW II. Porter (1997, 1998) recently reviewed the status of station-area development for North American urban rail systems that were placed in operation beginning in the mid 1950s. His categorization of these systems and older systems by generation is shown in Table 1-1.

Efforts are underway to extend and upgrade several of the current systems, and many other regional and local transit agencies have initiated or are contemplating major investments in new transit capacity, particularly light rail systems. These agencies expect that dense and mixed-use development around stations will follow and cause significant shifts away from automobile usage for both work and nonwork trips.

Table 1-1. Generations of Urban Rail Transit Systems

Generation	City or Region (Year Operations Initiated)
Simultaneous city/transit development, continuous since the mid 1800s, including modern extensions:	Boston Chicago Cleveland New York Philadelphia
Mid 1950s to mid 1970s major regionwide systems:	Toronto (1954) San Francisco (1973) Washington, D.C. (1976)
The Third Wave, late 1970s through 1980s:	Atlanta (1979) San Diego (1981) Miami (1984) Buffalo (1985) Pittsburgh (1985) Portland (1986) Vancouver (1986) Baltimore Metro (1987)
New systems the 1990s:	Los Angeles (1990) Sacramento (1990) San Jose (1991) Baltimore LRT (1992) Detroit (1993) St. Louis (1993) Denver (1994) Dallas (1996)

Source: Porter 1997, 1998

FEDERAL AND PRIVATE SECTOR ENCOURAGEMENT OF TRANSIT-SUPPORTIVE LAND USE

Federal transit support for construction of these new systems is conditioned on a showing of supportive land use patterns. And several separate federal initiatives have been mounted to encourage the integration of transportation with land development. Federal interest in the linkage between land use and transportation goes back to the late 1970s when new subway systems in the San Francisco Bay area and metropolitan Washington, DC failed to gain the ridership expected because not enough housing and commercial development was close to the train stations (TCRP 1995). Authority for the most recent efforts was granted in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and revised in the Transportation Equity Act for the 21st Century (TEA-21) of 1998. TEA-21 requires that the metropolitan planning process provide for consideration of projects and strategies that will, among other things, "protect and enhance the environment, promote energy conservation, and improve the quality of life."

Regulations implementing the Act (23CFR450.316) require several factors to be considered and reflected in metropolitan transportation plans including: "the likely effect of transportation policy decisions on land use and development and the consistency of transportation plans and programs with the provisions of all applicable short- and long-term land use and development plans." The regulations specify that this analysis should include "projections of metropolitan planning area economic, demographic, environmental protection, growth management, and land use activities consistent with metropolitan and local/central city development goals, and projections of potential transportation demands based on the interrelated level of activity in these areas."

Thus, TEA-21 appears to explicitly require a future estimate of the level of activities encompassing both work and nonwork and their impact on transportation patterns.

Federal New Starts and Funding Criteria

"New starts" transit projects are funded by the Federal Transit Administration under authority granted by Congress in TEA-21 and the federal transportation budget. Recommendation for full funding is now based, in part, on a number of land use criteria that are strongly supportive of TOD goals (Table 1-2). Projects receive higher ratings and are more likely to be funded when there are transit-supportive land use conditions and government policies, including regional growth management policies to control dispersed development.

Current New Starts Funding Status

The U.S. General Accounting Office, in a report to Congress that scrutinized the "new starts" transit projects, identified 14 projects under construction, and 42 other projects already either in final design or preliminary engineering stages (GAO 1999b). The GAO estimated that the $8.2 billion that Congress authorized in 1998 for new transit projects will fall $7.6 billion short of the federal money needed to construct these projects. In addition, the GAO said the FTA expects that over $40 billion more in federal dollars will be requested to help fund another 100 projects currently in the early planning stage.

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Table 1-2. FTA Land Use Criteria for New Starts

Category	Rating Based On:
Corridor Economic Conditions	Demand for locating in corridor
Existing Zoning	Density and mixed-use allowable
Existing Station Area Development	Existing land use is transit-supportive
Station Area Planning	Is being conducted and is supportive of TOD
Regional Growth Management	Effective region wide policies implemented
Urban Design Guidelines	TOD-supportive; implemented for station areas
Promotion and Outreach	Agencies actively conducting for TOD
Parking Policies	Strength of restrictive policies
Zoning Changes	TOD-supportive, implemented or developed
Market Studies	Comprehensive analysis of TOD market potential
Joint Development Planning	Strength of public-private program

Source: U.S. DOT 1998

Other Federal Support for TOD

Several federal agencies, including Department of Transportation, Department of Housing and Urban Development, and Environmental Protection Agency have initiated efforts to encourage more compact and efficient patterns. These new initiatives include grant programs the Federal administration announced in January 1999 and re-emphasized in the FY2001 budget submission in January 2000. The programs try to protect sensitive lands and leverage new, more intensive forms of development (Table 1-3). They supplement efforts begun under ISTEA and continued under TEA-21 to rate and fund new mass transit starts based on a set of land-use criteria.

Table 1-3. New Federal Transportation-Land Use Initiatives

Agency	Program
Environmental Protection Agency	Better America Bonds—$10.75 billion in bonding authority over five years to finance projects that preserve green space, create or restore urban parks, protect water quality, and clean up brownfields.
Department of Transportation	Transportation and Community and System Preservation Pilot—$52 million in FY 2001 encouraging states and localities to coordinate land use plans and transportation.
Department of Housing and Urban Development	Regional Connections Initiative—$25 million in FY 2001 for matching grants to design and pursue smarter growth strategies across local government jurisdictional lines.

Source: Clinton-Gore 2000

Fannie Mae Mortgage Initiative

In August of 1999, Fannie Mae announced a $100 million “location efficient” home mortgage initiative (Fannie Mae 1999). The program will attempt to increase home ownership in densely populated communities accessible to efficient public transit. It recognizes the lower household expenditures that result if household members use transit rather than a personal vehicle. More of a household's income is thus available to pay housing costs, and the owner can

qualify for a mortgage loan at a lower level of income. Trials of the program are underway as of mid 2000 in five cities.

ACTUAL EXPERIENCE AND GROWING CRITIQUE

In spite of unprecedented efforts to rebuild metropolitan areas around transit-oriented development, the actual future benefits of TOD on a metropolitan scale remain uncertain, as we will show in the research review below. The most important reason for the uncertainty is the difficulty of predicting the market's response to policies dependent upon major transit system changes and land use shifts.

As described in the previous section, TOD often involves major new transit capacity investments, usually hundreds of millions of dollars or more in light rail and commuter rail systems. In order to stimulate new land use patterns and density, these public investments are typically made before supportive land uses — employment, housing, and commercial services— are in place.

Unfortunately, at the state of the planning art at the end of the 20th century, transit investments are made without the assistance of empirical data or predictive models that can test the veracity of the assumption that benefits commensurate with costs will be achieved. In particular, the effect of TOD on nonwork activities, from which a majority of all personal travel is derived, has not yet been thoroughly addressed by research. The analysis of nonwork travel for shopping, eating out, and recreation is complex because of the interplay of numerous variables that determine developer, store owner, and consumer reaction to transit investments, land use policies, and other government actions. New data and insights regarding the consumer marketplace are needed to realistically evaluate the likely success of TOD and the expensive investments in new transit capacity that it requires.

Furthermore, taxpayer-funded investments whose payoff depends on private-sector organizational and consumer embrace of TOD are invariably made without a research-based recognition of the many elements that already determine the current patterns of retail structure and consumer behavior (Nelson & Niles 1999). An understanding of retail structure and derived travel as it exists today is obviously essential for the determination of TOD success tomorrow. Retail, when broadly defined as activities involving shopping, eating out, or engaging in recreation and other leisure pursuits, constitutes a major portion of all personal and household trips. In addition, retail logistics patterns account for much of the growing intraurban commercial truck travel that contributes to traffic congestion.

Thus, information that reveals the interplay of real estate and retail industry investments and consumer preferences is important for the purpose of validating two separate, widely-held planning assumptions: 1) that TOD, and its required transit expenditures, will actually result in dense, mixed-use centers; and 2) that these centers will, if created, appreciably change the overwhelming preference for automobile-based mobility.

After further framing of the important research questions, this section reviews the existing research that does bear on these issues.

Framework for Measuring TOD's Success

In our research framework, the central question for planners and decision makers is the magnitude of TOD's effect on travel behavior on a regional scale in established metropolitan areas. From an economic perspective, regional success of TOD will depend on the benefits it produces—both public or societal and personal—relative to its costs (Table 1-4). The public may experience benefits in the form of congestion reduction and air quality improvements. To the extent that TOD reduces excessive infrastructure costs associated with dispersed development, these would be accounted as secondary public benefits. The principal personal benefits may be travel time and expense saved, in addition to reduced congestion time. Personal benefits also include the possibility that some households can reduce the number of cars they own and operate. Other benefits, of a social nature and more difficult to monetize, are associated with the enhanced quality of living that some social analysts believe TOD produces (TRCP 1997).

Table 1-4. Simplified TOD Regional Cost-Benefit Accounting

Costs	Benefits
Transit system construction	Congestion reduction (time delay and excess fuel)
Transit system operations	Air quality improvement (health costs reduction)
Mitigation of traffic congestion caused by compact development	Reduced infrastructure
TOD planning, developer incentives	Personal travel time, vehicle operation savings
	Personal vehicle ownership reduction

Source: Nelson & Niles 1999b

The antecedent transit capital and operating costs are the primary public costs of TOD. The cost of producing housing in proximity to stations may also be higher. Other direct costs may arise, as well. For example, to the extent that increased density does not result in reduced travel, congestion mitigation measures may be required. There may also be costs associated with TOD planning and any public incentives that may be needed.

Achieving a level of benefits that exceed costs under the accounting in Table 1-4 depends on the response of developers, consumers, and taxpayers to the concept and to the public strategies that encourage it. We note in passing here that this response depends on even more elements than the complex of retail industry and consumer behavior issues, which this report identifies. The specific characteristics of the selected transit technology, the compatibility of TOD with personal housing, employment and commuting preferences, and the economics of location selection by organizations that do not serve the general public are also pertinent. Niles and Nelson (1999a) have identified 16 planning elements that will determine success at the regional or transit corridor level (Table 1-5). The table also highlights that fewer factors will control success at a single station-area, which puts the already well recognized challenges of station-area planning in perspective (PSRC 2000).

Table 1-5. Factors Determining the Success of TOD

Factor	Station Area Success	Regional Success
Number and siting of TODs (station areas)		X
Transit quality		X
Transit technology		X
Street pattern	X	X
Station area parking	X	X
Employment and housing density	X	X
Commercial mix	X	X
Retail siting criteria		X
Regional market structure		X

Table 1-5. Factors Determining the Success of TOD (Continued)

Factor	Station Area Success	Regional Success
Consumer activity patterns		X
Travel behavior/trip chaining		X
Zoning flexibility/land assembly	X	X
Resident reactions	X	X
Housing type preference/life style & life stage		X
Self-selection in residential choice	X	X
Government policies		X

Source: Niles & Nelson 1999b

Empirical Studies of TOD's Impacts

Since multi-center TOD on the regional level is now only a vision in the minds of planners, the impact of TOD on regional travel demand, patterns and mode choice cannot yet be directly measured from experience. Consequently, researchers have resorted to comparing older neighborhoods that approximate TOD and conventional suburban neighborhoods that do not. Other studies attempt to isolate the influence of specific design features and land use density and diversity. Also, metropolitan planning organizations and others have carried out limited modeling of TOD under a layer of arbitrary assumptions about future mode splits.

Empirical studies suggest that compact and mixed-use development may produce localized transportation benefits (See Table 1-6). However, these investigations fall short of giving planners and decision makers confidence that the promised macro-scale transportation benefits of TOD can be achieved (Nelson & Niles 1999a).

Table 1-6. Empirical Studies of the Travel and Land Use Impacts of Transit-Oriented Development and Related Design Elements

Location	Authors
Neighborhood/Community Form Comparisons	
Austin (Texas)	Handy 1996
Palm Beach County (Florida)	Ewing et al. 1994
Puget Sound region (Seattle)	Moudon et al. 1997
San Francisco Bay area	Handy 1992 & 1993
San Francisco Bay area	Friedman et al. 1994
San Francisco Bay area	Cervero & Radisch 1996
Seattle area	Rutherford et al. 1996
Density, Design, and Mixed Use Factors	
Los Angeles metro area	Boarnet & Sarmiento 1998
Puget Sound region (Seattle)	Frank & Pivo 1994
San Diego County	Crane & Crepeau 1998
San Francisco Bay area	Cervero & Kockelman 1997
Regional Congestion Management	
San Francisco Bay area	Luscher 1995
Post TOD Studies	
Portland metro area	Dueker & Bianco 1999
Los Angeles Blue Line	Moore 1993

Source: Nelson & Niles 1999a

In particular, the studies available do not sustain the belief that the necessary restructuring of the urban landscape and retail marketplace can actually be accomplished. And even if major restructuring can be realized, they provide little evidence that the large transit investments supporting the restructuring are

likely to produce transportation system performance benefits that the traveling public seeks.

Crane (1999) summarizes his review of empirical studies of the effect of land use variables on transportation as follows: “The results reported in any given study (may not be) incorrect, (rather) they appear to lack sufficient credibility to be the basis for policy. The risks of assuming they are reliable include unintended consequences, such as worsening traffic problems.”

There have been books and articles written that offer the opposite point of view (Calthorpe 1993, Cervero 1998), but none of them provide empirical evidence that refutes the conclusion we offer here.

Portland, Oregon, has been a laboratory for TOD and a focal point for research. Its Eastside Metropolitan MAX light rail transit line, the first in a planned metro-wide radial network focusing on downtown Portland, opened in 1986. Portland has gone to considerable lengths to encourage transit-oriented development that supports MAX.

Dueker and Bianco (1999) analyzed data to measure the impacts of the first ten years of operation of MAX on development patterns, choice of residential location, freeway traffic, and transit ridership. They found that light rail alone was not sufficient to change development patterns appreciably, and that the length of the peak period became longer for freeway traffic in the same corridor over the same decade. Growth in MAX riders occurred mainly in the non-peak and weekend periods. The researchers also observed substantial self-selection in housing location choice, meaning that some of the new housing near MAX light rail stations was mainly filled with residents who were already heavy transit users, rather than by formerly auto dependent households looking for a new, more transit-oriented style of mobility.

Implications of Empirical Research

Having an awareness of this empirical research, Dunphy (1995) suggests that if TOD is to make a meaningful difference in development patterns, there must be significant change on a regional scale. This change must be accomplished within the economic and political context of a particular region whose urban form has developed over a long period, the result of local zoning policies and myriad private investment decisions. Zoning, once established, is difficult to change, especially if the intent is to increase density. And because real estate is inherently a long-lived investment, a large majority of structures will still be standing at the end of the normal planning period.

Assuming that higher density centers linked by a quality transit service can be created, the scale of the transit investment required is an important

consideration. Downs (1994) provides one estimate by calculating the number of TODs needed to accommodate the average population growth during the 1980's of metropolitan areas with a 1990 population of one million or more. He concludes that TODs could handle the growth if their numbers were large, but that this would require a regional transit system that would likely not be financially feasible.

Long-term public support for such major investments requires that the potential benefits of TOD be clearly identified. Although station-area benefits are important, the public will put more weight on regional benefits, since typical household travel patterns extend beyond an individual's home neighborhood. Furthermore, most people will measure success by reduced congestion on major corridors and improved regional air quality, not by the more subjective goals of the proponents of New Urbanism and opponents of automobile-dependent development, goals such as less social segregation, a better quality of life, and a heightened sense of community.

TOD is more than a planning exercise; it involves major public investments. Sound public process dictates that officials estimate TOD's benefits before making major policy decisions. Beyond building new regional transportation systems, governments will need to buy public services and infrastructure that support compact development—streets, sidewalks, and parks. To the extent that mode shift does not follow from the changes in land use, there will be additional public expense associated with the management of increased vehicle traffic within compact areas.

These investments will likely compete with other demands on the public purse. And, if intended benefits are not forthcoming, they will translate to lost opportunity costs for government and to wasteful expenditures of political capital required to achieve significant urban restructuring.

As Bookout (1992) suggests, the challenge is to know the market that planning seeks to restructure, i.e., gain more information on the "ever-changing needs, preferences, and aspirations of people who make up communities." Howe and Rabiega (1992) posed a similar question after finding that the attitudes of members of the Oregon planning profession were negative toward strip malls and positive about "urban village" forms of commercial structure: "What do consumer choices and travel patterns reveal about their relationship to the most elemental parts of the commercial urbanscape—the stores?" Calthorpe, a leading proponent of TOD, acknowledges this challenge: "Clearly much more research and analysis is needed to clarify and quantify the potential results of new land use patterns on our travel behavior. It is critical... to effectively directing federal and state transportation dollars..." (Calthorpe 1993).

Robert Cervero, who has done extensive studies of the land use and transportation connection, has commented that “transit investments that are out of kilter with how our cities and regions grow do nobody any good. Running trains and buses that fail to draw people out of drive-alone cars does little to relieve traffic congestion, conserve fuel, or reduce pollution. The best prescription for filling trains and buses, and winning over motorists to transit, is to find a harmonious fit between transit systems and the cities and suburbs they serve” (Cervero 1998).

CHAPTER TWO

IMPORTANCE OF NONWORK ACTIVITIES AND TRAVEL IN REGIONAL PLANNING

INTRODUCTION

Travel for the purpose of engaging in nonwork activities has grown steadily in significance over the last three decades of the twentieth century. As we will show in this chapter, nonwork travel now accounts for about three-fourths of all household vehicle trips and four of five person trips. Nonwork is the major travel purpose even in weekday peak periods, both a.m. and p.m. Increasingly, nonwork trips are linked to work trips as well as to other nonwork trips in tours involving several stops. And nonwork activities may also be indirectly responsible for the increasing volume of commercial vehicle trips.

Yet, in spite of its overwhelming dominance in trip volumes, nonwork travel has received little attention in personal travel research and transportation planning, compared to the work trip. There have been only a few cursory analyses of nonwork travel, and these have neglected the probable impact of the large changes in the consumer marketplace that occurred in the 1980s and 1990s.

The focus on the work trip may be the result of its presumed regularity and predictability and its association with peak demand and congestion. Nonwork, in contrast, covers a broad variety of purposes, destinations, and starting times. Patterns of nonwork activities for one traveler change from day-to-day, and this has led some analysts to consider it to be discretionary travel. Nonwork travel is inherently more complicated and therefore more difficult to address analytically—to measure and to model predictably—than is work travel.

In real-world applications of transportation data, planners and project engineers often estimate the impact of nonwork trips through standardized trip generation rates for different land uses, covering the spectrum from fast food restaurants to major shopping malls. However, the effect of multiple generators on aggregate travel demand does not appear to have been fully explored.

A complete picture of personal travel in the United States requires an understanding of nonwork as well as work trips, the specific purposes and spatial locations of nonwork trip generators, and the often complex travel patterns that involve nonwork activities linked in a trip chain or tour. This understanding is of more than academic interest. Nonwork travel, because of

its magnitude, has important implications for current transportation and land use policy, particularly transit-oriented development (TOD).

In this chapter we summarize national trends for nonwork activities and travel patterns. We review the conclusions of previous studies that speculated on the causation of growth of certain categories of nonwork trips, and we offer some additional reasons for nonwork travel growth that seem more explanatory of the observed phenomena. In particular, we relate the growth of nonwork travel to the dynamic changes that have occurred in the retail and consumer services marketplace, particularly to shopping for goods and services, eating out, and other leisure activities.

NONWORK TRAVEL DEMAND

The Nationwide Personal Transportation Survey provides data on nonwork travel aggregated at the national level (U.S. DOT 1995). Table 2-1 indicates the distribution of the 379 billion person trips by all modes in the United States in 1995, by specific trip purpose. Shopping generates more individual point-to-point trips than going to work. The three next largest purposes are also nonwork categories: “other family and personal business”, “other social and recreational,” and “eating out.” The “other family and personal business” category includes the purchase of services such dry cleaning, auto repair, personal care, banking, and legal services. “Other social and recreational” includes entertainment, recreation, and cultural events. These four nonwork categories accounted for about 54 percent of all person trips in 1995.

Our focus is on these trip purposes because they involve locations that comprise what we define as the retail marketplace: namely stores and other businesses offering consumer goods and services, restaurants and drinking establishments, and venues for a wide range of recreation, social, and cultural activities. These activities tend to have numerous locations as a result of multiple enterprises competing to find the best sites for attracting the consumer’s dollar and attention. In other words, a traveler has more than one possible choice of destination for each activity. The “other” category includes some nonwork activities that are more likely to be constrained to locations that are fixed by circumstances, such as visiting friends, seeing a doctor or dentist, and trips to school and church, although we recognize that even doctors, schools, and places of worship in some sense compete for customers, and that people switch their allegiance from time to time.

Table 2-1. Trip Purpose as Percentage of All Person Trips, 1995

Trip Purpose	Percentage	Destination Flexibility
Work and Work Related	18	Somewhat inflexible
Shopping	21	Flexible
Other Family and Personal Business	15	Somewhat flexible
Out to Eat	8	Flexible
Other Social/Recreation	10	Flexible
Other	28	Somewhat inflexible

Source for columns 1-2: U.S. DOT 1995
Source for column 3: Integrated Transport Research

Growth of Nonwork Travel

Nonwork travel can now be tracked across five applications of the NPTS as shown in Table 2-2. (The data are divided into two periods to reflect changes in the survey methodology that were made in the 1995 NPTS.) Although nonwork person trips have remained essentially constant as a share of all trips, nonwork vehicle trips have increased in relative significance. The largest vehicle trip frequency growth over the 26-year period has been for purposes of shopping and other family and personal business. VMT and vehicle trip length also increased until 1995, when some decreases were noted. Work trips grew between 1990 and 1995 as employment expanded in a strong economy.

Table 2-2. Percentage Change in Vehicle Travel and Trip Length by Trip Purpose, Per Person, 1969-90 and 1990-95

Trip Purpose	Average Annual Vehicle Trips		Average Annual VMT		Average Vehicle Trip Length	
	1960-90	1990-95	1969-90	1990-95	1969-90	1990-95
All Purposes	27	12	27	15	1	2

Table 2-2. Percentage Change in Vehicle Travel and Trip Length by Trip Purpose, Per Person, 1969-90 and 1990-95 (Continued)

Trip Purpose	Average Annual Vehicle Trips		Average Annual VMT		Average Vehicle Trip Length	
	1960-90	1990-95	1969-90	1990-95	1969-90	1990-95
To or from work	1	22	20	33	17	8
Shopping	76	16	108	28	16	16
Other family and personal business	137	8	169	1	14	-5
Social & Recreation	15	7	-1	11	-10	-5
Other*	27	36	-32	68	1	23

* Includes trips to school, church, doctor/dentist, and to drop off and pick up.
Source: U.S. DOT 1995

The average length of trips show interesting differences; work, shopping, and other family and personal business trips all increased in length to about the same degree in the 1969-90 period. In contrast, social and recreational trip lengths decreased.

Mode Choice for Nonwork Travel

Table 2-3 indicates the mode used for trips to work and selected nonwork purposes. The private vehicle, in its various forms, dominates as expected, across all trip purposes, but especially for nonwork trips. Walking is the second mode of choice compared to transit for a small, but still significant, portion of trips. This is especially true for “eating out” and “other social and recreational” activities, which probably reflects the convenience of walking from home to a nearby neighborhood commercial center.

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Table 2-3. Percentage of Daily Person Trips by Mode and Selected Trip Purpose, 1995*

Trip Purpose	Private Vehicle	Public Transit**	Walk	Other***
To work	85.8	3.2	4.3	6.7
Shopping	87.6	1.0	4.9	6.5
Other family or personal business	86.0	1.4	4.6	8.0
Out to eat	86.4	0.5	5.8	7.3
Other social/ recreational	79.1	1.8	7.5	11.6
ALL	84.5	2.0	5.3	8.2

*Does not include 3 percent of all trips for which a mode was not ascertained.
**Includes taxicab.
***Includes school bus and bicycle.
Source: U.S. DOT 1995

Timing and Linkage of Nonwork Trips

Nonwork trips are a major portion of all trips at all times of the day as seen in Figure 2-1. More than 80 percent of trips that start in the 4-7 p.m. peak period are for nonwork purposes. Many of these trips are individual links in chained trips or tours as indicated in Table 2-4. More than 60 percent of women and 46 percent of men make at least one stop on work-to-home tours. The location of stops in these tours is important because it tends to reflect the spatial distribution of nonwork activities. However, NPTS data is not geocoded for destination location so it does not give us the spatial pattern of tours.

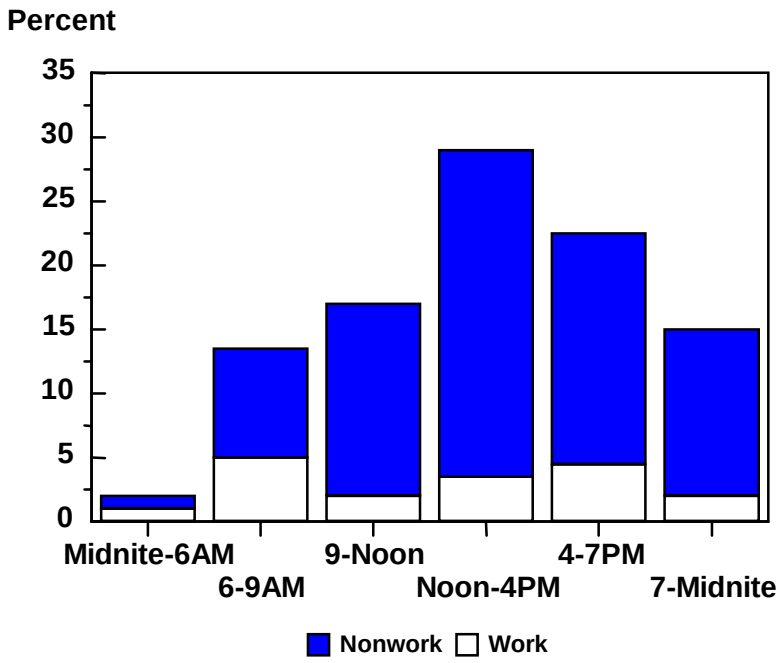

Figure 2-1. Percent of Work and Nonwork Trips by Time of Day

Source: U.S. DOT 1995

Table 2-4. Percentage of Men and Women Who Stop on Work-to-Home Tour

Number of Stops	Men	Women
One or more	46.4	61.2
Two or more	17.7	28.3

Source: McGuckin & Murakami 1998

As chaining of nonwork with work trips has become more prevalent, the distribution of nonwork trips across the seven days of a week has changed. For example in 1995, 77 percent of all shopping trips occurred on weekdays. On average, shopping trips had a higher frequency on weekdays than on weekend days (U.S. DOT 1995).

Vehicle Occupancy in Nonwork Travel

As Table 2-5 shows, vehicle occupancy has decreased for all major trip purposes since it was first recorded in 1977. Yet occupancy for nonwork trips remains considerably greater than for work trips, reflecting the social nature of shopping, family business, and leisure activities. Of course, it is understood that two or more people going to the same destination makes driving more attractive than transit when a private vehicle is available.

Table 2-5. Trends in Average Vehicle Occupancy for Selected Trip Purposes

Trip Purpose	1977	1983	1990	1995	Change (1977-95)
To or from work	1.30	1.29	1.14	1.14	-15.4%
Shopping	2.10	1.79	1.71	1.74	-19.1%
Other family or personal business	2.00	1.81	1.84	1.78	-10.0%
Social and recreational	2.40	2.12	2.08	2.04	-16.7%
All purposes	1.90	1.751	1.64	1.59	-15.8%

Source: U.S. DOT 1995

DISCUSSION

The large growth in personal travel in the last three decades has largely resulted from increased frequencies of nonwork trips, especially trips for shopping and other family and personal business activities. Retail activities account for more than half of all person trips, and most are made to locations where the traveler has more than one choice of destination. Many retail trips are linked in complex tours that involve multiple stops for a variety of purposes. Several family members may be traveling together. These tours require the flexibility that the private vehicle provides, and consequently transit and pedestrian modes are chosen for only a small proportion of all person trips.

CHAPTER THREE

RETAIL ENVIRONMENT AND NONWORK TRAVEL TRENDS

INTRODUCTION

Although the NPTS and regional surveys have documented the large and continuing increases in several categories of nonwork trips since the late 1960's, there have been surprisingly few investigations into root causes. Researchers have suggested various reasons for the growth of nonwork travel: changing lifestyles, a greater proportion of women in the work force, and the decentralization of housing and jobs that has reduced commute time, allowing time saved to be used for nonwork pursuits.

In this chapter we suggest why these explanations provide an incomplete causal understanding of nonwork travel growth. As we have indicated, activities generating nonwork trips have also changed remarkably in the past few decades. An important additional explanation of nonwork travel growth is the rise of considerably more opportunities and choices than ever before to shop, purchase services, and engage in recreation and other leisure pursuits.

We summarize in this chapter the transformation that has occurred in the national retail environment in the new postindustrial, information-based economy. Societal, behavioral, and market forces have combined to create new patterns of retail structure and nonwork activities. Our focus, illustrated by national data, is on the major changes that have transpired in the last three decades in the consumer goods and services marketplace. These changes are ongoing and have important transportation policy implications.

National data are supplemented by the example regional database assembled in this study for the Puget Sound region (see Task 3 report, available at http://www.globaltelematics.com/mineta/). A search of the literature turned up only one other study of the current retail structure of a U.S. metropolitan region. An examination of metropolitan Atlanta found that retail activity in existing neo-traditional communities tended to be limited in scope—coffee bars, restaurants, and dry cleaners—and that general household shopping requires numerous auto trips outside the neighborhood (Fujii & Hartshorn 1995).

NEW STORE FORMATS

The retail landscape has been reshaped by the introduction of numerous new "discount" formats, some at the expense of traditional formats such as

department stores and smaller, often neighborhood, stores. The new formats range from mass merchandisers like Wal-Mart to a wide variety of specialty retailers. The pace of their introduction has been extraordinary (Table 3-1), typically yielding a tenfold or more growth in the number of stores over the last two decades. Because of the many variations and the constantly changing environment, it is difficult to classify all of the store concepts and formats. But nine distinct categories stand out, each increasingly dominated by a small number of national chains (Table 3-2).

Table 3-1. Selected Examples of the Rapid Growth of Mass Retailers

Chain	Category	Units		
		1979	**1989**	**1999**
Wal-Mart	Discount Department Store	229	1,378	2,433
Home Depot	Home Center	3	118	761
Toys “R” US	Toy Superstore	84	522	700
Costco	Wholesale Club	--	43	217
Circuit City	Home Electronics Superstore	--	125	585
Staples	Office Supplies Superstore	--	50	745
Walgreen’s	Combination Drugstore	926	1,416	2,800

Sources: Discount Merchandiser 1999
Chain Store Age: State of the Industry Report 1979, 1989, and 1999

Table 3-2. The New "Discount" Mass Retail Formats

Format	Approx. Units Nationwide - 1998	Size Range or Average (sq. ft.)
Mass merchandiser (discount department store)	9,000	10,000-100,000
Supercenter	1,000	120,000-200,000
Club warehouse	800	100,000
Specialty or "superstore"	91,500	20,000-100,000
Home center	1,000	150,000
Outlet store	10,000	10,000
Combination supermarket	3,900	59,000
Combination drugstore	3,600	13,500
Convenience Store	93,200	800-5,000

Sources: Discount Merchandiser 1999
National Association of Convenience Stores 1998
American Express, 1999

All of these new retail formats are described in some detail in a progress report (see the Task 1 Report, available on the Web for downloading at http://www.globaltelematics.com/mineta/). We focus here on only two: "superstores" and "combination" grocery stores. These stores exemplify the changes in trade areas and trip patterns as stores seek to find competitive advantage in specialization and economy of scale.

Superstores

Superstores, also known as "category killers," are chain stores that control a particular specialty market (Table 3-3). These stores attract customers by offering a large variety of goods within a particular specialty such as books, sporting goods, or office supplies. Superstores typically draw their customers from large trade area equivalent in size to one that is commanded by a regional mall. In fact, many superstores tend to cluster near malls creating major retail concentrations. However, they are not just a suburban phenomenon; superstores are distributed widely across the urban landscape, both inside and

outside central cities. Because of its recent and rapid growth, the superstore phenomenon has not been well documented.

Table 3-3. Superstores in the Puget Sound Region

Category	Number of Stores
Arts & Crafts	6
Books	14
Car electronics	7
Computers	25
Drugs & misc. goods	31
Electronic games	9
Home electronics	25
Home furnishings	10
Music recordings	12
Office supplies	29
Pets & supplies	27
Sporting goods	32
Thrift (second hand)	4
Video tapes	41

Source: Integrated Transport Research

Super or Combination Grocery Stores

Grocery stores are growing in size and decreasing in number, even as the population grows. The number of stores peaked in about 1978 and over the last two decades has been steadily decreasing (Figure 3-1). Between 1990 and 1995, all types of grocery stores decreased 7 percent. Conventional supermarkets decreased 20 percent while the number of grocery "superstores," which typically have a delicatessen, bakery, and nonfood goods and services, increased 17 percent. Some grocery stores have added gasoline pumps. As a result, trips to the supermarket are growing in distance and probably in time expended.

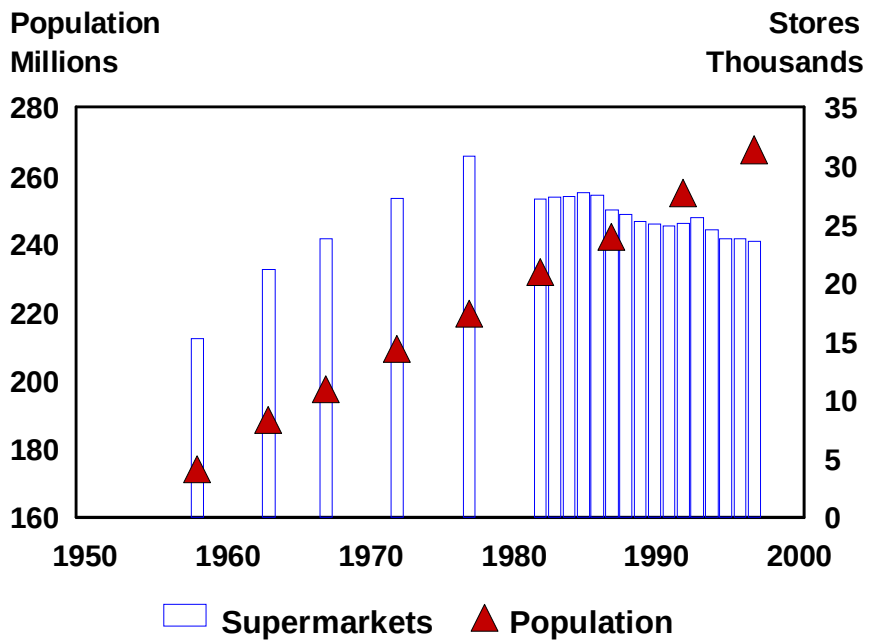

Figure 3-1. Relative Growth of Grocery "Supermarkets" and Population, 1958-1997

Source: U.S. Department of Agriculture, Economic Research Service 1998

NEW CONSUMER SERVICES

The importance of the service industry in the new economy is often measured by its increasing share of the job market. But another measure is the growing diversity of commercial services. Many specialty businesses have been created just for the maintenance and repair of houses, cars, and other personal equipment, and to serve other household and small business needs. Several services in these categories are listed in Table 3-4. A number of these reflect the society's growing wealth and decreasing available time. More people place a higher value on their time and will pay for services, even for routine home maintenance tasks that may have been previously performed by a household member. Time freed up can then be used for higher-valued purposes, whether work or leisure.

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Table 3-4. New Consumer Services

Services We Travel To
ATMs
Specialized auto servicing and repair
Copy centers
Day care
Health clinics
Personal beauty care
Services That Come To Us
Package delivery
Home systems repair
Landscaping
Housecleaning
Used goods charity pickup
Municipal recycling pickup
Home security
Delivery of online and mail-order merchandise

Source: Integrated Transport Research

GROWTH OF OUT-OF-HOME DINING

Dining out continues to be a strong feature of American leisure habits. Although people are not eating and drinking more, they appear to be enjoying a much greater variety. While per capita food expenditures remained essentially constant, food consumed away from home grew from 34 percent of food expenditures in 1970 to 45 percent in 1997 (U.S. Department of Agriculture 1998). The number and variety of eating and drinking establishments grew even faster. In the period 1963 to 1992, the total of these venues rose 66 percent, compared to a 35 percent increase in population. Annual sales growth

between 1999 and 2000 is estimated at five percent by the National Restaurant Association (National Restaurant Association, 2000).

As viewed from the consumers perspective, several reasons have been suggested for the increase in spending on food away from home: 1) the increase in two-earner households that leaves less time for food preparation, and which also increases household income and makes more discretionary income available; 2) the rise in single person households; and 3) the greater variety of restaurant options available (Robicheaux & Harmon 1997).

Fast Food Dominance

Table 3-5 indicates the current major restaurant industry segments and market shares of the leading 100 companies in 1998. These companies accounted for about $125 billion in sales and 164,000 units (Nation's Restaurant News 1999). This was about half of all away from home food expenditures and two-thirds of all units. Fast food—sandwiches, chicken, pizza, snacks—is the predominant choice over sit down eating, and it represents more than half of all units.

Table 3-5. Restaurant Market Share by Major Market Segments for Top 100 Chains

Concept	Market Share
Sandwich	42
Dinner House	10
Pizza	9
Family	7
Chicken	6
Snack	2
Grill-Buffet	2
Fish	1
Other (Contract/sports concessions, Hotel, Buffet, Coffee, Convenience Store, In-Store, and Theme Park)	21

Source: Nation's Restaurant News 1999

Popularity of Cuisines

Although national counts that would reveal the restaurant industry's fine structure are lacking, the changes in the restaurant industry involve much more than the growth of fast-food establishments. For example, foreign and specialty cuisines have shown astonishing popularity, and consequently the food dollar is being spent at many more locations than previously. Table 3-6 indicates the growth of foreign and specialty cuisine restaurants in the Seattle metro area. An industry survey of leading chefs strongly pointed to ethnic cuisines and foreign flavors as the dominant trend (National Restaurant Association 1999). The impetus, in part, may be due to the large immigrant stream from many nations in the last decade. Another factor may be the growing number of Americans who travel abroad and are exposed to foods of different regions and cultures.

Table 3-6. Growth of Cuisine Restaurants in Seattle Metropolitan Area, 1980 -1998

Restaurant Cuisine	Number of Establishments 1980	1998
American	14	30
Barbeque	5	23
Chinese	27	81
Indian	1	27
Italian	13	101
Japanese	10	77
Mexican	19	67
Pizza	13	26
Seafood	13	36
Thai	1	67
Vietnamese	1	24
Other (46 cuisines)	73	188
TOTALS	190	747

Source: U.S. West Yellow pages

GROWTH OF LEISURE ACTIVITY

Recreation is still another example of the major transformation that has occurred in nonwork activities. The share of household expenditures on entertainment and recreation, increased 40 percent between 1950 and 1995, from 4.0 percent to 5.6 percent (U.S. Department of Labor). Real dollars spent by all households on entertainment jumped 8 percent between 1987 and 1997. Since a large portion of recreation is consumed outside the home, the travel effects have been equally large.

More revealing are economic studies that show per capita participation rates for recreation have increased as incomes and leisure time have increased, and as invention and technology have stimulated a rich diversity in the types of recreational opportunities, whether for participants or spectators (Costa 1997). People are able to buy much more recreation value for every dollar they spend. From an increasingly wide variety of choices, people enjoy the opportunity to select the forms of recreation that best serve their interests, abilities, age, and lifestyle.

According to Schwenk, the trends in leisure time and entertainment expenditures can be attributed to demographic patterns, the movement toward healthier lifestyles, and new technology (Schwenk 1992). In 1989, baby boomers between age 35 and 44 spent more than those in other age groups on recreation and entertainment. As these people age, they can be expected to have more discretionary income to spend on leisure activities compared to previous generations.

The great diversity of leisure opportunities makes analysis of participation rates specific activities and the spatial patterns of venues very difficult. Given the ever-changing nature of leisure, trends are even more difficult to follow. Most activity surveys are either lacking in scope or accuracy of measurement technique to allow much more than the identification of broad trends. One national survey has tracked attendance at live artistic performances and participation in other leisure activities since 1982 (National Endowment for the Arts 1998). Growth in participation rates is evident in most major categories (Table 3-7).

Table 3-7. Participation in Arts Events and Other Leisure Activities

Activity	Percent Attending or Participating Once in Last 12 Months			
	1982	**1985**	**1992**	**1997**
Classical Music	13	13	13	16
Musical Play	18	17	17	25
Non-musical Play	12	12	14	16
Active Sports	39	41	39	45
Exercise	51	57	60	76
Amusement Park	49	45	50	57

Source: National Endowment for the Arts 1998

SPATIAL ORGANIZATION OF RETAIL STRUCTURE

In addition to the growing variety of retail activities, the spatial structure of the retail environment has undergone major reorganization in the past few decades. We can only review here the highlights of these changes on a national level that we described more fully in the Task One report. We also provide examples of the spatial distribution of retail locations selected from a series of maps produced for the Puget Sound region nonwork database that was documented in the Task Three report.

Growth in Numbers and Types of Shopping Centers

The planned shopping center is largely a post WW-II invention. Figure 3-2 shows the growth in number of shopping centers of all categories and sizes since 1986, when reasonably accurate national data was first collected. For shopping centers of all sizes, the 1980s were a period of rapid growth that mirrored the increasing numbers of baby boomers who have high levels of personal expenditures.

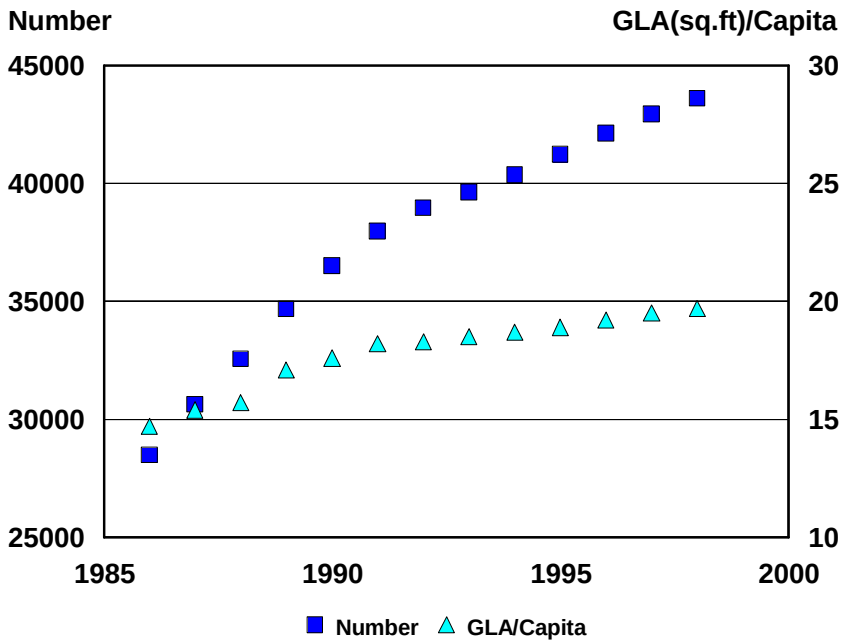

Figure 3-2. Shopping Center Trends

Source: National Research Bureau 1999

Over half of all shopping center area is in facilities that are less than 200,000 square feet. On a per capita basis, the amount of shopping center area has continued to increase. If automobile sales are ignored, planned shopping centers now account for more than half of all retail sales (ICSC 1998). Over the years, new types of centers have emerged, comprising a wide variety of spatial configurations and sizes (Table 3-8).

Table 3-8. Types and Spatial Characteristics of Shopping Centers

Shopping Center Type	Typical Configuration	Floor Area (Sqare Feet)	Primary Trade Area Radius (Miles)
Super regional	Mall, usually enclosed	>800,000	5-25
Regional	Mall	400,000-800,000	5-15

Table 3-8. Types and Spatial Characteristics of Shopping Centers (Continued)

Shopping Center Type	Typical Configuration	Floor Area (Sqare Feet)	Primary Trade Area Radius (Miles)
Community	Strip	100,000-350,000	3-6
Neighborhood	Strip	30,000-150,000	3
Power	Freestanding Cluster	250,000-600,000	5-10
Specialty	Mall	80,000-250,000	5-15
Theme	Mall, sometimes in historic building	80,000-250,000	N/A
Outlet	Mall, strip, "village" cluster	50,000-400,000	25-75

Source: International Council of Shopping Centers 1998

OTHER SPATIAL PATTERN CHANGES

Retail Activity Increasingly Polycentric and Dispersed

That metropolitan America is rapidly developing a polycentric structure is a fact that has been widely documented. Perhaps an extreme example is the Atlanta region, which has more than 70 retail cores, including downtowns and regional malls, with over 1000 retail employees each (Fujii & Hartshorn 1995).

Clustering at Regional Centers Creates Major Retail Concentrations

Both regional and superregional centers are often surrounded by other smaller centers that together comprise very large retail concentrations. National, and even regional, data on the number and size of these commercial clusters is lacking. One regional mall in the Puget Sound area has as many stores and retail space outside as inside (Task Three report). These stores are in strip malls and power centers within one mile of the regional mall.

Freestanding is Still a Major Choice

Many national chains prefer freestanding sites for enhanced visibility and customer access. In 1997, more than half of retail construction starts in the U.S. were freestanding (Levine 1998).

Decay, Renewal and Adaptation of Older Neighborhood Centers and Arterial Strips

The major changes in store format and size, and the increasing number and variety of shopping centers has obviously had an impact on older community and neighborhood centers and strips, as well as the downtowns of older cities in a metropolitan region. However, other than a few studies of individual inner city strips and centers in Los Angeles and some anecdotal information about the condition of strips elsewhere (Loukaitou-Sideris 1997; Jacobs 1997), there appears not to have been a systematic study of the change that these centers have experienced. Although commercial activity in some of these centers has declined, others have adapted and prospered by becoming specialty centers serving a large trade area. One older neighborhood commercial strip in Seattle (Wallingford) is now a center for eating out and entertainment that attracts customers from across the city and nearby suburbs.

Markets Differentiated by Age and Lifestyle

Many stores, especially those selling apparel and other soft goods, target market segments having narrow age and lifestyle ranges. Some stores now cater exclusively to the early teenage market. Thus, household shopping excursions can be expected to involve stops at several different locations, or in the extreme, several separate trips.

Maldistribution of Essential Services

In some instances, the market does not provide convenient access to necessary goods and services for those with low levels of mobility (U.S. HUD 1999). One example that has been studied is the lack of inner-city supermarkets, and as a consequence, higher food prices and/or transportation costs for residents of these areas. A study of 21 metro areas found significantly fewer grocery stores per capita in the lowest-income areas compared to region wide averages. These same areas also had the lowest rates of vehicle ownership (Cotterill & Franklin 1995). Those inner-city families who are able to gain the income and wealth to purchase a vehicle or to move to a better neighborhood probably enter into a more automobile-dependent lifestyle of the type that TOD planners are working against.

Examples of Retail's Spatial Environment

The Task 3 report described the Puget Sound region's retail environment in a series of maps that indicate locations for major nonwork activity venues relative to the proposed TOD structure. Just two of those maps are reproduced here to provide examples of the variety and dispersion of these venues. Figure 3-3 shows the locations of the 300 "superstores" listed in Table 3-3. Many of these stores are clustered in proximity to the major malls and have equally large trade areas. Figure 3-4 shows the locations of all of the major nonwork

trip generators that were geocoded and mapped in the process of creating the Puget Sound nonwork database. These range from discount department stores to nightclubs, and total approximately 1,900 separate venues.

DEVELOPER, RETAILER, AND CONSUMER DECISION DYNAMICS

Several market indicators help explain the observed spatial structure of the retail marketplace, including the size of individual stores, their siting at particular locations, and their spatial relationships to other establishments. They also explain why the retail structure appears to be successful, i.e., why consumers patronize the stores, how it attracts their discretionary spending, and how their response in turn helps shape the retail environment. This synergistic relationship between the interests of developers/retailers and consumers is an essential determinant of nonwork transportation patterns.

New Retailing Strategies

Retailers today, more than ever before, are running their businesses based on a financial planning approach rather than a merchandising approach. A strong economy throughout the 1990s and resulting available investment capital has meant growth in the size of retail firms and resulting monopolistic and oligopolistic behavior. For example, in 1992, the top five supermarket chains had 19 percent of the national market; in 1999 that share grew to 33 percent (Bergmann 1999). Merger activity is high. Hence, the increased importance of larger, national chains in the marketplace.

Investments by larger firms in information and other technologies have caused advancements in manufacturing and logistics to the point that cost of goods and the physical distribution to the store are a shrinking share of the cost of consumption. The main problem faced by firms serving consumers is that of marketing against competition. For retailers, store location is paramount, and planning multiple store sites in a regional market has become much more sophisticated.

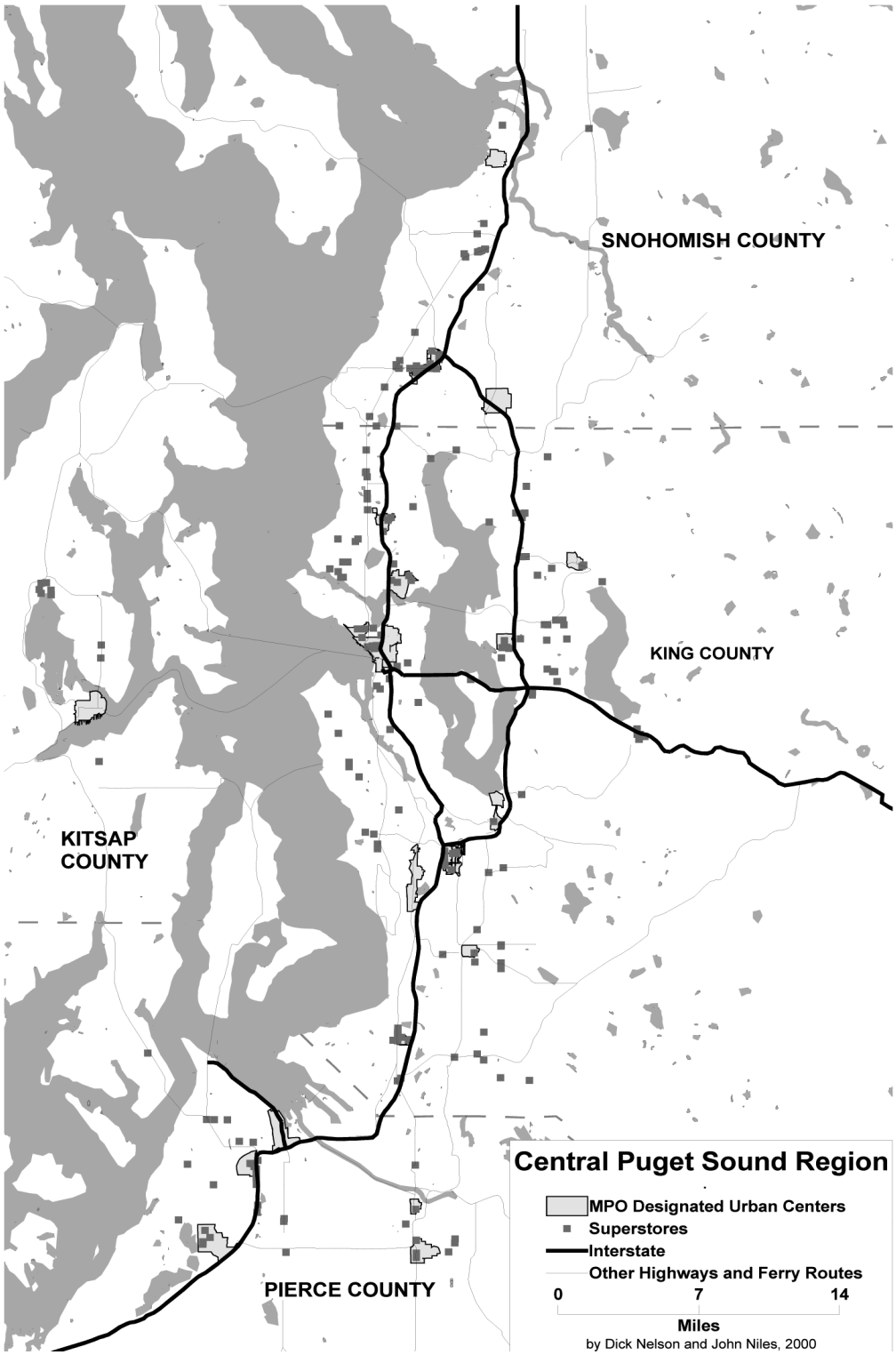

Figure 3-3. Locations of "Superstores" Relative to the Proposed TOD Structure of the Puget Sound Region

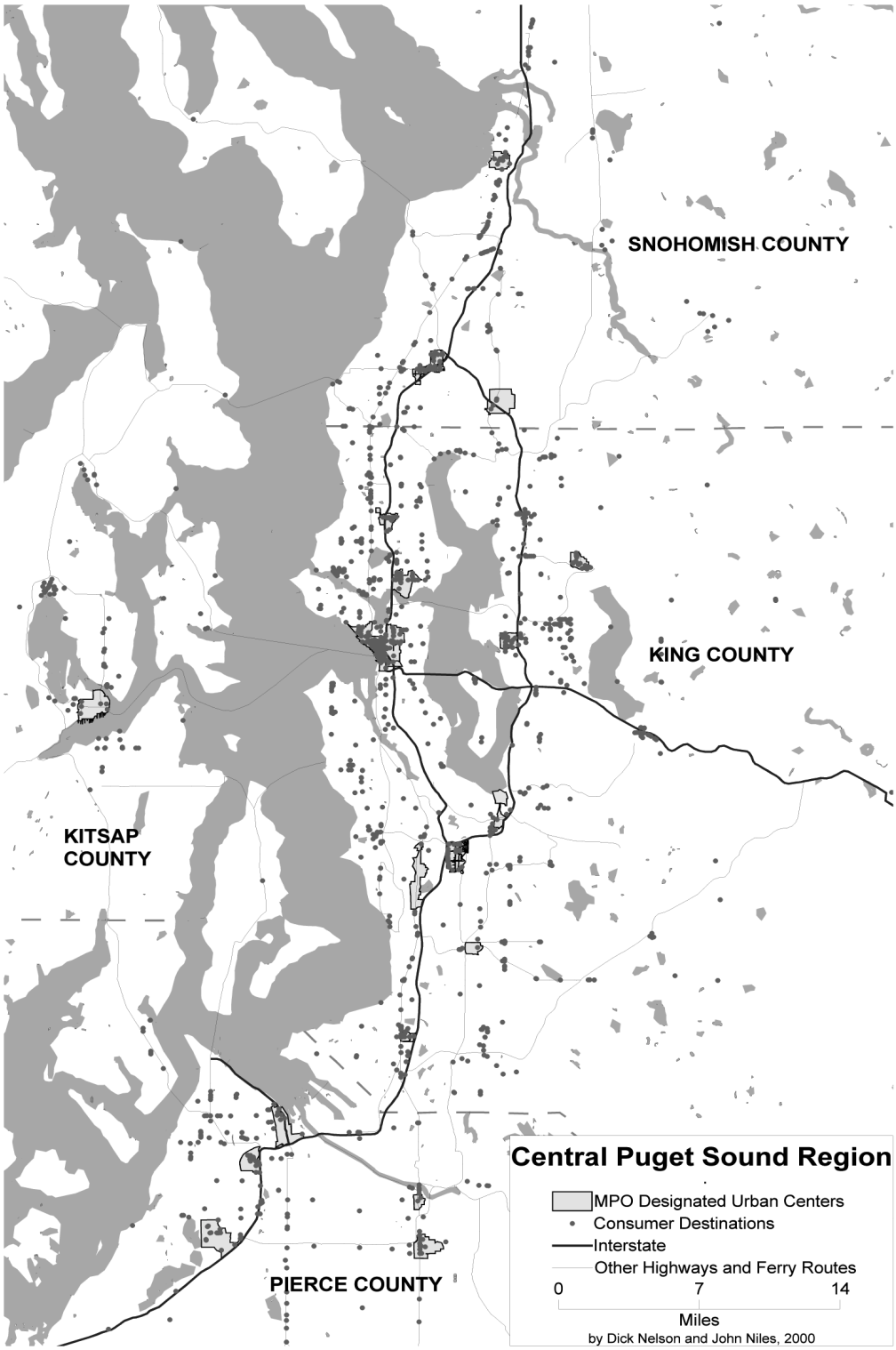

Figure 3-4. Locations of Major Nonwork Trip Generators Relative to the TOD Structure of the Puget Sound Region

Power in the market has shifted to the consumer and in turn to retailers who are closer to the consumers and are aware of their needs. One need is time saving. Thus as society becomes more affluent, the time constraint is replacing the income constraint in the allocation of goods. Increasingly, people buy goods and services that save time that is then allocated to other activities.

The trend toward increasing polarity in retailing continues. On one hand, superstores emphasizing large-scale diversified operations and logistical efficiency take a larger share of the market. On the other hand, firms that emphasize deep but narrow product lines and more responsive consumer services grow in importance. As the share of the market of both types increases, the share of firms in the space between these two poles shrinks.

Social institutions, such as the family, the work place, and the school, are in charge of shaping consumption and are directing and constraining both the times and nature of activities. Social institutions similarly influence the choices that consumers make among major product categories associated with activities.

Store Location Strategies

Table 3-9 lists the chief factors that are involved in the land developer's and retailer's choice of size of retail unit, and the general location and specific site selected for the unit (Nelson & Niles 1999). We briefly describe each of these factors.

Table 3-9. Key Retail Location Decision Factors

Scale and scope economies
Agglomeration economies
Regional accessibility
Visibility, local access and parking
Environmental impacts
Zoning and public resistance
Local government revenue needs

Source: Nelson & Niles 1999

Scale and Scope Economies

Economies of scale and scope are the most visible manifestations of the new retail economy and structure. Many categories of retail firms are building

bigger stores that attract customers from a larger geographic market area. Even stores that have been traditionally a part of neighborhood retail centers, and that remain so today—groceries, barbershops, pharmacies, and bookstores—have scaled up. Some retail formats have reached a market size that requires a store area, including parking, that would be a difficult fit in a core commercial center such as a downtown. These include "big box" retailers—discount department stores, warehouse club stores, home improvement centers, and other "category killers"—that generate large numbers of trips for many hours of both week days and weekends. Most customers arrive by car which enables them to conveniently haul purchased items that are heavy, bulky, or numerous.

Even the convenience store, which has replaced the "mom and pop" neighborhood grocery as the nearest place to purchase food, bottled drinks, and tobacco, has achieved a market scale that creates a difficult fit except in locations at the edge of a residential neighborhood. Most convenience stores are on busy arterials, and their customers are drawn from a large trade area.

Agglomeration Economies

Clustering has long been a feature of the retail marketplace. Competition leads simultaneously to competing stores positioning themselves geographically into clusters and to similarity among products (Hotelling 1929). Retail firms also tend to locate in close proximity to other firms that offer complementary goods (Jones & Simmons 1990). The clustering of competitors facilitates comparison shopping; the clustering of different kinds of stores facilitates one-stop shopping. In both cases, clustering benefits both the retailers and their customers. Total travel distance and cost are reduced, and positive externalities are created, i.e., a total market that is greater than the sum of the individual markets when the same stores are not clustered. Agglomerations also offer retailers the benefit of reduced overhead. Parking is shared, as are other costs such as security and even advertising.

Clustering occurs at several levels: in central business districts, regional malls, outlet malls, "power centers," and smaller malls and retail strips along arterials. Clusters involve services as well as retail stores, e.g., post offices, libraries, banks and ATM machines in shopping centers and malls. The mix of stores is usually subject to careful selection to maximize cumulative attraction and impulsive purchasing.

Fast food outlets cluster with department stores in regional malls to take advantage of high pedestrian flows generated by their neighbors. Restaurants also cluster. Pilsbury concluded, after an extensive study of the Atlanta-area restaurant industry, that clustering was the most important factor determining restaurant location (Pilsbury 1987). According to Pilsbury, this "competitive

linkage" strategy has produced an almost total clustering of restaurants in most communities in Atlanta.

As the retail marketplace continues to reinvent itself, clustering becomes even more heterogeneous. A recent development is the "stacked entertainment zone," that may include restaurants, food courts, cinemas, ice rinks, video game arcades, art galleries, and spas. These highly diverse activity assemblages have replaced the department store as the destination anchor in some shopping centers.

Regional Accessibility

The growing size of market areas is obviously related to the greatly increased regional accessibility that personal vehicles and modern urban roadway systems provide. Some retail centers—e.g., ethnic and lifestyle shopping districts, factory outlet malls, major recreation venues—may be dependent on a market that extends across an entire metropolitan area. Even regional shopping malls generate a considerable amount of "cross shopping," i.e., shoppers live close to one mall but also frequently shop at other regional malls.

Large stores and their lower prices are also very much facilitated by modern information technology, another form of accessibility. This includes bar-code price scanners to keep checkout lines moving, point of sale terminals wired to inventory management systems and credit/debit card networks, and global logistics management systems connecting stores to warehouses and factories worldwide.

Visibility, Local Access, and Parking

All stores seek visibility to attract customers and to provide convenient access to the site. Since the car is the dominant mode for shopping trips, many retail chains prefer stand-alone sites on major roads and at key intersections. Such sites serve to project the image of the company and to support its advertising, and they provide convenient site access, entrance and egress, and parking that is free from competition from other activities. Compared to a shopping mall location, freestanding stores control their own business hours and can be open to customers around the clock. Stand-alone sites also allow retailers to grow at faster rates than through traditional shopping center development.

Environmental Effects

Quite apart from the vehicle traffic consequences caused by large size, certain stores are difficult to locate adjacent to residential areas because the activity generates noise, high volumes of refuse, or just looks bad. These include modern grocery stores, auto repair services, funeral homes, and operations like craft stores and brew-pubs that have manufacturing or processing operations on the premises.

Zoning and Resident Resistance

In already developed areas, current zoning is a central political issue for realization of restructured neighborhood centers. Residents resist rezones that allow more mixed-use development. Efforts to introduce commercial businesses into existing residential areas, even when not requiring zoning changes, often meet opposition. Expansion of commercial activities is more probable in commercial zones that have underutilized capacity. It will tend to take the form of the existing commercial center, which is most often an arterial strip.

Local Government Competition

Local governments generally see commercial development as a net tax revenue generator compared to even dense residential development, and are inclined to being receptive to the siting of major retail stores and complexes. Some local governments provide incentives to attract developers who are looking for a site and who can choose among locations within a large trade area.

Consumer Behavioral Factors

Several key behavioral traits of consumers that hold implications for TOD planning are listed in Table 3-10.

Table 3-10. Key Consumer Behavior Factors

Bargain hunting
Comparison shopping
Preference for variety
Destination flexibility
Schedule flexibility

Source: Integrated Transport Research

Bargain Hunting

Competition attracts price-conscious consumers who travel outside their neighborhood, trading higher travel and time costs for lower-cost merchandise. This is particularly the case when consumers purchasing prepackaged, standardized, well-known brands are responding to regional promotion. Newspapers typically carry inserts containing coupons, rebates and advertising

inserts describing low-priced goods available only in big-box stores, superstores, and off-price retailers located throughout a metropolitan region.

Comparison Shopping

Both stores and goods are classified as either convenience or specialty. Convenience stores and goods account for most purchases, and consumers choose locations for convenience shopping that minimize travel. Even for specialty shopping, consumers generally prefer locations that are as close as possible.

However, some specialty stores—such as those selling furniture, major appliances, or automobiles—generate higher levels of longer, "comparison" shopping trips, i.e., customers will bypass other similar stores to shop there. This behavior results from marketplace competition offering customers unique mixtures of price, quality, variety, and service that may be scattered throughout a metro area.

High levels of comparison shopping have been observed on a regional scale. Although large malls in the same metro region may have the same anchoring chain stores, they may differ in their mix of specialty stores. Some may have a more upscale mix compared to the regional average. This tends to produce "cross shopping," with some consumers consistently visiting two or more regional malls.

Preference for Variety

People will pay more in travel costs to find variety or a unique shopping experience. For some, shopping is a recreational activity, and "satisfaction" is a large component. Malls that include food courts, multi-screen cinemas, amusement rides and electronic game parlors, concert stages, traveling festivals, and fashion, automobile, hobby, and crafts shows are playing to this preference. These venues and events are typically designed to draw customers and their family members from a large area well beyond the immediate neighborhoods.

Bargain hunting, comparison shopping, and preference for variety all show up in market research. From 1995 to 1999, the number of weekly shopping trips by females held steady at 3.5, but the number of stores visited doubled, from 1.4 to 2.9 across the same period of time (Prepared Foods Online Newsletter 2000). Consumers who were surveyed viewed shopping as part necessity, adventure, pragmatism, and emotion.

Location Flexibility

Choice in the marketplace allows travelers to adjust to changes in the cost of a trip. For example, to avoid congestion or to combine several travel purposes in

a chained trip, consumers can access the same retail store at another location without increasing the time or direct cost of the trip.

Schedule Flexibility

Consumers exhibit considerable flexibility in the time scheduling of trips to retail activity centers, often made possible by extended store hours. Nonwork trips combine with trips to and from work, and they originate from work sites. Tours involving one or several nonwork activities typically occur after work hours and on weekends.

Dispersion of Other Nonwork Activities

In the past, people might have chosen to patronize local businesses and professional services. Now, many of these nonretail, nonwork household activities, have for many people moved to locations outside their immediate neighborhoods. Examples are choice of church, children's school, and family doctor.

DISCUSSION

Table 3-11 summarizes important current national trends in the size, number, variety and spatial dispersion of stores (Nelson & Niles 1999b). Equally important trends are apparent in the consumer services and recreational sectors.

Table 3-11. Major Trends in Retail Structure

Retail activity increasingly polycentric and dispersed
Planned shopping centers dominate market
Smaller malls cluster around major malls
"Big Box" market share growing
"Super" stores growing in kind and number
Many chains prefer stand alone sites
Drive to and through convenience growing

Source: Nelson & Niles 1999b

From a transportation perspective, the most important aspects of the new store formats is their number, spatial distribution, and spatial organization, i.e., their siting with respect to other stores and to older centers of retail activity. The number of trip generators has expanded greatly, much faster than population. At the same time, retail's spatial structure has changed in ways that both

increase and decrease travel. One trend is to one-stop shopping, either within an individual retail unit that offers a wide range of goods and services, or as a result of the spatial clustering of several separate units. The result in the latter case can be very large retail concentrations such as those found at regional malls. Another trend is the choice of some retail businesses to prefer isolated locations. While some retailers prefer to cluster, even with their competitors, other retailers choose stand-alone sites that provide greater visibility, access, and control over hours of operation, which increasingly are 24/7—24 hours per day and 7 days per week. The market has reacted to the need for more flexible hours of operation that more closely fit increasingly varied household schedules.

Store locations and their spatial organization have not been unduly constrained by land use limitations, and developers and retailers have been generally free to build stores where they are most profitable. Their freedom to locate has been indirectly assisted by residents who, being very protective of existing residential zoning, are not critical of the retail strip and the retail clustering that are the bane of planners. Freedom for retailers to locate about anywhere is also helped by competition among local jurisdictions for tax revenue generated by retail sales.

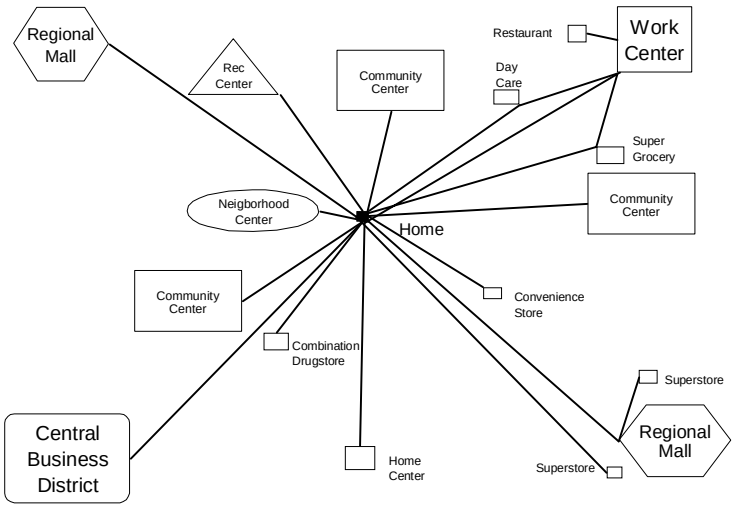

Figure 3-5. Hypothetical Household Nonwork Travel Patterns

Source: Integrated Transport Research

Figure 3-5 attempts to represent schematically the household travel patterns generated by the new retail structure. Obviously, individual household patterns

will differ greatly. And a simple diagram cannot begin to suggest the complexity of actual travel patterns that are integrated over the population and time. Even the frequency of travel from one household to specific locations is not easily captured in one diagram.

But the schematic is instructive in that it does provide a sense of the increased number of retail destinations, their spatial relationships, and how high levels of mobility and accessibility enable trips to multiple centers and stand-alone sites dispersed across a metropolitan region.

Figure 3-5 also suggests how chaining of trips improves the efficiency of travel. Finally, it attempts to portray a basic reality: consumers are willing to spend more of their disposable income on transportation to access the great variety of offerings now available in the marketplace.

An understanding of the new retail environment provides insight into the growth of nonwork travel, which is an essential element of TOD planning. Nonwork activities and travel have grown in a dynamic process involving consumer demand, technological change, and market innovations. Growing disposable income provides the buying power that supports expanding consumer preferences for a variety of goods and services and for the needs of saving time and achieving multiple purposes in trips to make purchases. These consumer needs are fed by the outputs of technological and market innovation, including new products and services, global production and supply chains, various levels and forms of customer service, and development of new retail niches. Innovation and expanding consumer preferences feed on one another, yielding the modern retail structure described in this chapter—many retail venues both large and small, dispersed widely, and responsive to the accessibility provided by automobiles, the overwhelmingly dominant mode of transport. This retail structure in turn leads to increasing nonwork travel demand.

An inherent aspect of a modern capitalistic market system is a two-way link between consumer preferences and business-driven innovation. Feedback serves and expands those preferences. And opportunities generated by growing wealth and technological innovation stimulate the market to offer even more variety and choice.

All of this plays out in the spatial realm of a metropolitan region, whether inside or outside the central city. New trip attractors are continually being added that change personal and aggregate travel patterns, both increasing the number of nonwork trips and vehicle miles traveled. People organize their trips into complex tours that allow efficient access to the increasing numbers of

destinations, while minimizing trip time and distance within their activity budgets.

CHAPTER FOUR

NEEDED: PLANNING METHODOLOGIES THAT ACCOUNT FOR URBAN COMPLEXITY AND UNCERTAINTY

INTRODUCTION

Retail dynamics, consumer behavior, and nonwork trip generation establish the dimensions of the complex, dynamic urban system that is the context for TOD planning. The complexity encompasses the interaction of known, multiple forces and the continuing introduction of new forces as a result of technological innovation, entrepreneurship, and competition. This chapter begins with a brief review of the theoretical understanding of complex systems and uncertainty. It then describes the limitations of current urban planning to encompass complexity and uncertainty, and it indicates the key elements of a new urban transportation and land use planning process that can deal with the complexity and future uncertainty of the dynamic urban system.

As Richmond (1998) points out, planners have to face up to this complexity in their planning: "Recognizing that transportation is inevitably tied into an intricate web of overlaps with all other urban functions and with the rich morass of human life complicates the planning task but makes it more likely to achieve meaningful results." Along the same lines, Innes and Booher (1999) note that in the complex metropolitan development system "simplification results in fundamentally wrong answers, and focus on individual sectors separately will be counterproductive."

CHARACTERISTICS OF COMPLEX SYSTEMS

As Casti (1997) describes, complex systems generate surprises from five distinct mechanisms:

- Paradoxes, leading to inconsistent phenomena;
- Instability, leading to large effects from small changes;
- Incompatibility, leading to behavior that transcends rules;
- Connectivity, leading to behavior that cannot be decomposed into parts; and
- Emergence, leading to self-organizing patterns.

These mechanisms work across the dynamics of daily vehicle traffic, of consumer response to opportunity over a seasonal buying period such as Christmas or summer, of the labor market as firms start up, expand, contract, and shut down, and of industry responses to business opportunity, whether the industry is commercial real estate, entertainment, or retail.

The surprises that come from complexity force planners to grapple with three forms of uncertainty about the future (van der Heijden 1996):

- Risk, where the occurrence has historical precedent, and the probability of reoccurrence can at least be estimated.
- Structural uncertainties, where we can understand how a unique new event can happen, even though there is not enough experience to judge the likelihood.
- Unknowables, where a future event cannot even be imagined. The existence of unknowables calls for enhanced perception and skill in reacting appropriately.

FACTORS CAUSING COMPLEXITY IN URBAN TRANSPORTATION AND LAND USE PLANNING

Table 4-1 summarizes the substantive factors that should be accounted for in long-range transportation and land use planning. This list of sources of risk, uncertainty, and complexity is organized around a list of topics and categories that we created from our own observations and general reading about the forces that bear on how urban areas function. Many of these are complex in themselves, and some are obviously interrelated, which adds additional complexity. Aspects of this complexity are analyzed by Hibshoosh and Nicosia (1987), who describe how the dynamics of family life, employment, and other social institutions work individually and in combination to influence travel behavior.

It is important to note that many of these factors carry both a weight and direction in terms of their impact on metropolitan spatial form and travel patterns (Colby 1933). In other words, they differ in the effect they have on the compactness and integration of land uses. Some are centripetal, tending to produce lower densities and separation of uses, e.g., the need of families for affordable housing tends to move demand and growth to the periphery of an urban region. Others are centrifugal, tending to cause higher land use densities and an amalgamation of uses. This could be the case for some members of an aging population who seek to downsize their residence and find a location convenient to goods and services. The factors are vectors in mathematical terminology, and should be treated as such when used in a planning exercise.

Furthermore, the amount of change across any future time period cannot be very well predicted, and thus is a cause of the risk and uncertainty inherent in transportation planning. The new factors that might arise in Table 4-1 that are totally unexpected illustrate the potential for unknowables.

An understanding of these vectors is enhanced by both national and regional empirical data and other more subjective information. We have presented national data in our Task one report. Regional nonwork-related data for the case study region, the central Puget Sound area, is presented in the Task three report.

COMPLEXITY AND THE CURRENT PLANNING PROCESS

The results of metropolitan planning processes carried out by Metropolitan Planning Organizations (MPOs) are generally not infused with a recognition of the complexity and uncertainty that is underlined by the length of the list in Table 4-1. Metropolitan Transportation Plan (MTP) documents rarely describe and discuss the many risks and areas of uncertainty that result from the action and interaction of the factors listed. In particular, an emphasis on guiding development toward areas of currently existing and emerging areas of geographic concentration, and then connecting the areas with mass transit, does not obviously seem to embrace the need for flexibility to respond to unknowables.

Mierzejewski reaches a similar conclusion about the handling of complexity and uncertainty after a comprehensive survey of current planning and modeling approaches (Mierzejewski 1995, 1996, 1998a), and a close study of the planning efforts of 25 MPOs in Florida (Mierzejewski 1998b). He reviews the inability of travel demand models to accurately predict future travel patterns, and he suggests a need for new regional planning methods that take into account uncertainty and provide for flexibility in transportation investments and strategies.

Table 4-1. Sources of Complexity, Risk, and Uncertainty

Demographics/Socioeconomics
Net population change, including migration
Household size trends
Age profile, life span, and lifestyle
Income levels and distribution
Residential Dynamics

Table 4-1. Sources of Complexity, Risk, and Uncertainty (Continued)

Residential mobility
Preference for residential size, style, and environment
Regional distribution of housing costs
Effects of aging population
Preference for home ownership
Self-selection by transit riders
Household reaction to congestion
Employment/Education Dynamics
Industrial Structure
Spatial distribution of workplaces
Change in workday and week
Part-time and temporary work
Multiple jobholders
Self employment/work at home
Telecommuting/telelearning
Employer reaction to congestion
Work-based travel for work-related and other purposes
Population Distribution
Growth beyond central cities and counties
Intra-regional shifts
Inter-regional shifts
Older central city resurgence
Land Use Dynamics
Land use policies and regulations
Redevelopment and in fill development

Table 4-1. Sources of Complexity, Risk, and Uncertainty (Continued)

Open space preservation
Public reaction to density and mixed-use
Nonwork Activity
Variety and spatial distribution of "retail"
Local government need/competition for tax revenues on location
Trends in going out vs. staying at home
E-commerce
Freight and Goods Movement
Just-in-time delivery to industry
Home delivery of goods
Courier services
Changing load factors in trucks
Costs, Benefits, and Other Fiscal Factors
System capital and operating costs, including those for feeder
System utilization rate--new transit riders
Externalities, including delay time and wasted fuel
Direct private vehicle costs, including demand pricing
Net benefit (cost) of alternatives
Opportunity costs
Available government and private resources
Employer subsidization of alternative modes
Personal and Public Transportation Technology
Alternative fuels
Advanced vehicle propulsion technology
Advanced fixed-guideway systems

Table 4-1. Sources of Complexity, Risk, and Uncertainty (Continued)

Safety improvements
ITS applications
Other Technology Affecting Travel to Work and Nonwork Destinations
Teleconferencing
Electronic service delivery
Ubiquitous Internet
Virtual reality
Environmental Policy
Air quality standards
Greenhouse gases
Pollution from surface water runoff

Source: Integrated Transport Research and Global Telematics

LIMITATIONS OF CURRENT MPO MODELING

The response to complexity seen in the typical MPO planning processes (standardized in Federal laws such as ISTEA and TEA-21) yields a simplified geographic configuration consisting of travel analysis zones (TAZ) made up of three kinds of subzones where people to varying degrees sleep, work, and engage in buying goods and services. The usual four-step model used to describe movement among these zones and subzones is a series of equations calibrated to the latest available data on traffic flows and transit patronage. The model defines how land use is related to the movement of cars and transit vehicles. The basic structure of the model is then applied 20 or more years in the future against the same zones with projected estimates of who and what will be in the zones, based on assumptions for future residential population, employment, and kind of development. The mode by which people will travel in the future, car, train, bus, or walking is also estimated.

The modeling process carried out as described has a number of significant limitations (Nelson & Niles 1999), summarized in Table 4-2.

Table 4-2. Limitations of Four-Step Transportation Modeling Applied to Nonwork Travel

Characterizes nonwork travel as unlinked trips
Aggregates all nonwork purposes into one or two categories
Assumes that functional relationships between input data and nonwork activity are constant from the present to 30 years out in the future
Does not encompass all the presently known forces shaping consumer activities and destinations
Cannot be calibrated in the baseline historical year with nonwork activity data
Makes no allowance for consumer or retail industry response to congestion

Source: Integrated Transport Research

A planning methodology that exposes the considerable complexity in current and future transportation and land use patterns will consequently add to the uncertainty attached to regional models used to predict future patterns and transportation system performance. This should cause MPO planners to reconsider the application of models to long term prediction or, in the very least, should persuade them to introduce uncertainty into their modeling practice in their predictions of both continuous and discrete values.

CURRENT MAJOR PREMISE: GOVERNMENT ACTION SHAPES URBAN FORM

The overarching paradigm and set of policies governing all the assumptions in MPO planning is a government plan for changing transportation and land use in the future—typically, new roads, expanded public transportation systems, and more density near the places to be served by public transportation.

The very common TOD-rail paradigm that is considered a front-edge planning practice in alignment with Smart Growth principles is essentially a high-stakes gamble that in the long-run, government investment, incentives, and rules will cause the density of population, employment, and service offerings to increase around a network of transit stations. This density boost on top of the

availability of transit capacity is assumed in the future to cause a reduction in driving, to be replaced by transit use, walking, and bicycling.

Ironically, while the TOD paradigm responds to the complexity of the marketplace, technology, and entrepreneurial behavior with a seemingly elegant concept, TOD also introduces additional complexity to both urban development and the lives of individuals:

- Mixed-use buildings in a dense configuration are more complex to construct and operate than single uses in a more dispersed configuration (City of Seattle 1999).
- Experience has shown that mixed-use TOD projects introduce complications to the development process. For example, as Boarnet et al (1997, 1998, 1999) have found in California that local governments that are pursuing the TOD-rail paradigm seek to maximize their tax revenue by emphasizing commercial and minimizing housing near transit stops. In most cases they pursue local needs over regional policies.
- For travelers, journeys involving transfers at transit stations between modes or vehicles are often more complex and time-consuming than single-mode auto journeys.
- Visible stores in a traditional mall with parking may be easier for more consumers to find and use more of the time than multilevel retail space packed around a train station.

One track for urban transportation improvement, of course, is to work to overcome these complexities inherent in TOD. But even doing that does not reduce the real risk that TOD—even if very well done—may not be able to change the travel behavior of enough people in a region to make any difference in the environmental quality that people care about. Our conclusion from the findings presented so far is that the time is right for a new, structured examination of the assumptions and results of the MPO's planning work. A new process could take advantage of the existing modeling, design-oriented visioning, and other MPO practices, but then bring an additional focus on the complexity in metropolitan markets and nonwork travel, and the resulting uncertainty about the future. The results of a supplementary process, described below, could then be melded into the results of the MPO planning process for a more robust result in the face of risk, uncertainty, and unknowables. The new planning process could generate a range of possible future scenarios that go beyond TOD, that could serve an alternative or supplementary response to growing complexity and the manifestly uncertain impact of present TOD policies designed to achieve goals.

KEY ELEMENTS OF A NEW NONWORK TRAVEL PLANNING PROCESS

We call the new approach the Nonwork Travel Improvement Planning Process (NWTIPP). These are the definitions of terms we commonly use:

- Premise: The assumptions about how the world operates that stand behind paradigms, scenarios, and policies. A common main premise in MPO transportation planning is that government over several decades can influence land use to change sufficiently to cause modifications in household behavior that show up as a regional shift in travel mode.
- Paradigm: A vision of how society could work if certain premises about individual and organizational behavior hold true and if certain policies are implemented. TOD is a paradigm that follows from the main premise in MPO transportation planning.
- Scenario: Summary description of patterns of events in the future, as influenced by uncontrollable external forces and by public policies and spending. Scenarios are alternate implementation paths for paradigms. An example of a scenario: Developers of retail space changing their focus from customers arriving by automobile to customers arriving by transit.
- Policy or strategy: Broad principles that guide action by government and the private sectors, often in pursuit of a paradigm, as in the case of transportation planning. Investment in rail mass transit to influence future land use is an example of a policy or strategy. In the private sector, “strategy” has a connotation of taking competitive behavior into account, whereas “policy” does not.
- Program or tactic: Specific action that conforms to and implements policy or strategy. The detail of zoning and design requirements around a transit station is an example.

One objective in the design of the NWTIPP is to create a planning template that is capable of identifying strengths and weaknesses in the main premise behind the TOD-rail paradigm. In detail, the main premise is that low-density, single-use urban form can be reshaped by government action—rail (mass) transit investments and land use policies/strategies—to result in compact, mixed-use urban form that in turn supports and justifies the rail investment by producing new transit riders.

Example statements that summarize the TOD-rail paradigm are shown in Table 4-3. They range from general to specific and from national to regional to local. The first is from a meeting of U.S. planning professionals and local

government officials in 1991, the second from a metropolitan planning organization, and the third from a city planning department. In the case of the Puget Sound Regional Council statement, "transit" refers to a mix of light rail, express buses, and local buses. Viewed in light of the previous chapters, these statements together represent good intentions of well-meaning leaders to change the way businesses operate and people live their lives, despite the challenge of market forces that work in different directions.

Table 4-3. The TOD Paradigm: From General to Specific

Congress of New Urbanism: The Ahwahnee Principles **Guidelines for New Urbanism Development — Community Principles** "Community size should be designed so that housing, jobs, daily needs, and other activities are within walking distance of one another." "As many activities as possible should be located within easy walking distance of transit stops." Source: Local Government Commission 1992
Puget Sound Regional Council – Vision 2020 Plan for Urban Centers "The VISION 2020 strategy is to reinforce and diversify our existing urban centers ... to build an environment that will attract residents and businesses to the advantages it offers. These advantages include excellent access to frequent and fast transit that connects to other centers and to surrounding neighborhoods, a selection of attractive and well-designed residences, and proximity to a diverse collection of services, shopping, recreation and jobs." Source: Puget Sound Regional Council 1995
City of Seattle Transportation Strategic Plan – October 1998 "Support Development of 'Full Service' Neighborhood Business Districts." "This strategy promotes shopping within neighborhoods by helping Seattle's urban villages to offer a full range of products and services to meet people's day-to-day needs." Source: City of Seattle 1998

We think a good planning process needs to consider alternative premises: for example, that the forces at large in the marketplace are too numerous and strong for government actions to reshape regional form and modes of travel to any meaningful degree. Following from revised premises, the NWTIPP would be able to identify alternative paradigms, scenarios, and policies/strategies.

Premise and Paradigms are a Planning Choice

Table 4-4 illustrates how the recognition of a broad premise—that government action can make a difference—leads to the opportunity to choose among a variety of paradigms and strategies that may reduce automobility and its impacts. Note that we take account of cost in classifying the strategies for a particular paradigm. The pursuit of one strategy may consume so many public dollars that the opportunity to pursue other strategies is lost because of insufficient resources. In short, every strategy carries with it an *opportunity cost*.

Although the paradigms and strategies listed in Table 4-4 appear to encompass a broad range of possibilities, the listings in the table are intended to serve only as examples. And as we continually emphasize, the planning process may choose to begin with a wholly different premise regarding the efficacy of public transit construction to shape land use and the resulting regional market share of transit and walking modes.

Other characteristics we have designed into the NWTIPP:

- **An emphasis on continuous learning by participants in the planning process.**

From analyzing urban development in California as a complex system, Innes and Booher (1999) conclude that more sustainable urban development will come from learning that is generated from the individual interactions of system participants. They note that "sustainability is about process, not about a particular vision, pattern, set of rules, or criterion."

Table 4-4. Policy Paradigm Choices and Strategies in Government Action that Address Growing Urban Automobile Usage

Paradigm	Strategy Examples Classified by Relative Cost			
	Higher Cost	Moderate Cost	Lower Cost	Incremental
Improve or promote transit to increase its market share in the competition with cars	Rail construction	Bus rapid transit; park and ride lots	Increase frequency and quality of existing transit service	Subsidies and incentives for bus pass distribution, carpools, and vanpools

Table 4-4. Policy Paradigm Choices and Strategies in Government Action that Address Growing Urban Automobile Usage (Continued)

Paradigm	Strategy Examples Classified by Relative Cost			
	Higher Cost	Moderate Cost	Lower Cost	Incremental
Change land use to stimulate more walking and transit use and constrain car use	TOD at new transit stations	TOD at existing transit centers	Limit parking spaces at new developments if served by transit	Prohibit zoning that limits apartment development in areas served by transit
Accommodate cars and other vehicles by increasing road capacity	Build new roads	Intelligent Transportation Systems (ITS) applications	Widening, intersection improvement and better signalization	Maintain existing roads to quality standards; build more only in proportion to population growth
Reduce pollution from cars to make their use less damaging	Buy back old, polluting vehicles	Promote the use of zero-emission vehicles	Annual emissions inspections	Spot detection and citation of polluting vehicles
Constrain automobility to reduce use of cars	Congestion pricing on existing highways	Tolls to finance new highways	Traffic calming	Raise taxes and fees on gasoline or cars
Preserve open space and sensitive lands	Extensive government land purchase	Moderate land purchase	Purchase of development rights	Require cluster development and dedicated open space

Note: Shaded two cells together constitute the Rail-TOD paradigm. Paradigms and strategy elements are illustrative. They can be mixed and matched in various combinations. The main point is to illustrate the wide range of choices available.

Source: Integrated Transport Research

Based on the findings described earlier in this report, we conclude that a uniform, nationwide planning model imposed by the Federal Government on complex metropolitan transportation development may not yield sufficient learning to successfully address the complex problems at hand.

- **Explicit focus on nonwork travel.**

As fully described earlier, travel for shopping, eating out, culture, and recreation constitutes the majority of urban trips and these activities are a very important shaper of urban form. Our process also includes the residential and employment site location dynamics—the places where nonwork trips either originate or terminate.

- **Metro-region-wide process.**

Many retailers now think in terms of total metropolitan areas, so we recommend that thinking about nonwork travel improvement be focused on this scale as well, instead of at the corridor level or subarea level like the Major Investment Studies (MIS) carried out under ISTEA and now merged into Environmental Impact Statements (EIS) as a result of TEA-21. For TOD in particular, much of the research and planning focus is now carried on at the station-area level, rather than at the level of comprehending regional impacts.

- **Explicit recognition that not making an additional transportation investment, or doing less than initially contemplated, may be the most desirable alternative.**

There are two reasons for this recognition—(1) people can adapt to reduced transportation services by using alternative locations and behaviors, and (2) there are productive, non-transportation purposes for spending the money that is diverted from transportation-related spending, with some of these purposes serving the same needs that transportation spending would fulfill.

As a general example, it may make more sense to build a new shopping center close by to a residential community that lacks adequate roads to a distant shopping center, rather than expanding the road capacity to the existing shopping center. By putting limits on transportation spending, the planning process remains open to the larger array of issues and options in which transportation planning is embedded.

- **May be carried out by Metropolitan Planning Organizations (MPOs), but more likely to be carried out initially by civic interests not officially sanctioned by the MPO.**

MPOs are generally deeply invested in a limited set of options. The opportunity for designing new alternatives is most likely to come from a new set of actors. If not carried out by an MPO, the end result of the planning process will have influence on official decision making to the degree that the analysis carries the authority of expert knowledge and persuasive reasoning.

- **Will not necessarily follow federal planning guidelines, programs, and other requirements for transportation planning by MPOs.**

Figure 4-1 depicts a general representation of the urban transportation planning process carried out by MPOs, as described by Pas (1995). The NWTIPP we describe below emphasizes just the underlined portions of the overall process, in addition to the focus on nonwork travel. The Planning Team may recommend changes in federal requirements if they appear to block the execution of a superior planning process and set of resulting outcomes. Table 4-5 makes a comparison between the NWTIPP and the typical Metropolitan Transportation Plan carried out by MPOs.

- **Able to work within a more time-constrained planning horizon than the 20 years mandated by the U.S. government for a Metropolitan Transportation Plan, and much more constrained than the 30 to 50 year time frame utilized by some MPOs.**

We have stressed the complexity of the urban milieu that governs human activity and transportation, and entrepreneurial real estate development and consumer service offerings. The rapidly emerging Internet economy adds to the complexity. While planning for capital-intensive transportation infrastructure such as bridges, tunnels, freeways, and rail systems certainly calls for a multi-decade planning horizon, we note that options for transportation improvement need not be limited to capital expenditures of this type. We find the notion of putting all transportation planning into a multi-decade framework troubling, because the result may be an unnecessary

emphasis on capital expenditures, and a variety of lower cost, more short-term options may remain unconsidered.

Table 4-5. Comparison between the Proposed Transportation System Improvement Planning Process, and the Current Metropolitan Transportation Planning Process (MTP)

MTP	NWTIPP
Carried out by MPO under legal mandates	Possibly carried out by MPO, but more likely to be carried out initially by other civic interests
Legal basis for regional transportation investments	Potential influence on investments based on quality of planning results
Based on Federal regulatory requirements	Not constrained by Federal regulations
Seeks to optimize the morning peak period	Can be focused on other problems and issues
20+ year time horizon mandatory	Shorter time horizons possible and preferred
Typically begins with a paradigm such as rail-TOD or new road projects and seeks to justify that paradigm	Seeks to find better paradigms to address problems of public policy importance
Centered on the 4-step urban transportation model	4-step model results are just one input

Source: Integrated Transport Research

URBAN TRANSPORTATION PLANNING PROCESS

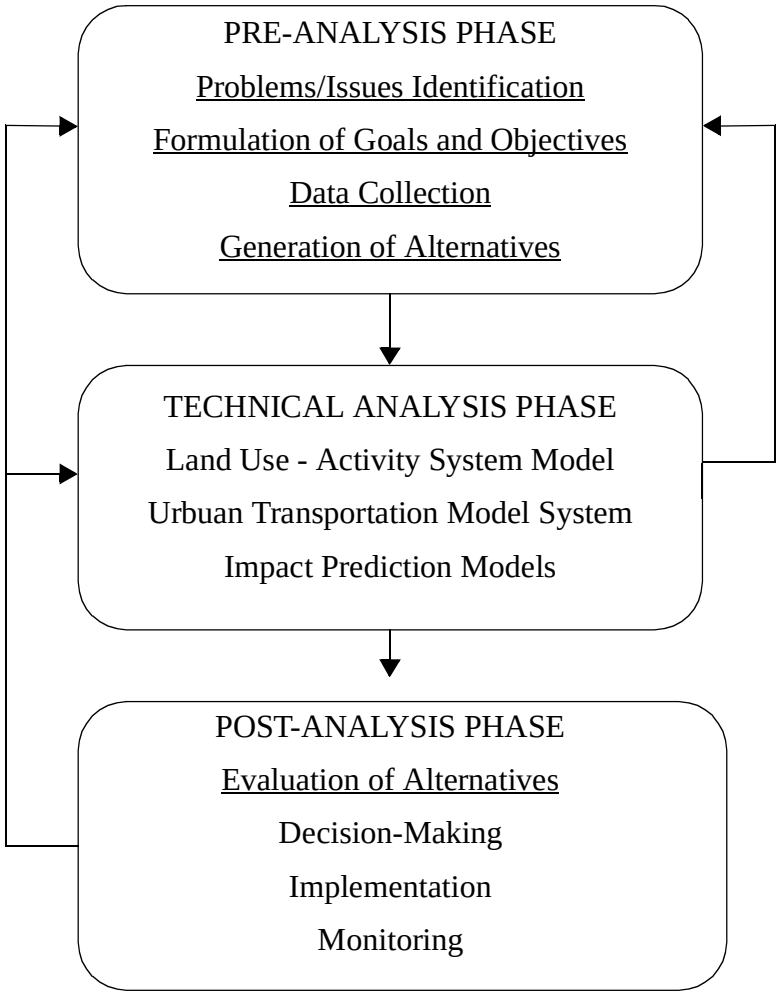

Figure 4-1. Urban Transportation Planning Process Flow Chart

Source: Pas 1995

Planning for more incremental expenditures may provide a more flexible response to an uncertain future, as opposed to demonstrating an heroic but ill-founded attempt to shape the future with steel and concrete built for the ages. With longer time horizons, solutions that are more easily implemented and

more flexible may be ignored in comparison to solutions that appear to be more durable and long-lasting, yet less effective in terms of public benefits (Zwerling 1974).

The reason that a more time-constrained planning horizon may be preferable in the case of the transportation planning overlay we are recommending goes beyond the uncertainty about the future that is inherent in a complex system. The accelerating rate of change of the system adds to the uncertainty. The volume curves for several drivers of our society at the end of the century show accelerating rates of growth—transistors in a microchip, Internet hosts, Internet web sites, volume of online shopping, business-to-business electronic commerce, and e-mail messages.

- **Generates and supports strategies and policies that are flexible and adaptable.**

Given the complexity of urban development and of the market economy that drives development, we expect that premises may need to be modified with the passage of time as a result of new understanding about the way the metropolitan area is functioning, and about the impact of public policies. The ability of a policy to change as premises and paradigms change is a measure of the policy's ability to achieve objectives and solve problems under an array of scenarios that may not be in government's control.

- **Incorporates predictive models that are transparent.**

The four-step, gravity-analog transportation models that are at the heart of MPO transportation planning are notoriously obscure for the non-specialist. We believe it is important to carry out additional processing on the raw outcomes from these models.

Assumptions, simplifications, and their impact on accuracy need to be apparent and outside the complex inner workings of the "black box" computer model.

- **Provides outputs as a range, in addition to discrete "point estimate" values.**

In practice, many MPO planners use their transportation models to issue only single values, rather than ranges. This practice portrays the estimates of transportation performance several decades in the future as more precise that they really are. Providing "predictive intervals" is educational as to the degree of uncertainty about the future.

- **Acknowledges and manages all technical transportation system alternatives — immediately feasible or not.**

Individual members of the public and the media are very interested in the prospect of advanced transportation systems. Businesses around the world have new options on the drawing board. A higher level of public involvement will result if a fairly open process of considering all technical transportation options is maintained. These can be handled fairly through a consideration of their performance and cost parameters. We observe that transportation planning in practice focuses very quickly and conservatively on a rather narrow range of technical alternatives—light rail, commuter rail, and standard buses.

- **Comes to grips with the emergence of the Internet economy, widely deployed microcomputers, ubiquitous personal communications, and other likely technology expansions over the next five years, and the decades beyond.**

The rise of the network economy is already a distinctive feature of the present era. The ubiquitous presence and use of computers and telecommunications is not yet mentioned in very many Metropolitan Transportation Plans, yet already is producing impacts on transportation. The routine use of cellular phones in cars is increasing the value of time alone in a moving automobile, for example. The continuing growth in small package delivery services in urban areas is another example, along with the announcement of billions of dollars in warehouse construction by firms selling goods on the Internet. The growing impacts from online selling on particular categories of retail businesses—bookstores, automobile dealers, and travel agencies—is a third illustration.

- **Accounts for the range of costs and benefits of the various scenarios that will arise from each examined alternative paradigm and its associated policies.**

This accounting also should describe the public costs and potential revenue sources to implement the policies.

CHAPTER FIVE

BACKCASTING DELPHI: A PLANNING TOOL FOR A COMPLEX PRESENT AND AN UNCERTAIN FUTURE

INTRODUCTION

This chapter provides a description of the template for the Nonwork Travel Improvement Planning Process (NWTIPP) that implements the characteristics we described in the previous chapter. We designed the methodology, a modification of the Delphi process, after a search of the planning literature to find an approach with a scope that matches the complex and dynamic scope of the urban transportation planning problem. As described earlier, we see the NWTIPP as an overlay and complement to the existing, well-established, government-mandated Metropolitan Transportation Plan (MTP) processes. The recommended steps listed here could certainly be carried out by existing Metropolitan Planning Organization (MPO) staff if they chose to do so. We would encourage that outcome. More likely, however, a new set of regional players from among the civic leadership of a metropolitan region would need to step forward to implement our recommendations.

THE DELPHI METHOD

An existing, well-tested group process that we recommend be adapted to meet the requirements listed in Chapter 4 is the Delphi expert panel, a technique originally developed at the Rand Corporation in the early 1950s. A Delphi panel is a structured interaction among the members of a group with different kinds of expertise that allows a consensus—or possibly very explicit points of divergence—to be reached on judgments about a complex topic, typically a forecasting problem.

In standard Delphi methodology, all responses to a given set of question on the problem are compiled in a feedback document, with display of the reasons for responses that deviate from an emerging consensus average. The feedback document is sent back to each participant, each of whom is now given the opportunity to change opinion and provide new responses based on what others have said that is persuasive. If a response will lie outside the average found in the previous iteration, the respondent is asked to supply supporting information. The goal is to achieve consensus among the experts as they learn from each other. Consensus is typically achieved after three to five rounds of feedback and response (Irving and Conrath 1988).

Khan, who has reviewed available methodologies for transportation policy and planning decision making, views the Delphi process as capable of dealing with uncertainties in factors that determine future travel demand and the technical performance of transportation systems (Khan 1989). He suggests that through group assessment and the application of decision theory, available information can be better utilized and more flexible plans are produced that can adapt to a range of future requirements.

Backcasting Delphi

Traditionally, Delphi has been used in making forecasts of the future. Backcasting, on the other hand, makes judgments about the steps needed to reach a desired future state of affairs. In the NWTIPP, we are somewhat interested in forecasting and even more interested in backcasting. In the context of the NWTIPP, backcasting means bringing goals, resources available to effect change, the reality of activity and movement, the feasibility of changes, and public policy recommendations all into alignment. A Backcasting Delphi panel works backwards from the problem and desired outcome—reduced traffic congestion, for example—to determine if it is feasible, and then assesses necessary policies and other inputs that will produce the outcome or a set of potentially feasible alternative solutions on which experts have agreed to disagree. When consensus cannot be reached on proposed solutions, alternative solutions are brought forward, or else some aspect of the goal is changed based on new knowledge (Robinson 1990, Dreborg 1996).

Table 5-1 summarizes Delphi and backcasting, the combination of which is a distinct feature of the proposed planning template.

Table 5-1. The Components of Delphi Backcasting

Delphi: Diverse expert opinion collected from a group and iteratively presented as feedback to the group to modify opinions and converge on a consensus.
Backcasting: Working backward from a particular desirable future endpoint to determine the feasibility of that future and what policy measures would be required to reach it.

Source: Integrated Transport Research

Note that “backcasting” is *not* used here in the sense of transportation planners calibrating their traffic forecast models by adjusting parameters to make the

models conform to already available input and output data describing the baseline year and the forecast year.

PREVIOUS APPLICATIONS OF DELPHI METHOD TO TRANSPORTATION AND LAND USE

Backcasting and Delphi have been applied separately and together to transportation futures, principally in Europe and Canada. Hojer (1998) used Backcasting Delphi to study the feasibility and effectiveness of three alternative passenger transportation scenarios: improved road system with user fees, improved public transit through rider information, and a hypothetical dual mode system which combines the flexibility of the private car with the capacity of public transport.

Backcasting Delphi was also employed by Marchau and van der Heijden (1998) to explore the likely benefits of driver support systems. Cooper et al (1974) used the Delphi technique to study the likelihood of future environmentally desirable developments in transportation.

An application of Delphi somewhat similar to its proposed use in supplementing MPO planning for TOD was the study by Cavalli-Sforza and Ortolano (1984). These investigators used the Delphi method to predict the impacts of three alternative transportation programs in Santa Clara County (San Jose) California. Three alternative transportation improvement scenarios were evaluated: highway improvements, highway improvements with HOV lanes, and highway improvements plus a light rail system supported by zoning changes at stations. Each of the alternatives also involved a bus system improvement plan. Forecasts of residential land use and choice of transit mode were made for 1990 and 2000, from 1978 baseline data.

A related point of familiarity is that expert panels are routinely employed by MPOs to predict future land use patterns that are used as inputs in regional travel demand modeling. Although perhaps not a formal Delphi method, local planners are asked to estimate the distribution and of new residential population and employment out 20 to 30 years.

SCOPE OF THE PROPOSED METHOD

In the NWTIPP, we envision engaging a multidisciplinary panel with expertise collectively to understand the many areas of substantive knowledge and experience that bear on the key factors necessarily considered in transportation and land use planning, listed comprehensively in Table 4-1. We call this panel the Expert Advisory Group (EAG).

We recommend that the EAG consist of at least fifteen persons with a range of diverse expertise that bears on an assessment of consumer activities and nonwork travel in the present and the future. Areas of useful expertise for this group are shown in Table 5-2.

Table 5-2. Areas of Expertise for the Expert Advisory Group

Regional economics
Population demographics
Retail business strategy and store location planning
Consumer behavior regarding spatial choice in shopping, residential preference
Leisure and recreation
Behavioral characteristics of key segments: by age range, ethnicity, income group
Public opinion analysis
Electronic commerce: telework and teleshopping
Commercial real estate development, leasing, appraisal
Residential real estate development, marketing, appraisal
Public transit planning
Highway planning
Intelligent Transportation Systems (ITS)
Personal travel behavior
Freight logistics
Rideshare/vanpool promotion and coordination
Local government lawmaking and regulation
Urban land use planning
Architecture
Urban geography

Table 5-2. Areas of Expertise for the Expert Advisory Group (Continued)

Environmental quality
Cost-benefit analysis
Dynamics of citizens' land use objections

Source: Integrated Transport Research

Before the backcasting exercise in NWTIPP, we have specified two forecasting exercises to orient the panelists to the overall transportation planning topic and the process of providing opinions and receiving feedback. We envision that a draft problem statement, set of alternative solutions, and framework for evaluation would be initially provided by a professional planning team at the beginning of the backcasting procedure. The panelists themselves as independent authorities would have the opportunity to modify all inputs in the pursuit of a better way of approaching the problems of urban transportation.

ADVANTAGES OF BACKCASTING DELPHI

Within the context of the NWTIPP overlay on existing MPO processes, and for the purpose of TOD reassessment and new approaches to nonwork travel, Backcasting Delphi provides several advantages over other methods. In the ideal case, it would precede decisions to invest in capital-intensive transit capacity such as light rail. It would allow involvement of a broader range of expertise than is normally the case in transportation and land use planning. For example, retail industry analysts, commercial real estate portfolio managers, and consumer market researchers would have equal status with regional transportation planners. Many more of the significant forces shaping urban form would be considered. The process would allow setting a planning horizon that reflects the uncertainty inherent in these forces. The land use-transportation scenarios evaluated would not be limited to the regional planning vision and to typical "no-build" and "build" transportation alternatives.

Within many of the areas of expertise that bear on understanding urban activities, movement demands, and transportation and land use options, there are divergent opinions among experts. The results of the Delphi process will be dependent on the specific point of view of the individual representative experts selected. This introduces some uncertainty into the outcome of the planning process, which we do not regard as a bad event.

Through the iterative process, both capital-intensive and low-cost incentive and marketing solutions would be considered until a consensus is reached on

one or even several scenarios that are compatible with the forces shaping the urban environment. With appropriate framing, broader social equity questions would be considered, as well as a range of opportunity costs.

The attributes of Backcasting Delphi are summarized in Table 5-3.

Table 5-3. Attributes of Backcasting Delphi

Embraces multiple disciplines of expertise
Considers all forces shaping urban form
Incorporates all environmental and economic dimensions
Allows for iteration to reach policy consensus
Can be executed at any geographic scale, including across multiple jurisdictions
Understandable by a wider audience than is four-step transportation modeling as practiced by MPOs

Source: Integrated Transport Research

THE TEMPLATE: IMPLEMENTING BACKCASTING DELPHI IN A NEW PLANNING PROCESS

The NWTIPP is presented in this research effort as a planning "template," that is, a set of guidelines and elements, that indicate how to augment and modify an MPO-created Metropolitan Transportation Plan (MTP) to reflect more accurately and comprehensively the existence and characteristics of nonwork activities and trips. The heart of the proposed process is interaction between a small core Planning Team and the Expert Advisory Group that will carry out a focused environmental assessment and a public policy backcast using a structured Delphi Backcasting technique of opinion-gathering and feedback. As this planning exercise proceeds, it is quite likely that the participants will modify it to fit the circumstances of the metropolitan region. Thus, the template is described next with a minimum of detail. Somewhat more detail than is presented here is provided in the Task six report from this project, posted at http://www.globaltelematics.com/mineta/.

Table 5-4. Components of the Nonwork Travel Improvement Planning Process (NWTIPP)

Charter that establishes the sponsorship and mission of the NWTIPP.
Expert Advisory Group that brings diverse knowledge to the improvement of transportation planning for urban nonwork travel.
Professional Planning Team to carry out a knowledge acquisition and dissemination process and to facilitate the knowledge generation activities of the Expert Advisory Group.
Knowledge Management Process that initiates, refines, expands, and disseminates a Knowledge Base.
Initial Knowledge Base that includes the findings from this project, plus a region-specific database like the prototype presented in the third report of this project, and that will expand throughout the project.
Delphi process for eliciting structured opinions and justifications from the Expert Advisory Group; backcasting orientation brings goals, policies, and market conditions into alignment.

Source: Integrated Transport Research

COMPONENTS, PHASES, AND TASKS OF THE NWTIPP

The key components of the NWTIPP are listed in Table 5-4. The NWTIPP consists of fourteen steps, organized into the five distinct phases, all listed in Table 5-5.

Table 5-5. Phases and Tasks of the Nonwork Travel Improvement Planning Process

Phase 1: Process Initiation	
Task 1-1:	NWTIPP Planning Team chartered and organized
Task 1-2:	Planning Team assembles Knowledge Base
Task 1-3:	Planning Team recruits Expert Advisory Group

Table 5-5. Phases and Tasks of the Nonwork Travel Improvement Planning Process (Continued)

Phase 2: Orientation of Expert Advisory Group Task 2-1: Expert Advisory Group receives and assimilates initial Knowledge Base in preparation for meeting Task 2-2: Planning Team and Expert Advisory Group meet face-to-face for team building and exchanging viewpoints Task 2-3: Planning Team modifies initial Knowledge Base and adjusts remaining processes in response to Expert Advisory Group feedback
Phase 3: Consideration of consumer activities and nonwork travel scenarios Task 3-1: Planning Team facilitates Expert Advisory Group's web-based Delphi review process on consumer activities and nonwork travel scenarios Task 3-2: Planning Team modifies the Knowledge Base in response to the Expert Advisory Group's Delphi findings
Phase 4: Development of public policy objectives and action alternatives Task 4-1: Planning Team compiles draft public policy objectives for nonwork travel Task 4-2: Planning Team creates draft action alternatives to meet nonwork travel policy objectives Task 4-3: Planning Team facilitates Expert Advisory Group's web-based Delphi Backcasting process on objectives and action alternatives Task 4-4: Planning Team modifies objectives and finalizes action alternatives based on Expert Advisory Group's Delphi Backcasting outcome
Phase 5: Process completion: Evaluation and dissemination of results Task 5-1: Planning Team prepares reporting documents on results of NWTIPP Task 5-2: Planning Team and Expert Advisory Group evaluate the NWTIPP just completed

Source: Integrated Transport Research

FURTHER DETAIL ON THE TASKS OF THE NWTIPP

The following is a brief preliminary sketch of the work steps of a prototype Nonwork Travel Improvement Planning Process that meets the requirements set out earlier in this report. More detail is provided in the Task 6 report at http://www.globaltelematics.com/mineta.com/.

Phase 1: Process Initiation

Task 1-1: NWTIPP Planning Team Chartered and Organized

The basic requirement for proceeding with an NWTIPP is its chartering and the commitment of resources to compensate and otherwise support the professional Planning Team. The source of resources could be a government agency or legislative body, foundation, corporation, or individual.

We envision that the Planning Team (PT) would consist of at least one full-time project management professional as Team Leader and enough other personnel to equal one and one half additional Full Time Equivalent persons. We recommend that the Planning Team organize around the following full and part-time roles: research coordinator, student intern supervisor, liaison with MPO, public involvement coordinator, web master, and Expert Advisory Group coordinator. At least half of the members of the Planning Team should have transportation planning experience, although it will be useful that some have relevant experience outside of transportation planning.

Task 1-2: Planning Team Assembles Knowledge Base

The Planning Team should carry out its work in a framework of knowledge management (Cortada 1999, Heide 1996). The PT will be continually augmenting a Knowledge Base (KB) that is made available to the Expert Advisory Group and other interested parties. The conclusions of the EAG will be part of the KB also. We recommend presenting this KB as a well indexed, well summarized, cross-linked series of documents on the World Wide Web.

The KB would begin with an updated *review of academic research focused* on land use, transportation, and the TOD paradigm, as was begun by the present project in the review of literature in the appendix.

Other important parts of the Knowledge Base:

- Review of the forces shaping the future of retail.
- Assessment of present and future consumer activities.
- Descriptive data on present land use and land use trends underway.
- List of the exogenous forces likely to be shaping the retail land use and activity in the region over the next five to ten years.

- Information on how and why people travel now.
- The current Metropolitan Transportation Plan by the MPO .
- “Present commitments” land use map of the region in the MPO's planning horizon year.
- Assessment of significant transportation-related actions to be taken by governments, large employers, and significant trip-attraction sites.
- Overview of the available financial resources to pay for government implementation of transportation capital construction and services.
- All of the information described above should be rolled up by the Planning Team into a series of alternative, descriptive draft scenarios on the future of nonwork travel in the region.

Task 1-3: Planning Team Recruits Expert Advisory Group

As a central feature of the NWTIPP, the Planning Team interacts with a specially recruited panel of at least 15 experts we call the Expert Advisory Group (EAG). The EAG will carry out an initial review of the Knowledge Base at the beginning of their work, plus two Delphi exercises that assess and expand upon critical additions to the KB made by the PT. Earlier in Table 5-2 we specified the expertise of the EAG.

Phase 2: Orientation of Expert Advisory Group

Task 2-1: Expert Advisory Group receives and assimilates initial Knowledge Base in preparation for meeting

The EAG will be provided immediately with Internet web access to the structured Knowledge Base, with their attention initially invited toward the mission of the NWTIPP, an overview of the process that is planned to be followed, and a baseline set of findings and conclusions from previous literature on consumer activities and nonwork travel. Over a period of a month or so, each member of the EAG would need to have a working familiarity with the full range of material in the initial KB as sketched in Task 1-2 earlier.

Task 2-2: Planning Team and Expert Advisory Group meet face-to-face for team building and exchanging viewpoints

In general, because we recommend the use of a web-enabled Delphi process, the PT and the EAG do not need to do their work in a face-to-face fashion. However, we do recommend one early face-to-face meeting of the EAG and the Planning Team to gain a common understanding of the NWTIPP to motivate a high level of participation and to build mutual understanding and trust.

This meeting would be an important opportunity for the EAG members to learn about the Delphi process to be used, and to provide feedback on the initial Knowledge Base and on the planned Delphi activities over the coming months of activity. The face-to-face meeting should result in a common understanding by the EAG and Planning Team on problem definition, and the range and scope of the premises, paradigms, and strategies that the NWTIPP will encompass.

Task 2-3: Planning Team modifies initial Knowledge Base and adjusts remaining processes in response to Expert Advisory Group feedback
In response to information received during the face-to-face meeting between the EAG and the PT, the PT would in this step take steps to augment the KB with additional information requested by the EAG. The PT would also make adjustments in the planned Delphi processes to take into account suggestions made by the EAG members about those processes.

Phase 3: Consideration of Consumer Activities and Nonwork Travel Scenarios

Task 3-1: Planning Team facilitates Expert Advisory Group's web-based Delphi review process on consumer activities and nonwork travel scenarios
In this step, the Planning Team facilitates the Expert Advisory Group's Delphi review process on consumer activities and future nonwork travel scenarios. This facilitation requires providing the EAG with structured information on a series of options for these activities and scenarios that the members can validate, refine, qualify, extend, or endorse.

The EAG members would be encouraged to ask for additional information as they see fit from the Planning Team or anyone else. Information requested by one EAG member would be made available to all members. We would expect that the specialists on the EAG would come up with descriptions of many areas of risk and uncertainty that should be incorporated into the Knowledge Base.

Developing conclusions on important trends defining consumer activities over the next five to ten years in the region is the first desired result from the Delphi process to be exercised with the EAG. Under the guidance of the PT, over one to three iterations, the EAG would review, comment on, add to, and vote on a structured list of potential trends provided by the PT.

Simultaneously and in coordination with this review of trends, as a second component of the Delphi exercise, the EAG would review, comment on, add to, and vote on a number of scenarios on future regional nonwork trip-making for consumer activities, as prepared by the PT.

Task 3-2: Planning Team modifies the Knowledge Base in response to the Expert Advisory Group's Delphi findings

After the EAG has reached its conclusions on consumer activities and nonwork travel scenarios, the PT will incorporate the results of the Delphi process into the KB.

Phase 4: Development of Public Policy Objectives and Action Alternatives

Task 4-1: Planning Team compiles draft public policy objectives for nonwork travel

In this step, only after gaining insight into the nature of the urban environment as described in this project, the Planning Team establishes draft public policy objectives for nonwork travel. This means defining the problem or problems that the government is capable of addressing in its transportation and land use policy, and how one would know the extent to which the problems are solved. Reduce the congestion caused by the growth of nonwork travel? Reduce air and water pollution from vehicular travel? Preserve and protect environmental values? Increase the quality of urban life, including opportunities for home ownership with desired amenities? The objectives may go beyond those in the MTP. To the degree possible, the PT should work with regional decision makers to understand and incorporate their views into the draft objectives.

The objective for nonwork travel may be the same as the objective for *all* travel in the region. It may be that the public policy objective for nonwork travel is related to land-use; freezing the number of major decentralized shopping destinations, for example.

The statement of the objectives that the NWTIPP can reasonably address also needs to specify how to measure these problems in a base year and in a defined out year, and how success in the resolution of these problems will be judged in the out year. As stated before, it is also important that financial budget limitations be recognized in the statement of objectives.

Task 4-2: Planning Team creates draft action alternatives to meet nonwork travel policy objectives

In this step, the Planning Team would formulate one or more paradigms and the associated policy packages that would potentially cause the region to achieve the draft objectives defined in the previous step. The output of this step is a draft list from the Planning Team of three to five effective and efficient policy packages intended to impact transportation performance in the out year for submission to the EAG.

Planners carrying out this NWTIPP template may want to include TOD as one of the alternative paradigms, but they should be free to design and choose whatever alternatives fit the circumstances of the region that is the focus.

Task 4-3: Planning Team facilitates Expert Advisory Group's web-based Delphi Backcasting process on objectives and action alternatives
In this critical portion of the NWTIPP, the focus for the Expert Advisory Group would be on judging the effectiveness and cost-effectiveness of different policy packages developed by the PT. By cost-effectiveness, we mean consideration of what transportation performance or what amount of problem resolution is delivered for each dollar of cost. Cost-effectiveness may well have to be estimated, and different policy packages may offer different kinds of performance, so comparing packages may well be subjective.

The recommended policy package may end up being one suggested by the Planning Team, or it may be an alternative policy design. Under the backcasting protocol that is part of this step, the PT must be ready to accommodate an adjustment of the problem definition or at least of the public policy objectives associated with the definition, if the EAG is unable to find a set of policies and associated actions that is likely to solve the defined problem within a cost that is reasonable given available resources.

Task 4-4: Planning Team modifies objectives and finalizes action alternatives based on Expert Advisory Group’s Delphi Backcasting outcome
After two to three iterative rounds of Delphi consideration by the EAG that reaches consensus or at least a stable point of non-consensus, the PT would end the EAG process and add what was learned from their deliberations to the KB.

Phase 5: Process Completion

Task 5-1: Planning Team prepares reporting documents on results of NWTIPP
If this template works as designed, a refined, winnowed package of policy initiatives will be the result. This work of the Planning Team and Expert Advisory Group should be packaged for presentation to the media, the MPO, government administrators, elected decision makers, the general public, and the civic leadership of the region.

The Team may also recommend further planning steps. Under the influence of what the EAG reports, the Planning Team may face the prospect of having to repeat and rework earlier steps to account for considerations brought to light by the interaction of the diverse experts. There may be a need for further iterations of the objectives-paradigms-policies development. Alternatively or additionally, recommendations for action by the MPO may result.

Task 5-2: Planning Team and Expert Advisory Group evaluate the NWTIPP just completed

A final step in the NWTIPP is a reflective end-of-project evaluation of how the entire process functioned, with an emphasis on documenting and disseminating recommendations for the improvement of future planning rounds. A fundamental characteristic of the NWTIPP will be the probable need to revisit the process regularly as new knowledge is developed.

ADDITIONAL CONSIDERATIONS

The intent of the described NWTIPP planning template is to produce a supplemental transportation plan in the form of a report, web site, or other document that can educate and influence established planning authorities, decision makers both elected and appointed, the business community, various special interests, other stakeholders, the media, and the public generally.

We have not specified in any detail how the NWTIPP should or could manage its relationships with all of these parties along the way during the elapsed time when the planning process described above is carried out. These ongoing relationships are important, and they will need to be managed by the professional Planning Team and those responsible for oversight of the NWTIPP.

In this description of the NWTIPP we have maintained a sharp focus on a particular area of substance (consumer behavior, retail industry dynamics, and resulting nonwork travel behavior) that is too slightly considered in today's MPO-led transportation planning. We will leave specifying the important tasks of external relations to the pioneering community leaders that first implement the NWTIPP.

CHAPTER SIX

CONCLUSIONS ABOUT PLANNING FOR TOD

GROWING POPULARITY AND CRITIQUE OF TOD

Regional and federal planners and decision makers, in response to traffic congestion and other impacts resulting from growth and change in human activity patterns, have embraced transit-oriented development. However, there is a growing body of empirical research suggesting that TOD, when preceded by large investments in rail system capacity, will in most cases not produce benefits that are commensurate with the costs. Consequently, TOD planners need to be informed of the technology and market factors beyond the control of public policy that cause traffic growth, congestion, and related environmental impacts. In addition, they need to appreciate the difference between TOD's success at the station-area level compared to the regional level, and adopt methods to measure regional success.

With regard to regional success, the large differences in patterns of population and land use change across metropolitan America over the past few decades suggests that a one size fits all approach to land use and transportation planning is not effective. Each urban region has its own unique set of characteristics and forces that are determining settlement and mobility patterns.

IMPORTANCE OF NONWORK TRAVEL

The large growth in personal travel in the last three decades has in large part resulted from increased frequencies of nonwork trips, especially trips for shopping and other family and personal business activities. Retail activities account for more than half of all person trips, and most are made to locations that are flexible in that the traveler has more than one choice of destination for a given activity. Many retail trips are linked in complex tours that may involve multiple stops for a variety of purposes and several family members traveling together. These tours would usually benefit from the flexibility that a private vehicle provides, and consequently transit and pedestrian modes are chosen for a small proportion of all person trips.

THE EVER CHANGING RETAIL MARKETPLACE

The new retail marketplace is characterized by considerably more variety and opportunity than ever before in history. Consumers now have a much larger

array of choices for their household needs, leisure-time pursuits, and other personal activities. For retail structure, this has translated to larger and fewer retail store formats in any one category, at the same time the number of individual categories has greatly increased. Some retailers have taken advantage of consumer demand for more choice and good values by inventing new formats and offering a wide scope of products. Others have carved niches from older store formats while expanding product offerings.

Although past trends suggest future realities, the retail marketplace can be expected to continue to reinvent itself in new ways that are difficult to predict. A good example is online marketing. E-commerce is currently a small fraction of all retail sales, yet it has a large and unknown potential, and an equally large possible impact on personal travel patterns.

PLANNING THAT ADDRESSES COMPLEXITY, RISK, AND UNCERTAINTY

A large number of socioeconomic, technological, and other factors, in addition to those that define the retail environment, are active in a metropolitan region, and they produce a state of continuous dynamic change in urban form and personal travel patterns. Key among these are preferences for the location and size of residence, the location of work centers, and the growth and spatial dispersion of nonwork activities. These forces are strong in comparison to the policy tools that American government jurisdictions have at their command to control and shape urban growth. Taken together, the array of forces implies a future planning environment that must deal with considerable complexity, risk, and uncertainty.

A NEW METRO PLANNING TOOL: BACKCASTING DELPHI

There is a clear need for a new and better urban transportation planning approach that supplements existing four-step modeling and other statutory processes, and that more directly matches the difficulty of the urban transportation problem. A new and better planning tool would take into account the complexity and ongoing dynamic evolution of the metropolitan economy. A new and better tool would employ available descriptive data and information, and not demand that only quantitative results from mathematical approximations be relied upon for estimating the likely impacts of TOD. A new and better tool would bring in new, heretofore unconsidered descriptions and analysis of the way the market economy for consumer goods and services is now being served in metropolitan areas.

One tool that appears to meet these requirements is Backcasting Delphi. With this technique, the urban transportation problem is addressed by using a

diverse panel of experts (Delphi) to consider the feasibility of TOD and alternative paradigms and strategies (Backcasting).

FINAL CONSIDERATIONS

The core of the research project that designed the NWTIPP lies not in the particular details of the phases and tasks of how the process is carried out, but rather in the specification of four ideas for action to improve transportation planning:

- Emphasizing nonwork trips in urban transportation planning.
- Assembling data to describe these trips and the activities and destinations that cause them.
- Assessing the complexity, risk and uncertainty that these data reveal for transportation in the future.
- Adjusting the direction of public policy in response to the revealed data and the assessment of what they mean for the future.

If the specifics in this Planning Template do not resonate within a particular metropolitan community's leadership as a good way to implement the four ideas listed, we recommend trying an alternative implementation that fits the community.

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APPENDIX A:

REVIEW OF SELECTED TOD LITERATURE

A number of researchers have been actively testing various features of the TOD paradigm and the premise that government actions can significantly reshape urban form and travel patterns so that a greater share of urban travel is by mass transit. We very briefly review and cite selected examples of their work. These papers touch on, to various degrees, important TOD issues, including nonwork activity patterns and the land use-transportation linkage. We provide direct quotes (in italics) that appear to summarize key findings and conclusions. While this review does not by any means include all of the research literature on these topics, we believe these authors and papers to represent a consistent and comprehensive perspective of the current state-of-understanding.

Marlon Boarnet

Marlon Boarnet is associate professor, Urban Planning and Economics Departments, University of California at Irvine, and research associate of UC-Irvine's Institute of Transportation Studies. His interest is how local governments actually implement TOD. In a series of papers and a forthcoming book with Randall Crane, Boarnet addresses the financial and other objectives of local governments that can differ from regional planning goals.

Boarnet investigated the development of housing at 232 station-areas across Southern California, and compared the intensity of housing with that allowed under local zoning (Boarnet & Crane 1997). He found that municipalities behave as if they prefer to use rail transit stations for economic rather than residential development. There is a stronger trend toward commercial rather than residential zoning that is consistent across existing and proposed rail lines, whether in central or suburban communities.

Residential development appears to be a secondary goal, at best. Left to their own devices, almost every city wants the train to bring people into town in the morning rather than send them elsewhere (in order to maximize the fiscal and economic benefits).

Boarnet suggests that this creates an imbalance in the form of an excessive number of employment and shopping “destination” stations relative to the number of residential “origin”' stations. And he doesn’t believe that California is unique.

The cross-jurisdictional economic competition that makes transit-based commercial development attractive in Southern California is also characteristic of many other urban areas. The tensions that prompt municipalities to think first of their own economic development have, if anything, grown stronger over time.

In a follow-up paper, Boarnet suggests that local fiscal concerns are evident in a broad range of planning activities beyond transit-oriented development (Boarnet & Crane 1998).

Anecdotal evidence suggests that local competition for regional shopping malls and big-box retailers is becoming increasingly intense. In the past, researchers have studied incentives for fiscal zoning focusing on attempts to increase the local property tax base. In California, and likely in other states also, fiscal pressures are increasingly focusing on land uses that generate sales tax revenue. Fiscal competition now is over commercial uses, and the ramifications of these new fiscal pressures are not fully understood.

Boarnet undertook a more detailed study of TOD implementation in San Diego that has the oldest of the current generation of light rail lines (Boarnet & Compin 1999). He found, through detailed interviews with planning directors, that cities along rail routes, though sympathetic to regional rail planning objectives, have approached TOD from a perspective of local goals, opportunities, and constraints.

The lesson from San Diego County is that progress towards TOD goals is often incremental. TOD projects are the results of a number of local governments acting in their own interests, pursuing opportunities as they present themselves, and working within local constraints. The legacy of preexisting land uses (and rights-of-ways) is an important determinant of TOD implementation. Placing rail lines along high-growth corridors can be expensive, especially when those corridors do not have suitable existing rail rights-of-way. Whether TOD benefits, such as an increase in transit ridership, outweigh the cost of placing a line along a high growth corridor is open to question.

Boarnet and a coworker also modeled the effect of general neighborhood land use variables (extent of grid street pattern, population density and retail and service job concentrations) on nonwork automobile trips, using southern California travel diary data (Boarnet & Sarmiento 1998). None of the land-use variables was found to be significant either individually or jointly, which is consistent with the findings of Crane. Based on the results, they conclude:

We are not yet ready to make transport policy based on the link between nonwork travel and land-use patterns. The primary lesson to emerge from this study is that any link between land use and nonwork trip generation is a complicated one.

The authors suggest that several issues need to be addressed in further research: New Urbanists designs are at a neighborhood scale, whereas nonwork trips cover much larger areas; the possibility that persons choose their residential location based in part on how they wish to travel; and the complexity of non work trips, i.e., trip chaining.

Robert Cervero

Robert Cervero is professor, Department of City and Regional Planning, University of California at Berkeley. He and his coworkers have conducted many studies of the relationship between travel patterns and urban design features, both in the United States and abroad. Cervero has published extensively in transportation and planning journals, and has written several books on the topic of the land use and transportation problem.

Cerver's perspective is clearly one of support for a menu of government policies that can have some impact on urban form in ways that will reduce the effects of automobility. Yet, he tempers his enthusiasm for these efforts with a pragmatic assessment of what has been experienced and can be expected in terms of actual outcomes.

Cervero comments on the concern expressed about light rail systems (1998a):

Proposals to build and extend fixed-guideway systems, especially light rail, in the United States have triggered a wrath of criticism. Even cities that show great promise, such as Portland, have come under attack, and with some justification. The track record with new rail systems in the United States leaves a lot to be desired. Studies show that new-generation rail systems have failed to produce the ridership that was promised and ended up costing more than was forecast.

Although the reasons for transit's poor showing over the years are many, the gross under pricing of automobile travel—especially along heavily trafficked corridors where transit is most needed—heads the list. An absence of coordinated and comprehensive planning, carried out on a regional scale, is also to blame. Putting a point-to-point rail system in a sea of spread-out, auto-oriented development is hardly a recipe for successful and sustainable transit. Quite simple, too often across America, transit and cityscapes have been way out of synch.

Of course, transit investments that are out of kilter with how our cities and regions grow do nobody any good. Running trains and buses that fail to draw people out of drive-alone cars does little to relieve traffic congestion, conserve fuel, or reduce pollution. The best prescription for filling trains and buses, and winning over motorists to transit, is to find a harmonious fit between transit systems and the cities and suburbs they serve.

Cervero also comments on bus rapid transit, debunking what he terms the myth that bus transit is incapable of shaping urban form and attracting high-rise development around stops:

Besides buses being stigmatized as a second-class form of conveyance, the conventional wisdom holds that buses repel development because of their negative-byproducts: diesel toxins that spew from tail pipes. Experiences around busway stops in Ottawa and Curitiba should put this myth to rest. In both cities, some of the priciest condominiums anchor sites adjacent to busway stops. Retail and office developers also flocked to busway corridors in both cities. Good quality service—whether vehicles are propelled by electricity or fossil fuels, or whether they roll on steel wheels or pneumatic tires—will spawn compact development. It is the accessibility premium that attracts real estate development, not the type of transit equipment. In fact, compared to freeways and even rail corridors, busways produce relatively low ambient noise levels. Its inherent flexibility advantages and superior adaptability to spread-out patterns of development make bus transit—especially when combined with dedicated busways—a potentially stronger shaper of growth patterns than rail transit in some settings.

Cervero has also reviewed TOD in California which he has actively sought to promote through government polices (1998b):

Despite successes, the track record with TOD in California has not always been positive. Far more growth in the Bay Area has been auto-oriented than transit-oriented, despite BART's 25-year presence. A number of stations along Sacramento's light rail line have attracted big-box retail projects; despite repeated efforts by the Sacramento Regional Transit Authority to promote TOD, in the final analysis, the prospect of localities receiving large sums of sales tax revenues won out over regional concerns, like TOD.

In a separate study, Cervero and a co-author estimate that only about 9 percent of the residents from the three BART-served counties lived within a half mile of a BART station in 1990 (Bernick & Cervero 1996). And 1990 Census journey-to-work data indicate that only 18 percent of these station-area residents commuted by rail transit. Multiplying these two percentages led them

to conclude that fewer than 2 percent of 1990 commute trips within the three counties were by station-area rail users.

Doubling the number of station-area rail users would have a pretty small impact on current commuting and environmental conditions in the Bay Area.

The two authors suggest that more than singular measures, such as transit-based housing are needed if outcomes are to be more than minimal.

Transit-oriented development matters when bundled together with other supportive policies.

They call for fundamentally different settlement patterns and pricing arrangements for driving:

Putting more suburban jobs in office towers near rail instead of sprawling business parks would no doubt make these numbers more impressive. So would dramatically raising the price of fuel and parking (so that motorists pay for externalities they create, including time losses and air pollution).

Urban villages, they suggest

...would tap the synergy of orienting the future growth of both ends of the commute trip—homes and workplaces—to rail, in addition to retail shops, restaurants, entertainment centers, and other urban uses. Land-use initiatives, like transit-supportive development, by themselves are clearly no panacea to today's congestion, air quality, and social equity problems.

Randall Crane

Randall Crane is associate professor of urban planning, environmental analysis, and economics at the University of California, Irvine. He has done extensive modeling and empirical analysis of the possible influence of urban design factors on travel behavior, and has authored several papers and is co-authoring a book with Marlon Boarnet on the subject which is due to be published in September 2000.

We refer here to only two papers, in which he summarized the results of his work (Crane 1998, 1999). Crane's concern is that much of the analysis that purports to support the belief that changes in urban form can shape travel behavior is problematic. It does not, in his opinion, have a strong behavioral foundation. Crane has attempted to improve the research on TOD by isolating the separable influences of urban design on travel.

Individuals make choices based on their preferences for benefits obtained by travel and on the relative costs of making different trips and of taking different modes. Past empirical research about the influence of neighborhood design on travel has neglected the role of costs in choosing among trips and modes.

Crane believes that individual design elements, such as grid street patterns, traffic calming features, and a concentration and greater mix of uses, may both increase and decrease car trips and VMT. Walking trips may be similarly affected. Crane cites the example of shopping:

People may shop more often if stores are nearby, and they may make so many shopping trips that they drive more miles.

Crane believes the net effect of urban design features on travel is uncertain at best, and that actual outcomes depend on specific details of implementation at each location, not on their intrinsic traffic-affecting properties.

There is no evidence that New Urbanist's designs influence travel behavior at the margin. They remain a wobbly foundation indeed for current transportation policy.

Crane comments on previous research involving the effect of urban design on travel:

Any empirical work of this nature is problematic given the enormous complexity of the behavior to be explained and the great difficulties of conceptualizing the interaction of travel and the physical character of the city.

Anthony Downs

Downs is a senior fellow in the Economic Studies Program at the Brookings Institution (Washington, D.C.). He has analyzed and commented on the patterns and problems of American urban areas for more than three decades. His recent books include strategies to address traffic congestion and the renewal of large older central cities. He has also written on the problem of urban sprawl. Downs' perspective is often conditioned by what he feels is politically possible and feasible in the American system.

Downs often uses simple spatial models to elucidate his points. He did so to estimate the effect on transit commute mode share of a major radial mass transit system serving the central city's employment center (Downs 1992). He concluded that

...even an extensive rapid transit system serving many high-density housing clusters near their stops would carry only relatively few suburban commuters. The results would be minor in comparison to the economic and political efforts required to build and maintain the transit systems and create high-density clusters.

Downs subsequently extended this analysis by estimating the size of the TOD areas and rail transit system required to accommodate the population growth experienced by the average Metropolitan Statistical Area over one million in

population in the decade of the 1980s (Downs 1994). He found that the system would have to be much larger than the actual systems in either the Washington, DC, or the San Francisco Bay metro areas, yet those areas have much larger total populations than the population used to calculate the model.

Realistically, it may not be feasible to accommodate all or even most urban growth in transit-oriented developments. The feasibility of applying them on a large scale is weakened by the high cost of building the rapid-transit links among them. However, Calthorpe's TODs should be viewed as building blocks that could be used to handle some significant part of growth in the range of visions except the unlimited low-density vision.

In a contribution to a multifaceted discussion of sprawl, Downs sounds a rather pessimistic note about government's ability to adopt tactics that effectively address the growth problems plaguing many metro areas (Downs 1998).

Effectively adopting any of these tactics, or certainly most of them, would require a strong region wide implementing body. Yet hardly any US metro areas have been willing to consider doing this. Nor is it certain that these tactics would overcome a region's growth related problems. For example, I am positive that traffic congestion will get worse almost everywhere, no matter what tactics anyone adopts. Until advocates of limited future sprawl can overcome the metropolitan majority's belief that the benefits of sprawl outweigh its social costs, they are not likely to notably reduce sprawl's dominance.

Kenneth Dueker

Ken Dueker is professor of Urban Studies and Planning and director of the Transportation Studies Center, Portland State University. He directed the Center for Urban Studies at PSU from 1979 to 1998. His areas of research interest include transportation and land use interactions.

Dueker and his PSU colleagues have been closely monitoring the impacts of Portland's light rail transit system and its TOD strategy. Just as the State of Oregon has been a testing ground for strong growth controls, Portland is a laboratory for TOD. Its Eastside light rail line, the first in a planned metro-wide radial network focusing on downtown Portland, opened in 1986. Portland has gone to considerable lengths to encourage development that supports light rail.

Dueker has used data for the first 10 years of operation to research the impacts of the rail line on development patterns, choice of residential location, freeway traffic, and transit ridership (1999a). In a presentation at a 1999 conference (1999b), Dueker reported that:

What we have found is that light rail alone has not been sufficient to change development patterns appreciably.

He sees an apparent self-selection in housing location choice. People who are already prone to use transit are willing to relocate to areas accessible to light rail, but rail has not had an impact on traffic congestion.

What we're observing is that the peak period for highway traffic is widening, and that non-peak and weekend travel on light rail is where the growth in transit riders is occurring.

And Dueker has concerns about the transit component of Portland's TOD.

A lot of bus lines, including express bus lines, have been discontinued, and a lot of people have been forced onto light rail and to make transfers. Light rail in suburban service has problems. When you get 15 miles out, you're almost an hour by light rail to downtown, because it has to stop at every stop. I think that express bus service could do a better job for the suburban commute.

Dueker confirms that Portland's success at controlling growth is somewhat clouded by its proximity to Clark County in Washington State, which is a bedroom suburb just across the Columbia River (1999c). Clark County is the most rapidly growing county in Washington State, with an annual population growth rate that surpassed even the high range of forecast population. Its 1999 population accounted for approximately 25 percent of the Portland-Vancouver urbanized area.

Reid Ewing

Reid Ewing is with the Surface Transportation Policy Project in Washington, D.C. He formerly was associate professor, College of Engineering and Design at Florida International University. He has authored books on development practices and transportation and land use innovations, as well as research dealing with travel patterns in Florida communities and their land use relationships (Ewing, et al, 1994). Ewing wrote a lengthy paper from the "anti" sprawl perspective as counterpoint to a "pro sprawl" paper by Peter Gordon (Ewing 1997). We quote from that paper.

We include Ewing because he is a thoughtful proponent of strategies to minimize auto externalities. Ewing believes that sprawl, that he defines as suburban development lacking accessibility and open space, is not a natural response to market forces, but a product of subsidies and market imperfections. His solution is active planning as it is practiced "almost everywhere but the United States."

Ewing's analysis of Florida suburban communities found that regional accessibility, not land use density, is the most significant land use variable. In other words, land use patterns that recognize that density is not feasible but provide more services in closer proximity can reduce some auto trips. Ewing also recognizes that

As suburban areas grow, the central city becomes less and less accessible. At some point, emergence of other centers is beneficial.

He favors "good" development over "bad." He cites Florida's best practices as an example of an initiative to upgrade the quality of development, "wherever" and "whenever" it should occur. Cluster development, which concentrates housing and commercial in walkable areas while preserving a large part of the land area as park or natural open space, is one approach.

Peter Gordon

Peter Gordon is professor of planning and economics in the School of Urban Planning and Development and the Department of Economics, University of Southern California. Gordon, often together with his colleague Harry Richardson, has authored numerous research papers addressing the forces shaping the growth of major metro areas and associate travel patterns.

Gordon (& Richardson's) general premise is stated in the first sentence of his "pro" sprawl article:

The revolution in information processing and telecommunications is accelerating the growth and dispersion of both economic activities and population, possibly moving towards the point where 'geography is irrelevant' (Gordon & Richardson 1997).

Gordon has a blunt opinion of high-capacity transit and TOD.

Low densities make high-capacity transit systems unattractive and therefor wasteful of all resources utilized, including energy. Because the spreading out of cities reduces markets for conventional public transit (especially fixed rail, which is spatially inflexible and usually oriented downtown, it should be no surprise that the U.S. transit industry has been in decline for most of the 20th century. Massive subsidies have not helped. New federally assisted systems have not added to mass transit; instead, they have replaced flexible bus routes with costly fixed-routes to a few downtown areas, while the growth of jobs and population has been in the suburbs and in the smaller cities. At the same time transit fleets in general are under used, and the new systems have added to costs without attracting riders from cars.

Citing Cervero and Downs, he says:

It appears that 'Neo-traditional' neighborhoods do not make much of a difference.

Genevieve Giuliano

Giuliano is professor and vice dean, School of Policy, Planning and Development, University of Southern California. She has investigated the land use and travel impacts produced by the high accessibility that modern roadway systems create, and the effectiveness of land use policy on reducing congestion and the environmental costs of automobility. Giuliano has also contrasted the land use-transportation relationship in Europe and the United States.

Because of the federal highway program of the 1950s through the 1970s, she observes that Metro areas are marked by well-developed transportation systems (Giuliano 1995):

Even a large investment (such as a new freeway segment) will have only an incremental effect on accessibility. Moreover, the decentralized land use pattern of today's metro areas has reduced differences in accessibility among locations.

Giuliano also observes that rail transit continues to have strong public support, in spite of "rather overwhelming evidence" that transit investment is not an efficient means for affecting land use patterns (1). She cites Los Angeles as the most extreme example of this view.

Planners expect this massive program (originally a $78 billion rail-transit investment) to increase the proportion of commuters who use transit from 4.5 percent to 19 percent by the year 2010, through the generation of high-density and mixed-use development along transit lines. To test whether their expectations were reasonable, the regional planning agency sponsored a study using a transportation forecasting model to determine the effect of various land use scenarios on transit use. Results show that by relocating 75 percent of all forecast employment growth and 65 percent of all population growth in the 5-county region to transit-station areas, 7 to 10 percent of commuters would use transit. Study authors conclude that even if anticipated land use changes were to occur, travel patterns would not change very much, because the overall regional pattern of land use would not change very much.

Giuliano does not view land use policy as an effective means for reducing the environmental impacts associated with private vehicle use (Giuliano 1999):

Significantly less private vehicle use would require substantial increases in densities from existing levels and a reversal of development trends that have been in progress for many decades. I do not think such increases in density can be achieved, and increases in density that might be achieved would have at

best very little effect on private vehicle travel. The trends in car use and decentralization are powerful (even in Europe where government land use controls are stronger and where tax and pricing policies favorable to car ownership and use are not present). They are supported by changing economic structure and rising affluence, and there is no reason to believe that fundamental shifts away from these trends will occur in the future. The greatest success in addressing automobile externalities has been realized by regulating the car, rather than the driver.

Susan Handy

Handy is Assistant Professor of Community and Regional Planning, School of Architecture, University of Texas at Austin. Part of her research was done at the Institute of Transportation Studies, University of California at Berkeley.

Handy was the first researcher to question the suggestion by supporters of New Urbanism that traditional urban form (rectilinear street patterns, sidewalks, accessibility to transit service, and proximity to a mix of commercial establishments, including jobs) discourages automobile dependence (Handy 1991). She points out that there is a tension between providing local services and regional transit links:

- *The ability of residents to live and work in the same place is limited by numerous constraints, including the match between employee qualifications and employer needs, dual wage earner households, job security, etc.;*
- *The growing variety and complexity of lifestyles requires a number of services that can't be supported by a small neighborhood population;*
- *Residents may choose not to use local services if they have easy access to other areas, and if other factors that affect destination choice play a role. These include price, quality of service, habit, etc.; and*
- *Services evolve over time as the size and character of the population changes; what is sufficient to encourage use of local facilities now may be insufficient in the future.*

In a series of papers (Handy 1992, 1996a, 1996b, 1996c), she addresses the effect of TOD design elements on mode choice, particularly pedestrian travel to nonwork destinations, in San Francisco Bay area and Austin neighborhoods. In the most traditional Austin neighborhood, 95 percent of residents live within walking distance of the neighborhood commercial center. She both surveyed and modeled the travel behavior of residents.

Handy finds that certain design aspects can encourage walking trips but the savings in travel from substitution for driving are likely to be small. For San Francisco:

The evidence does not support the popular belief that neo-traditional style development will help reduce levels of nonwork travel (Handy 1992).

For Austin:

The total savings in automobile travel appears to be on the order of 8 km per adult resident per month—a drop in the bucket when average driving per month is approximately 2000 km per household (Handy 1996a).

Handy, based on further detailed analyses of the San Francisco neighborhoods, suggests that some land use policies may help provide alternatives to driving, but their effectiveness in reducing total travel will be at least partially offset by the range of choices available to residents of a metropolitan region (Handy 1996b).

A greater range of choice seems to be associated with greater trip frequency; a greater range of choice may induce some trips that would not have been made given more limited choices. And the greater the range of destinations visited, the longer the average trip, such each additional destination is farther away.

Handy suggests that the overall policy goal—namely that of reducing auto travel—toward which much of research on the link between urban form and travel behavior is directed, should be reconsidered (Handy 1996c).

Land-use policies are likely to have only a marginal impact on travel given the extent of existing development and the relatively small increment that new growth represents. Certainly it is important that any development that occurs be designed appropriately so as to minimize the need for automobile travel, but other strategies to manage travel demand, such as pricing strategies, are also needed.

Richard W. Longstreth

Longstreth is an architectural and urban historian whose interest is in understanding the role of the retail marketplace in shaping the modern metropolis. In a comprehensive study (Longstreth 1997), he has traced the evolution of the regional mall in Los Angeles in the mid 20th-century, and how these shopping centers, together with the rapid growth of private vehicles, shaped the land use and travel environment of the city and region.

His book is an observational and deductive work, relying on photographs, maps, and historical records found in newspapers and other documents. From

this evidence, Longstreth sees relationships and patterns that lead him to draw several conclusions about the importance of retail in the building of Los Angeles and post-auto cities generally:

...(M)ost historical studies of how the automobile has affected the landscape imply, at least, that the process was un- or even anti-urban, ultimately leading to decline and decay in the city. Such characterizations, however, ignore the inherently urban circumstances affecting change in the commercial sphere. Los Angeles reveals that the automobile was not an isolated cause but one of several factors that contributed to a recasting of metropolitan form rather than its destruction.

Just as Los Angeles is one of the major population, business, and cultural centers of the nation, so retail development is a key indicator of urban form and identity. No other single component of the city attracts so many people so frequently and for so many reasons. No other more frankly reveals current attitudes toward public assembly and decorum. No other so clearly reflects change both in market conditions and consumer taste. No other embodies more fully the unyielding impact of motor vehicles on the landscape.

At a time when "sprawl" is becoming a code word for urban ills, much as "congestion" and "overcrowding" were two generations ago, we need to be careful not to condemn in wholesale fashion the environment created in recent decades. My argument is not to defend all that has been developed in the recent past, nor is it against the strategies for change, but only that we should not repeat the mistake of previous generations who dismissed cities of the nineteenth and early twentieth centuries as wastelands. Only through understanding the modern metropolis can our choices for the future be informed, rational, and productive.

Daniel Luscher

Luscher is manager, economics and policy analysis, Acurex Environmental Corporation, Mountain View, CA. The paper summarized here is based on work done at the J. F. Kennedy School of Government, Cambridge, MA.

Luscher's work is unique because it directly addresses a central public concern: congestion. He estimated the congestion reduction benefits of TOD in the San Francisco Bay area using a simple spatial model (Luscher 1995). His analysis focused on residential development and did not directly address the role of TODs in altering commercial development patterns. Luscher found that, employing optimistic travel behavior modification assumptions, that redeveloping the area around most of the existing rail transit stations, coordinating similar development around feeder bus routes, and clustering one-fifth of the region's population in these areas would reduce vehicle

miles traveled by 5 percent. The strategy would offset about three years of VMT growth.

Luscher concludes that TOD would not have a significant impact on the Bay Area's congestion problems but may have collateral benefits.

It is clear that TOD is inappropriate as the foundation of a congestion reduction strategy for the Bay Area. To the extent that TODs are a part of a larger scale rethinking of urban design, they are likely to have worthwhile non-transportation benefits, such as an enhanced sense of community and the preservation of open space on the suburban fringe.

Douglas Porter

Porter is president of The Growth Management Institute, Chevy Chase, MD, and a planning and development consultant. He has written and edited books on growth management, and was the author of the Transit Cooperative Research program study of transit-focused development in 23 U.S. cities and metro regions (Porter 1997, 1998). We excerpt and summarize here some of the conclusions he reached in the latter research.

Porter was interested in the effect of TOD-supportive policies on development around light and heavy rail station areas. He did not probe for actual transportation benefits. What he observed were actual patterns of development that, in some cases, were the result of governmental efforts over several decades. His analysis suggests that transportation and land use planners, who have expectations that TOD can reduce auto dependency, must recognize the realities of the real estate markets, public attitudes, and the nature of rail lines themselves.

Especially along light rail lines, development opportunities will be influenced by changes in the development industry and its primary markets, increasing deference to neighborhood groups regarding development impacts, and the generally lower intensity of use of suburban rail stations compared to stations along heavy rail lines. Unlike experience with heavy rail systems, non central business-district stations on light rail lines are more likely to attract relatively small, uncomplicated projects (Porter 1998).

Porter found that the intensive development that has taken place has occurred mostly in central business districts and some midtown and inner suburban locations.

Except in older cities and downtown area, development falls short of the density and design thresholds needed for generating significant transit ridership; transit-focused development still remains more a concept than a reality in most regions. The primacy of the automobile and the desire of most

North Americans to live and work in low-density surroundings strongly dissuade market forces and governmental policies from producing densities and forms of development most supportive of transit.

Jonathan E. D. Richmond

Jonathan Richmond is a fellow at the Taubman Center for State and Local Government, Kennedy School of Government, Harvard University. Richmond has extensively studied light rail systems built in the U.S. since 1970. He recently published a review of the capital and operating costs, and the ridership levels, of these systems (Richmond 1998a). His findings correspond with earlier work by Pickrell who found that costs typically were underestimated and ridership was overestimated.

Richmond has also investigated the reasons rail systems are highly popular in spite of considerable evidence that they do not perform well (Richmond 1998b). This may be his most interesting and useful work for TOD planning. It is only possible to distill the essence of this work into a few selected quotes, since space limits a thorough review.

Transportation as a problem is most basically understood as a static concept—a derived demand. But transportation is part of a complex and dynamic system of elements that overlap and interact in a plethora of ways at a given point in time and whose interaction patterns shift over time in response to those interactions.

The public-sector response to transportation problems has focused on transportation facilities and not the underlying problems.

There are frequent references to the need for a 'balanced' transportation system. The idea of 'balance' is attractive because it simplifies complex ideas into a physically based metaphor.

The train is seen as necessary part of a balanced system, excluding the possibility that rail service may not be appropriate for all cities. The vast per capita expenditures on the rail system take away opportunities for the more productive use of scarce resources.

The artificially created 'urban village' does not reflect the richness of today's multifaceted and overlapping urban possibilities. Residents will remain attracted to exploiting the overlapping richness of the city with automobiles in ways that remain beyond the ready capabilities of public transport.

The assumption that people will use local facilities in a village-like community setting and that they will cycle to the train station along dedicated landscaped cycle routes is easy to make if you do not appreciate the web of complex

interactions for work, shopping, and leisure that automobility has created throughout the metropolis.

Recognizing that transportation is inevitably tied in an intricate web of overlaps with all other urban functions and with the rich morass of human life complicates the planning task but makes it more likely to succeed.

The successful transportation planner of the future must move from attempting to shape lifestyles in ways that cannot succeed in a democratic society to instead appreciate the many dimensions of how people have chosen to live and interact across space and how this relates to their aspirations for life in the future. And then accommodate their wishes in environmentally responsible ways.

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APPENDIX B: GLOSSARY OF ACRONYMS	
ATM	Automated Teller Machine
EAG	Expert Advisory Group
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GAO	General Accounting Office
ICSC	International Council of Shopping Centers
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation System
KB	Knowledge Base
MIS	Major Investment Study
MPO	Metropolitan Planning Organization
MTP	Nationwide Personal Transportation Survey
NWTIPP	Nonwork Travel Improvement Planning Process
PSRC	Puget Sound Regional Council
PT	Project Team
TAZ	Transportation Analysis Zone
TEA-21	Transportation Efficiency Act for the 21st Century
TCRP	Transit Cooperative Research Program
TOD	Transit-Oriented Development
U.S. DOT	United States Department of Transportation
VMT	Vehicle Miles of Travel

APPENDIX C:

ABOUT THE RESEARCH TEAM

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Dick Nelson is president and senior researcher at Integrated Transport Research, a Washington State nonprofit corporation. He is also a Research Associate at the Mineta Transportation Institute. His recent work has focused on the integration of land use and transportation, specifically the concept of transit-oriented development. From 1977 through 1992, he was a member of the Washington State House of Representatives, where he worked to establish state laws that address growth management, state transportation planning, the linkage of transportation and land use, incentives to use transit and carpool, and transportation demand management. Over the past two decades, he has been a member of numerous state and local boards, commissions, and advisory committees related to transportation. He earned the Sc.D. from Massachusetts Institute of Technology and the BS from the University of Washington.

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John Niles is founder and president of Global Telematics, a contract research and policy consulting firm based in Seattle, Washington that focuses on the interaction of transportation and telecommunications. In addition, he is a Mineta Transportation Institute Research Associate. Lately, the focus of his work has been the response of transportation policy to the network economy. He has led research studies on telecom-driven travel reduction for several Metropolitan Planning Organizations and the United States Department of Energy. He is a member of the Telecommunications and Travel Behavior Committee of the Transportation Research Board and participates in the Washington State Telework Coalition. He earned the M.S. from the Graduate School of Industrial Administration at Carnegie Mellon University and the S.B. from Massachusetts Institute of Technology.

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Aharon Hibshoosh is a Professor in the Department of Marketing at San José State University and Research Associate at the Mineta Transportation Institute. He received the Ph.D. at University of California, Berkeley and the B.A. at Hebrew University in Israel. He has written many publications in diverse areas of marketing and applied economics, and has developed a variety of forecasting systems and quantitative tools and systems for regional planning and for urban and rural businesses. Research interests in support of

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PRE-PUBLICATION PEER REVIEW

San José State University, of the California State University System, and the Mineta Transportation Institute Board of Trustees have agreed upon a peer review process required for all research published by the Institute. The purpose of the review process is to ensure that the results presented are based upon a professionally acceptable research protocol.

Research projects begin with the approval of a scope of work by the sponsoring entities, with in-process reviews by the Mineta Transportation Institute Research Director and the project sponsor. Periodic progress reports are provided to the Research Director and the Research Associate Policy Oversight Committee (RAPOC). Review of the draft research product is conducted by the Research Committee of the Board of Trustees and may include invited critiques from other professionals in the subject field. The review is based on the professional propriety of the research methodology.