

Shopping Trip-Chaining Behavior at Malls in a Transitional Economy

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Cities in transitional economies are experiencing a proliferation of newly constructed suburban shopping malls. Curiously, travel habits to these new malls are quite distinct from those generally experienced in North America, particularly regarding trip chaining. While most weekday afternoon mall trips in developed nations are chained, few are linked in countries with transitional economies. Because trip chaining is a behavior strongly associated with sprawl, this research seeks to examine the nascent trip chaining at the four new peripheral malls in Prague, Czech Republic, to identify factors that contribute to such travel patterns. This research explores two types of trip chaining among a survey sample of 782 people. External trip chaining considers activities made before and after the mall stop, while internal trip chaining considers activities made during the mall stop. Overall, only 18.1% of patrons made external trip chains, while 42.3% made internal trip chains. This general finding suggests that, in the absence of many retail alternatives, mall patrons in transitional economies may substitute internal trip chaining for the external trip chaining that characterizes travel patterns in North America. This research demonstrates that male gender, high income, working age, small household size, ownership of multiple cars, suburban home location, few additional car passengers, weekly mall trip frequency, a long access travel time, poor mall accessibility, and a short mall activity duration are tied to higher rates of external trip chaining. Concomitantly, female gender, high income, working age, large household size, private vehicle use, additional passengers in the car, mall trip frequency, poor mall accessibility, grocery shopping, high mall expenditure, and long mall activity duration are tied to higher rates of internal trip chaining. These findings suggest that land use policies may be effective in limiting the growth of external trip chaining and maximizing internal trip chaining among suburban mall patrons.

An interesting by-product of the proliferation of shopping malls has been the development of complementary trip-chaining behaviors. These chains exist at two interrelated levels. Most notably, patrons carry out their stops at malls within the context of their other activity destinations, such as work and home. Such chains are referred to here as “external trip chains.” However, trips are also chained within the mall stop itself, as patrons seek a variety of goods and services during their single stop at the mall. These chains are referred to here as “internal trip chains.”

To date, research on trip chaining at suburban shopping malls has tended to focus on external trip-chaining behaviors in the developed world. Because such communities are also characterized by highly

dispersed land uses, it is not surprising that external trip chaining has been found to be a major mall access strategy (1).

Currently, however, a rapid proliferation of suburban shopping malls is occurring in transitional economies, such as those in countries in Central and Eastern Europe. Because these communities are characterized by dense, contiguous development, they are likely to report mall access travel patterns that are distinct and possibly more sustainable. Early research on these new mall sites has emphasized their high transit mode splits but has had little to say about trip-chaining behaviors (2; T. Dybicz, G. L. Newmark, and Y. Garb, Traffic Generation Characteristics of Shopping Malls in Central Europe, unpublished paper, 2002).

Because trip chaining is highly associated with sprawl, understanding the factors that contribute to these patterns is integral to designing more efficient land use and transportation policies both in the developing world and in the developed world. Toward these ends, this research examines shopping trip-chaining behaviors at four mall locations in Prague, Czech Republic. As the initial results of this research revealed very low rates of external mall trip chaining in Prague, this study defines and uses an innovative concomitant consideration of mall internal trip chaining.

This paper has four sections. The first section reviews the literature on shopping trip-chaining behaviors, particularly those that address mall stops. The second section presents the research methodology used in this study. The third section analyzes the findings to consider characteristics that affect trip chaining to or within a shopping mall. The fourth and final section concludes the paper.

LITERATURE REVIEW

Definition of Trip Chains

Many researchers have offered definitions of trip chains (3–12). These definitions are generally similar and typically consist of three elements: anchors, stops, and trip links. Anchors refer to the end points of the trip chain. Stops refer to the activity sojourns made between anchor locations. Trip links refer to the travel between the stops and the anchors. The trip chain thus comprises the stops and links between anchor locations. Definitions vary depending on the nature of the chain being studied. For example, early research in trip chaining tended to define home locations as anchors (4, 7), while more recent research on commuting trips has defined both home and work locations as anchors (3, 5, 8, 12).

This example brings out a common ambiguity among trip chain definitions, namely, a tendency to conflate activities and locations. Activities are not necessarily tied to single locations. Identical activities, such as the work of a salesman, may take place in multiple locations. Conversely, and more important for this research, multiple

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Transportation Research Record: Journal of the Transportation Research Board, No. 1939, Transportation Research Board of the National Academies, Washington, D.C., 2005, pp. 174–183.

activities may take place in a single location, such as a shopping center. Although this fact has been noted by many studies (3, 7, 10, 13), transportation research often assumes that single sojourns are for single-activity purposes. This assumption may reflect a research preoccupation with vehicle trips as opposed to pedestrian trips; however, such simplification likely obscures the more nuanced interplay of vehicle and pedestrian trip chaining that is particularly relevant to the current study.

Shopping center trip chains exist at two different but interrelated levels. Patrons incorporate their mall stop within their broader travel patterns, and while at the mall, patrons may also link several activities together. Furthermore, the desire to schedule a particular mall stop may be influenced by the center's convenient agglomeration of several different colocated activity opportunities. Therefore, it is important to define two types of mall-related trip chains: external trip chains and internal trip chains.

The first type, the external trip chain, places the mall stop within the larger context of non-mall activity purposes, such as work and home. This macrolevel focuses on the activity purpose destinations on either side of the mall trip. If those external activity purposes are different from one another, then the mall stop is part of a trip chain. For example, the set of journeys from work to a mall and then on to a home location (work–mall–home) is an archetypal mall external trip chain. In this set of journeys, the trip to the mall is linked to the distinct trip purposes of work and home. By contrast, the trip to the mall may be unlinked, as when one travels from home to the mall and back home again (home–mall–home). Such unlinked or primary trips are not considered external trip chains since the trip purposes on either side of the mall stop are identical.

The second type, the internal trip chain, places the individual mall activities, such as shopping for groceries and dining, within the context of the mall sojourn. This microlevel focuses on the trip purposes during the mall visit. If there is more than one purpose, e.g., when one attends a movie (entertainment) and then purchases a non-food item (other purchases), the mall sojourn includes an internal trip chain. By contrast, single-purpose visits, such as shopping for groceries only, are not considered to constitute internal trip chains.

Shopping Trip Chaining

In broad terms, trip-chaining is considered a strategy to attempt to maximize the prospective utility to be gleaned from accessing different activities (while minimizing the disutility of travel), given constraints on money, information, time, and space (6, 7, 9–11, 14, 15). Many studies of travel behavior have noted the tendency for shopping trips to be incorporated within larger trip chains (1, 3–5, 8, 9, 12); and several have noted that further chaining occurs within certain stops, such as malls and downtown areas (3, 7, 10, 13), although little research has elaborated internal trip chaining.

Research has emphasized that demographic factors affect shopping external trip-chaining behaviors. Gender differences are particularly pronounced. Women in North America generally bear a disproportionate burden of the shopping responsibilities (14) and are more likely to place these trips within larger trip chains (3, 11, 14). While nonworking women cluster their shopping trip chains in the early afternoon (11), increasing female participation in the workforce has shifted the bulk of these trip chains into the commutes from work to home during the afternoon peak hour (3, 4, 8, 14).

Travel behavior factors have also been found to influence shopping external trip chaining. The time of day that the trip is made, for example, affects the propensity to chain trips. For both men and women,

shopping stops are relatively prevalent on the work-to-home commute (3–5, 12). Jou and Mahmassani found that in two cities in Texas, a fifth of all stops made on the evening work-to-home commute are for shopping purposes (5). This pattern appears to hold true for malls, particularly during their weekday afternoon peak patronage periods. Shiftan and Newmark (1) compared several studies in North America and Great Britain (16–21) and found that with relative consistency, roughly two-thirds of stops at malls during this time period are reported to be part of larger trip chains.

Other travel behavior factors, such as trip distance and mode, are thought to affect external trip chaining. One study found that unlinked shopping trips are made over short distances, while complex shopping trip chains often have rather long initial links (4). Another study reported that, in general, regardless of the first link, increased trip chaining tends to result in decreased trip lengths between stops (11). A review of nationwide travel habit survey data showed that car drivers report a higher than average percentage of trip chains (3). Conversely, a study of travel patterns at several malls in California argued that specific chains of trip purposes can affect the choice of travel mode to shopping centers (22).

Finally, factors tied to the shopping experience itself, such as activity duration, may affect external trip chaining. Researchers have found that in more complex trip chains, less time is spent at each stop, in general (11), and for shopping trips, in particular (4). Therefore, shorter durations of stops at malls may suggest a greater likelihood of trip chaining.

Longitudinal Trends in Shopping Trip Chaining

As noted above, the new malls in Prague report remarkably low rates of external trip chaining. Longitudinal studies in North America might provide some insight into this phenomenon. For example, in a suburban county outside Chicago, Illinois, there was a 30.6% drop in the number of unlinked shopping trips between 1970 and 1990, despite continuing population increases. This reduction is attributed to the increase in shopping stops incorporated into external trip chains (4).

However, given a 58.9% rise in the county's population, it is difficult to understand why the total number of shopping sojourns rose only 7.6%. The authors argued that because the average shopping stop duration did not increase, shopping has most likely become a more time constrained and therefore directed activity. They suggest that rising female rates of participation in the workforce have been a particularly important factor in constraining the time budgeted for shopping (4). An unmentioned possibility is that such increased shopping efficiency might be fostered by increased internal trip chaining at regional malls and other smaller shopping centers.

Several (and conflicting) accessibility arguments are proposed to explain increases in shopping trip chaining. Kim et al. argue that the proliferation of suburban shopping opportunities increased suburbanite accessibility to retail venues in 1990 over that in 1970 (4). They suggest that the increased accessibility led to increased shopping trip chaining (4). McGuckin and Murakami also argue that increased accessibility to suburban shopping increased trip chaining; however, they suggest that accessibility is due to rising car ownership rather than the creation of new shopping locations (3). By contrast, Strathman et al. has found that suburbanites with high levels of access to retail opportunities make fewer trip chains (8). Similarly, Kumar and Levinson argue that access to shopping opportunities reduces the need for trip chaining; however, they suggest that the residential expansion to the suburbs and away from core areas reduces shopping accessibility and that that reduction is the cause of increases in shopping trip chaining (12).

METHODOLOGY

Site Selection

The capital of the Czech Republic, Prague, was chosen as the site of this inquiry. Prague is particularly appropriate, as the development of suburban shopping malls has been a new and rapid phenomenon. As a result, Prague serves as an archetype of a transitional economy adjusting to the suburban clustering of retail. Furthermore, because Prague serves as one of the more successful centers for economic growth in Central and Eastern Europe, it is assumed that the lessons learned there may be applicable for development elsewhere.

Until recently, the shopping options within Prague were quite limited. The 1989 collapse of the socialist system resulted in the development of new retail markets. Foreign investors began developing malls at a rapid pace in the second half of the 1990s as rising motorization rates leveled off at roughly one car for every two people (23). The first mall opened in 1997, as shown in Table 1. Since then, these new centers have become a major mode of retailing (24). This first wave of new malls, the focus of this research, has been characterized by construction at the city periphery, with a heavy emphasis on retailing as opposed to entertainment and other offerings.

These malls were built at four major sites, roughly corresponding to the compass directions, as shown in Figure 1. Throughout this paper, these cardinal points are used to facilitate the identification of the malls.

Data Collection

In October and November 2001, an intercept survey of 782 patrons at these four newly built malls was conducted to assess shopping travel patterns. Each mall was surveyed between 4 and 7 p.m. on a Thursday, as shown in Table 1. These hours were identified as the peak weekday shopping periods on the basis of previously obtained mall traffic counts from the region.

Surveyors were instructed to circulate throughout the public areas in the shopping centers and to approach individuals or groups to request their participation in the survey. When the surveyors encountered groups, the survey was directed at the member who responded to the request for surveys. The respondents were asked to provide demographic, travel, and mall activity information.

Data Analysis

The data were analyzed to examine external and internal mall trip chains. External trip chains, as noted above, are defined by dissimilar

trip purposes on either side of the mall shopping stop. Four external trip purpose options were provided. These include home, work, school, and other. A previous purpose of work and an after purpose of home would be counted as a linked trip, while a previous purpose of home and an after purpose of home would be counted as a primary trip.

A potential problem of this emphasis on trip purpose rather than on purpose location is that it may result in the undercounting of trip chains if similar trip purposes constitute different locations. For instance, an accountant or salesperson leaving his or her own office to shop at a mall before visiting a client's office building would list both before and after mall trip purposes as his or her work. The criteria of this survey would incorrectly assume that such a set of trips did not constitute a chain. Despite this valid concern, an analysis of trip purposes, as shown below, reveals that the vast majority of primary trips are anchored at home purposes. Home trip purposes are likely to be tied to single locations.

Internal trip chains are defined by multiple activity purposes at the mall stop itself. These activity purposes include groceries, other purchases (i.e., non-grocery shopping), dining, entertainment or sport, work and other. The respondents were asked to list one primary purpose and all secondary purposes, if any. Respondents who provided only a primary purpose were considered not to be making internal trip chains, while those who listed multiple purposes were considered to be making internal trip chains during their mall visit.

A potential problem of this emphasis on broad activity purposes rather than on either more narrow purposes or more specific activity locations is that it, too, may result in the undercounting of internal trip chains, if similar trip purposes constitute different locations within the mall. For example, a trip to several stores to purchase several nongrocery items (or even to merely comparison shop without purchasing) will, in this study, be considered the single purpose of other purchases rather than an internal trip chain. Despite this valid concern, an analysis of mall activity purposes reveals that the vast majority of single-purpose trips are for groceries. These activity purposes are likely to be truly tied to a single purpose and a single location within the mall.

Because this study examines shopping trip chaining, only those responses from respondents whose primary purpose is either groceries or other purchases are included in the analyses.

FINDINGS

This section presents the analysis of factors that are related to the external and internal mall trip-chaining behaviors. These factors are clustered according to three types of variables. These variables include demographic, travel behavior, and shopping mall characteristics.

TABLE 1 Shopping Center Characteristics and Survey Information

General Information								
Compass Point (Area)	Shopping Centers Surveyed	Date Opened	Center Style	Gross Leasable Area —GLA (m ²)	Hypermarket Percentage of GLA	Transit Access	Survey Information	
							Thursday	Surveys
North (Letnany)	Letnany	Nov. 1999	Mall	15,000	80%	Good	Oct. 25, 2001	217
South (Pruhonice)	Hypernova	April 1998	Box	16,200	60%	Poor	Nov. 8, 2001	38
	Makro	Oct. 1997	Box	10,500	95%	Poor	Nov. 8, 2001	106
	Spektrum	April 1998	Mall	6,500	0%	Poor	Nov. 8, 2001	24
East (Cerny Most)	Centrum Cerny Most	Nov. 1997	Mall	25,000	38%	Good	Oct. 4, 2001	208
West (Zlicin)	Shopping Park Praha	Nov. 1998	Plaza	47,400	33%	Good	Oct. 18, 2001	189



FIGURE 1 Map of Prague malls.

Among the 782 patrons surveyed, 99.5% provided information on their primary mall trip purpose. A total of 86.2% of these respondents came to the mall primarily for shopping purposes, while 13.8% came primarily for nonshopping purposes, mostly for entertainment or sport and work purposes, as shown in Figure 2.

Among the 671 patrons who came to the mall primarily for shopping purposes, 96.3% provided information on their location purposes both before and after the mall stop. Of these 646 Thursday afternoon shoppers, only 18.1% made external trip chains, while the remaining 81.9% returned, after their mall sojourn, directly to their place of origin. The most common linked trip sequence, which accounted for 58.0% of the external trip chains, was the work–mall–home path, which represented only 10.5% of total mall trips. The most common primary trip sequence, which accounted for 95.2% of primary trips, was the home–mall–home path, which represented 78.0% of total mall trips. Table 2 provides the entire before-and-after mall trip purpose matrix for shopping patrons.

Among the 671 shopping patrons, 284 (42.3%) came to the mall for more than one purpose. Such multipurpose sojourns signify internal trip chaining. The remaining 57.7% of the shopping patrons came to the mall for their primary purpose only. Such single-purpose sojourns do not signify internal trip chaining.

Demographic Variables

The demographic variables used to better understand trip-chaining behavior at the new peripheral malls in Prague included gender,

income, age, household size, car ownership, and home location. The relevant findings from the survey are shown in Table 3.

Gender

Gender has a divergent effect on rates of external and internal trip chaining. Men report a 25.8% higher share of external trip chaining and a 23.2% higher propensity to make the work–mall–home trip sequence; however, women report a 17.7% higher rate of internal trip chaining, once they are at the mall.

There are several possible explanations for these findings. Different rates of workforce participation, gender roles in family life (e.g., women may have the primary responsibility for tending to children), cultural norms that prioritize men's access to mobility, or variations in shopping preferences between men and women could all account for divergent trip-chaining patterns. Furthermore, these factors may interact in such a way that women may be substituting internal trip chaining for external trip chaining.

Income

Income has a direct effect on the rates of both external and internal trip chaining. Such rates appear to rise progressively with income level, as does the rate of making the work–mall–home trip sequence.

These findings suggest that because wealthier people value time more heavily and have more income to spend on goods, they will use

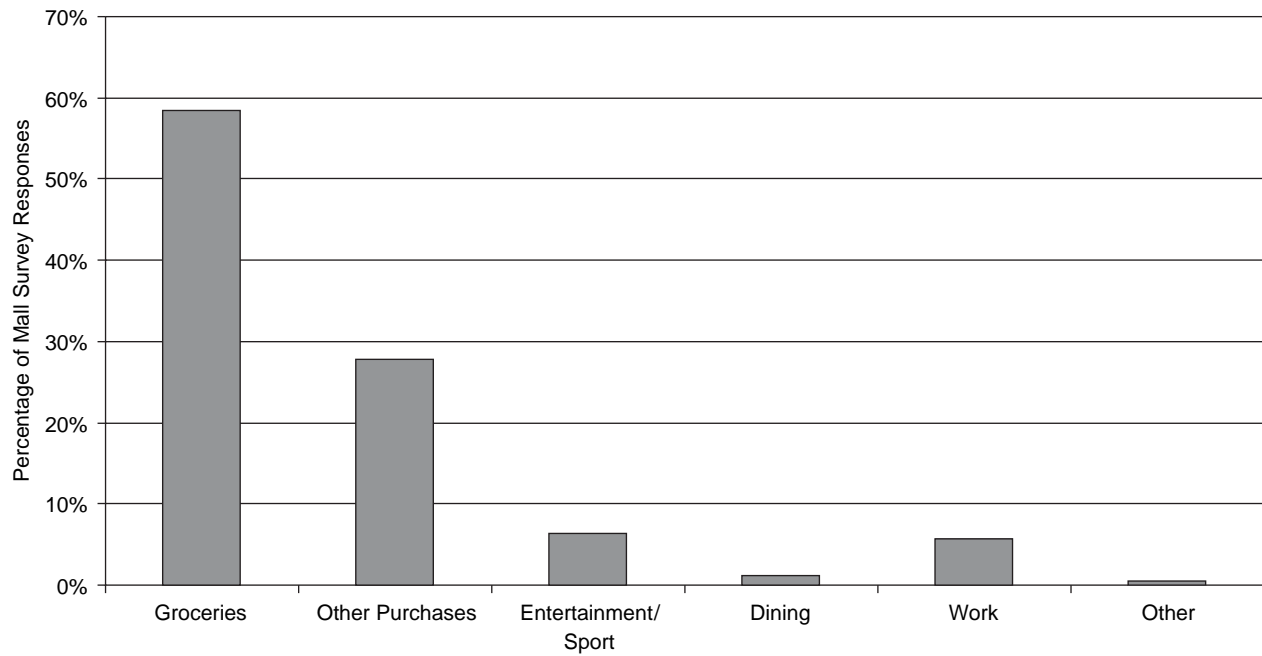


FIGURE 2 Shares of primary mall trip purposes.

their improved access to transportation to maximize access to goods while optimizing their travel time. This observation may also suggest that Western-style shopping behaviors are largely a factor of income.

Age

Age exerts various effects on mall trip chaining. Youth and seniors appear to be the least likely to externally trip chain. This may reflect limited access to means of mobility, as well as fewer time constraints because of a lack of workforce participation. Not surprisingly, youth, who are members of an age group known for spending time at the mall, report a high rate of internal trip chaining. Interestingly, the elderly individuals reported very low rates of internal trip chaining. Perhaps, given the inconvenience of transporting purchases and more flexible schedules, elderly individuals prefer to make single-purpose trips to the mall. Alternatively, elderly individuals may have fewer

needs that require multiple-purpose trips. This explanation might also incorporate young adults' (ages 18 to 24 years) low rates of internal trip chaining; however, given this group's high 23.2% share for external trip chaining, highly mobile, young adults may simply be replacing internal trip chaining with external trip chaining. Finally, adults ages 25 to 65 years do report high rates of external and internal trip chaining and of work–mall–home trips. These patterns suggest that individuals in this age group have many time constraints and attempt to make shopping efficient.

Household Size

Household size has an inverse relationship to the rates of external trip chaining and a direct relationship to the rates of internal trip chaining. This finding may suggest that for larger families with many household responsibilities, malls represent an opportunity to fulfill many shop-

TABLE 2 Before-and-After Mall Trip Purpose Matrix for Shoppers

		Purpose at Post Location									
		Home		Work		School		Other		Total	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Purpose at previous location	Home	504	(78.0)	2	(0.3)	3	(0.5)	18	(2.8)	527	(81.6)
	Work	68	(10.5)	11	(1.7)	0	(0)	5	(0.8)	84	(13.0)
	School	6	(0.9)	0	(0)	4	(0.6)	2	(0.3)	12	(1.9)
	Other	12	(1.9)	0	(0)	1	(0.2)	10	(1.5)	23	(3.6)
Total		590	(91.3)	13	(2.0)	8	(1.2)	35	(5.4)	646	(100.0)

All percentages are of the total sample. Values in italics refer to primary (i.e., unlinked) trips. Values in boldface refer to either row or column totals. Row totals refer to activity purposes directly preceding the mall stop. Column totals refer to activity purposes directly following the mall stop. All other values refer to external trip chains.

TABLE 3 Disaggregated Trip Chains: Demographic Variables

Variable	Category	Mall Trip Type				Main Trip Sequences				Mall Visit Type			
		Linked Trips (external chains)		Primary Trips (no chaining)		Work Mall Home		Home Mall Home		Single Purpose (no chaining)		Multipurpose (internal chains)	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Gender	Male	56	(20.5)	217	(79.5)	32	(11.7)	209	(76.6)	174	(61.5)	109	(38.5)
	Female	60	(16.3)	308	(83.7)	35	(9.5)	292	(79.3)	210	(54.8)	173	(45.2)
Income	Below average	12	(13.5)	77	(86.5)	4	(4.5)	72	(80.9)	56	(61.5)	35	(38.5)
	Average	78	(16.6)	392	(83.4)	50	(10.6)	374	(79.6)	282	(57.7)	207	(42.3)
	Above average	19	(27.9)	49	(72.1)	10	(14.7)	49	(72.1)	35	(49.3)	36	(50.7)
Age	0–17	4	(12.1)	29	(87.9)	0	(0.0)	29	(87.9)	20	(54.1)	17	(45.9)
	18–24	22	(23.2)	73	(76.8)	8	(8.4)	65	(68.4)	64	(65.3)	34	(34.7)
	25–64	82	(18.1)	371	(81.9)	55	(12.1)	356	(78.6)	260	(55.4)	209	(44.6)
	65 or older	5	(9.8)	46	(90.2)	1	(2.0)	45	(88.2)	37	(71.2)	15	(28.8)
Household size	One or two	36	(22.0)	128	(78.0)	20	(12.2)	120	(73.2)	106	(62.7)	63	(37.3)
	Three or four	59	(17.2)	284	(82.8)	37	(10.8)	274	(79.9)	201	(56.8)	153	(43.2)
	Five or more	22	(16.4)	112	(83.6)	11	(8.2)	106	(79.1)	76	(53.1)	67	(46.9)
Car ownership	No cars	17	(16.5)	86	(83.5)	9	(8.7)	79	(76.7)	67	(56.9)	40	(43.1)
	One car	66	(17.3)	316	(82.7)	45	(11.8)	303	(79.3)	224	(56.9)	170	(43.1)
	Two or more cars	29	(20.3)	114	(79.7)	13	(9.1)	110	(76.9)	83	(55.3)	67	(44.7)
Home location	Prague	71	(16.7)	355	(83.3)	45	(10.6)	355	(83.3)	249	(57.6)	183	(42.4)
	Beyond	38	(20.3)	149	(79.7)	23	(12.3)	149	(79.7)	107	(57.2)	80	(42.8)

All percentages are row percentages. Percentages within mall trip type and mall visit type categories sum to 100%. Percentages within main trip sequences represent the two largest components of mall trip type data.

ping needs effectively during one short sojourn from home. Smaller households are more likely to have larger amounts of disposable income and more time to afford the higher travel costs associated with linked, single-purpose shopping trips.

Car Ownership

Car ownership positively affects external trip chaining and has no impact on internal trip chaining. That positive impact is qualified, however. The rates of external trip chaining do not rise rapidly until a household has two or more cars. Nonetheless, households with one car do report relatively high rates of work–mall–home trips. This finding may suggest that in households with a single car, shopping trips are more directly linked to the return of the car user from work than in other households.

It is perhaps strange that car ownership does not affect internal trip chaining. One might expect that access to a car would facilitate transporting more purchases and therefore more internal trip chaining. Conversely, access to a car may facilitate trip making and thus reduce the pressure to maximize each shopping trip. In the aggregate, these trends seem to cancel out the differential impacts of car ownership on the behavior of individuals once they are at the mall.

Home Location

Mall shoppers who live outside of Prague report rates of external trip chaining and of making work–mall–home trips 21.6% and 16.0% higher, respectively, than shoppers who are residents of Prague. These findings are reasonable, as most residences in Prague are located

between core employment sites and the peripheral malls, which would facilitate stopping home before shopping.

The lack of variation in rates of internal trip chaining by home location may suggest the general dearth of retail opportunities available in the region and the central role that the new malls play in shopping provision.

Travel Behavior Variables

The travel behavior variables used to better understand trip-chaining patterns at the new peripheral malls in Prague include mode choice, additional passengers in the car, trip frequency, travel time, and external trip chaining. The relevant findings from the survey are shown in Table 4.

Mode Choice

Mall access mode choice affects trip chaining. Those shoppers who choose private vehicles or public transit access report much higher rates of external trip chaining than pedestrians. While there is little difference in the overall rates of external trip chaining between private vehicle and public transit users, private vehicle users report a much higher rate of the work–mall–home travel sequence. Pedestrians, by contrast, almost uniformly follow the home–mall–home sequence. Unlike for external trip chaining, private vehicle and public transit users report a distinction in their rates of internal trip chaining, with that of private vehicle users being 15.5% higher. Pedestrians demonstrate an internal trip-chaining rate between those for the two motorized groups.

TABLE 4 Disaggregated Trip Chains: Travel Behavior Variables

Variable	Category	Mall Trip Type				Main Trip Sequences				Mall Visit Type			
		Linked Trips (external chains)		Primary Trips (no chaining)		Work Mall Home		Home Mall Home		Single Purpose (no chaining)		Multipurpose (internal chains)	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Mode choice	Private vehicle	80	(18.5)	353	(81.5)	53	(12.2)	342	(79.0)	250	(56.1)	196	(43.9)
	Public transit	33	(19.3)	138	(80.7)	15	(8.8)	125	(73.1)	111	(62.0)	68	(38.0)
	Pedestrian	2	(5.1)	37	(94.9)	0	(0.0)	36	(92.3)	25	(58.1)	18	(41.9)
Additional passengers in car	None (drive alone)	19	(34.5)	36	(65.5)	13	(23.6)	35	(63.6)	36	(65.5)	19	(34.5)
	One passenger	38	(20.0)	152	(80.0)	25	(13.2)	146	(76.8)	101	(52.3)	92	(47.7)
	Two or more	6	(7.4)	75	(92.6)	4	(4.9)	72	(88.9)	47	(56.6)	36	(43.4)
Monthly trip frequency	Two or fewer	49	(16.6)	246	(83.4)	24	(8.1)	233	(79.0)	181	(60.1)	120	(39.9)
	Three or four	40	(22.1)	141	(77.9)	30	(16.6)	134	(74.0)	109	(58.0)	79	(42.0)
	More than four	27	(16.2)	140	(83.8)	14	(8.4)	135	(80.8)	94	(52.5)	85	(47.5)
Access travel time	0 to 15 min	32	(11.9)	236	(88.1)	21	(7.8)	230	(85.8)	160	(56.7)	122	(43.3)
	15 to 30 min	37	(19.8)	150	(80.2)	21	(11.2)	141	(75.4)	107	(56.3)	83	(43.7)
	30 to 45 min	22	(24.2)	69	(75.8)	11	(12.1)	64	(70.3)	52	(54.7)	43	(45.3)
	Over 45 min	25	(25.5)	73	(74.5)	14	(14.3)	68	(69.4)	66	(64.7)	36	(35.3)
Egress travel time	0 to 15 min	35	(12.6)	242	(87.4)	20	(7.2)	236	(85.2)	169	(58.3)	121	(41.7)
	15 to 30 min	40	(21.2)	149	(78.8)	28	(14.8)	140	(74.1)	108	(55.4)	87	(44.6)
	30 to 45 min	22	(24.7)	67	(75.3)	9	(10.1)	62	(69.7)	48	(53.3)	42	(46.7)
	Over 45 min	16	(18.4)	71	(81.6)	8	(9.2)	66	(75.9)	57	(62.6)	34	(37.4)
External trip chain	Linked	117	(100.0)	—	—	68	(58.1)	—	—	62	(53.0)	55	(47.0)
	Primary	—	—	529	(100.0)	—	—	504	(95.3)	311	(58.8)	218	(41.2)

All percentages are row percentages. Percentages within mall trip type and mall visit type categories sum to 100%. Percentages within main trip sequences represent the two largest components of mall trip type data.

There are several interpretations of these findings. Commuters favor the private vehicle mode for linking shopping trips to home. Private vehicle use, in general, may enable shorter travel times, longer shopping times, and more haulage than transit use. These factors (as well as the higher incomes associated with private vehicle use) may encourage more multipurpose shopping among car users than transit users. Although pedestrians have limits on what they can carry, they may live sufficiently close that they have the disposable time for more multipurpose mall visits; furthermore, part of their walking experience may include traversing the mall more broadly.

Additional Passengers in Car

The trip-chaining habits of the private vehicle users are further affected by the number of people in the vehicle. Vehicle occupancy appears to be inversely related to the rates of external trip chaining. Solo drivers report an extremely high 34.5% rate of external trip chaining, and that rate drops to 20.0% with one additional passenger and to 7.4% with two or more additional passengers. Similarly, the percentage of work–mall–home trip sequences drops and the percentage of home–mall–home trip sequences rises with additional passengers. The relationship between additional car passengers and internal trip chaining is less pronounced; nonetheless, there seems to be a threshold effect in which the mall activities of solo drivers seem to be more distinctly single purpose compared with those of carpoolers.

These findings suggest that driving alone affords a high degree of freedom and mobility to link trips to the mall and avoid linking trips within the mall. By contrast, the need to negotiate with others' schedules and preferences may reduce the likelihood that carpoolers will trip chain to a mall, while, conversely, it may increase the likelihood

of the internal chaining once they are there. Finally, the high rate of home–mall–home trip sequences among shoppers who are driving two or more passengers suggests that the nature of carpooling during the afternoon peak hours varies with the number of passengers. As the numbers of passengers increase, those passengers are less likely to be coworkers and more likely to be cohabitants.

Trip Frequency

Mall trip frequency has an inverted U-shaped relationship to external trip-chaining behaviors. Shoppers who go to the mall three or four times a month report levels of external trip chaining that are a third higher and rates of work–mall–home sequences that are almost twice those of shoppers who come either two times a month or less or more than four times a month. By contrast, mall trip frequency appears to have a direct relationship to the rate of internal trip chaining.

One explanation for these intriguing findings may be tied to different travel costs. Low-frequency mall patrons may come to the mall only for a particular and singular purpose that motivates their unique excursion, perhaps an advertised sale. Because the trip is unusual, it is not incorporated into a trip chain. These patrons are less familiar with the mall's alternative offerings and, given presumably higher travel costs, may not make time to explore. By contrast, high-frequency mall patrons may reflect a set of people who live in close temporal proximity to the mall. They may have no need to link their mall trip within larger travel tours, and they are most likely quite familiar with the mall's full range of offerings. Weekly shoppers may share elements of both groups. Perhaps, for them, the mall trip is not an entirely convenient excursion but one that they undertake sufficiently often both to link it into their travel schedule and to fulfill several purposes at one time.

Travel Time

Access travel time is positively related to rates of making external trip chains and work–mall–home trip sequences. Access time does not seem to be particularly related to the rates of internal trip chaining until access times exceed 45 min, at which point the rates of multipurpose sojourns fall off. These findings suggest that shoppers seek to minimize the costs of long mall access travel times by externally linking their trips. Nonetheless, patrons with particularly long access times may simply have less time remaining in their evening schedules to engage in multipurpose shopping.

Egress travel time shares a roughly similar relationship to external trip chaining as access travel times; however, the rates of internal trip chaining seem to increase slightly with egress travel times less than 45 min, above which they again decrease. This finding may hint at some multipurpose optimization of shoppers who anticipate longer, but not very long, egress trips.

External Trip Chaining

Finally, mall shoppers who engage in external trip chaining report a higher rate of internal trip chaining as well. This finding suggests that the same trip efficiency impulses that lead to the linking of trips to the mall also lead to the linking of trips within the mall.

Shopping Mall Variables

Shopping mall variables represent an amalgam of factors that describe both the malls themselves and the actions of their patrons once they are there. The shopping mall variables include the mall visited, the primary purpose for the visit to the mall, internal trip chaining, mall purchase amount, and mall activity duration. The relevant findings from the survey are shown in Table 5.

Mall Visited

Trip chaining behaviors vary by mall. Because the malls offer somewhat similar services, it is tempting to postulate that these travel behavior differences reflect conditions in the urban form that surround the malls. Given the small sample size, it is not prudent to make definitive statements; however, two observations are worth noting.

First, patrons at the south mall, which has poor transit access and no surrounding residences, report the highest rates of both external and internal trip chaining. By contrast, patrons at the north mall, which has good transit access and many surrounding residential estates, report the lowest rates of external and internal trip chaining. This observation may support the assertion that accessibility reduces trip chaining; however, this conclusion needs to be tempered by income concerns, as the south mall patrons were the most affluent and the north mall patrons were the least affluent.

Second, shoppers at the two malls surrounded by residential estates, the north and the east malls, report rates of work–mall–home chains that are about 40% lower than those reported at the malls with no surrounding residential estates. This observation may demonstrate that residential accessibility, in particular, reduces work–mall–home chains, as patrons can stop at home before shopping. These observations are not meant to be conclusive; however, they do conform to several of the research findings on accessibility and trip chaining noted in the literature review.

Primary Visit Purpose

The primary shopping trip purpose did not affect the rates of external trip chains, but it did affect the rates of work–mall–home trip sequences. Those shopping for groceries report rates of work–mall–home chains 64.4% higher than the rates for those shopping for other purchases. Just over half of the grocery shoppers also make internal trip chains, while only a quarter of shoppers going to the mall for

TABLE 5 Disaggregated Trip Chains: Shopping Mall Variables

Variable	Category	Mall Trip Type				Main Trip Sequences				Mall Visit Type			
		Linked Trips (external chains)		Primary Trips (no chaining)		Work Mall Home		Home Mall Home		Single Purpose (no chaining)		Multipurpose (internal chains)	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Shopping mall surveyed	North (Letnany)	27	(14.1)	165	(85.9)	15	(7.8)	158	(82.3)	127	(64.5)	70	(35.5)
	South (Pruhonce)	31	(20.7)	119	(79.3)	20	(13.3)	114	(76.0)	74	(48.4)	79	(51.6)
	East (Cerny Most)	29	(19.1)	123	(80.9)	12	(7.9)	120	(78.9)	96	(57.1)	72	(42.9)
	West (Zlicin)	30	(19.7)	122	(80.3)	21	(13.8)	122	(73.7)	90	(58.8)	63	(41.2)
Primary mall trip purpose	Groceries	82	(18.6)	358	(81.4)	53	(12.0)	344	(78.2)	225	(49.5)	230	(50.5)
	Other purchases	35	(17.0)	171	(83.0)	15	(7.3)	160	(77.7)	162	(75.0)	54	(25.0)
Internal trip chaining	Single purpose	62	(16.6)	311	(83.4)	36	(9.7)	295	(79.1)	373	(100.0)	—	—
	Multiple purpose	55	(19.4)	218	(76.8)	32	(11.7)	209	(76.6)	—	—	273	(100.0)
Purchase amount	Less than 500 ck	37	(18.8)	160	(81.2)	16	(8.1)	150	(76.1)	139	(66.8)	69	(33.2)
	500 to 1,000 ck	23	(15.5)	125	(84.5)	13	(8.8)	121	(81.8)	92	(59.0)	64	(41.0)
	More than 1,000 ck	57	(19.1)	241	(80.9)	39	(13.1)	232	(77.9)	153	(50.5)	150	(49.5)
Mall stay	Under 1 h	70	(21.9)	250	(78.1)	43	(13.4)	235	(73.4)	224	(66.5)	113	(33.5)
	Over 1 h	46	(14.2)	279	(85.8)	25	(7.7)	269	(82.8)	163	(48.9)	170	(51.1)

All percentages are row percentages. Percentages within mall trip type and mall visit type categories sum to 100%. Percentages within main trip sequences represent the two largest components of mall trip type data.

other purchases do. Although the broad taxon of “other purchases” may unduly cloak some of the internal trip chaining that takes place, these findings suggest the importance of hypermarkets as anchors for these malls.

Internal Trip Chaining

Internal trip chaining is related to external trip chaining, as noted earlier. Therefore, it is not surprising to find that those who make multipurpose sojourns report a higher share of work–mall–home travel sequences. This sequence is the largest component of weekday afternoon external trip chaining at malls.

Mall Purchase Amount

The relation of mall purchase amount to trip chaining appears to be mixed. Those who spend the least or the most report higher rates of external trip chaining than those who spend between 500 and 1,000 Czech crowns (ck; i.e., between roughly US\$13.50 and US\$27 in the fall of 2001), while the rates of internal trip chaining increase progressively with expenditure.

The direct relationship between expenditure and multipurpose trips is reasonable, as the more that people spend, the more widely they are likely to have shopped; however, the relationship to external trip chains lacks an explanation that is as straightforward. Perhaps the low spenders are disproportionately students going home from school, while the high spenders are higher-income patrons. This interpretation is affirmed by the high spenders’ disproportionate rate of work–mall–home trip sequences.

Mall Activity Duration

Finally, mall activity duration is negatively related to external trip chaining and is positively related to internal trip chaining. Those who shop in the mall for less than an hour report rates of external trip chaining and of work–mall–home trip sequencing 54.2% and 74.0% higher, respectively, than those who shop for more than an hour. By contrast, those who shop for more than an hour report a share of internal trip chaining that is 52.5% larger. These findings concur with experience elsewhere that the sojourn length of linked trips is likely to be shorter. Conversely, those who come to the mall for long durations may be making a special and most likely primary trip and have allocated time for multipurpose shopping.

CONCLUSIONS

This research identifies theories of external and internal trip chaining to explore the travel behaviors of patrons at Prague’s newly constructed suburban shopping centers. External trip chaining is a strategy associated with sprawling land use patterns, while internal trip chaining is associated with an agglomeration of activity opportunities. Overall, only 18.1% of patrons made external trip chains, while 42.3% made internal trip chains. This general finding suggests that in the absence of many retail alternatives, mall patrons in transitional economies substitute internal trip chaining for the external trip chaining that characterizes the travel patterns in North America.

This research demonstrates that male gender, high income, working age, small household size, ownership of multiple cars, suburban home location, few additional car passengers, weekly mall trip frequency,

long access travel time, poor mall accessibility, and short mall activity duration are all tied to higher rates of external trip chaining. Female gender, high income, working age, large household size, private vehicle use, additional passengers in the car, mall trip frequency, poor mall accessibility, grocery shopping, high mall expenditure, and long mall activity duration are all tied to higher rates of internal trip chaining.

These findings suggest a complex picture of why rates of external trip chaining are so low in Prague. It appears that the current organization of land uses, with most residential and employment locations densely packed in the urban core or along well-managed transit corridors, makes traveling beyond these areas to the malls on the periphery a primary rather than a linked trip. The relatively low median incomes in the transitioning Czech economy may be contributing to this behavior, as there has yet to emerge a major boom of low-density, peripheral housing construction that would favor further retail dispersion and the ownership of multiple cars.

This interpretation supports the notion that land use policies can be quite effective in minimizing external trip chaining and maximizing internal trip chaining. Such policies might include locating shopping malls close to residential areas instead of on isolated tracts, integrating supermarkets within shopping centers, and limiting the dispersion of land uses to continue to favor dense clusters and corridors.

The existing metropolitan planning for Prague has been influential in fostering these outcomes to date. Three of these four new major retail areas were sited by the city to take advantage of the existing transit networks and planned future residential expansion. However, the south mall was built just outside the municipal limits and beyond the transit network by developers frustrated with the lengthy planning and approval process. Patrons at that mall report the highest levels of private vehicle use and external trip chaining (and internal trip chaining). They also report the highest income levels.

The south mall may represent a private rush toward less sustainable development patterns. The challenge for urban planners in developing nations is to avert such compromising of the existing accessibility benefits of a densely developed urban form while still fostering growth in income and opportunities. Prague is succeeding relatively well on this front. Since this first wave of mall openings, new retail development has been constrained to adjacent peripheral sites or to in-fill locations within Prague’s built-up area. At the same time, the south mall continues to expand and raise the specter of sprawl across Prague.

Cities in transitional economies can benefit from the experience in Prague to channel retail growth to highly accessible and, ideally, in-fill areas. Such success will depend on the active and regional integration of transportation and land use planning.

ACKNOWLEDGMENTS

This research was made possible by the Institute for Transport and Development Policy (www.itdp.org) and the Rockefeller Brothers’ Fund Initiative on Smart Growth. The authors acknowledge the help of Yaakov Garb and Jirina Jacksonova of the Institute for Transport and Development Policy and Yoram Shifan of the Technion—Israel Institute of Technology in the design and administration of the survey.

REFERENCES

1. Shifan, Y., and G. L. Newmark. Effects of In-Fill Retail Center Development on Regional Travel Patterns. In *Transportation Research Record: Journal of the Transportation Research Board*, No. 1805, Transportation Research Board of the National Academies, Washington, D.C., 2002, pp. 53–59.

2. Newmark, G. L., P. O. Plaut, and Y. Garb. Shopping Travel Behaviors in an Era of Rapid Economic Transition: Evidence from Newly Built Malls in Prague, Czech Republic. In *Transportation Research Record: Journal of the Transportation Research Board*, No. 1898, Transportation Research Board of the National Academies, Washington, D.C., 2004, pp. 165–174.
3. McGuckin, N., and E. Murakami. Examining Trip-Chaining Behavior: Comparison of Travel by Men and Women. In *Transportation Research Record: Journal of the Transportation Research Board*, No. 1693, TRB, National Research Council, Washington, D.C., 1999, pp. 79–85.
4. Kim, H., A. Sen, S. Sööt, and E. Christopher. Shopping Trip Chains: Current Patterns and Changes Since 1970. In *Transportation Research Record 1443*, TRB, National Research Council, Washington, D.C., 1994, pp. 38–44.
5. Jou, R.-C., and H. S. Mahmassani. Comparative Analysis of Day-to-Day Trip-Chaining Behavior of Urban Commuters in Two Cities. In *Transportation Research Record 1607*, TRB, National Research Council, Washington, D.C., 1997, pp. 163–170.
6. Kitamura, R. Incorporating Trip Chaining into Analysis of Destination Choice. *Transportation Research, Part B*, Vol. 18, 1984, pp. 67–81.
7. Adler, T., and M. Ben-Akiva. A Theoretical and Empirical Model of Trip Chaining Behavior. *Transportation Research, Part B*, Vol. 13, 1979, pp. 243–257.
8. Strathman, J. G., K. J. Dueker, and J. S. Davis. Effects of Household Structure and Selected Travel Characteristics on Trip Chaining. *Transportation*, Vol. 21, 1994, pp. 23–45.
9. Nishii, K., K. Kondo, and R. Kitamura. Empirical Analysis of Trip Chaining Behavior. In *Transportation Research Record 1203*, TRB, National Research Council, Washington, D.C., 1988, pp. 48–59.
10. Kitamura, R. Sequential, History-Dependent Approach to Trip Chaining Behavior. In *Transportation Research Record 944*, TRB, National Research Council, Washington, D.C., 1983, pp. 13–22.
11. Kitamura, R., and M. Kermanshah. Identifying Time and History Dependencies of Activity Choice. In *Transportation Research Record 944*, TRB, National Research Council, Washington, D.C., 1983, pp. 22–30.
12. Kumar, A., and D. M. Levinson. Chained Trips in Montgomery County, Maryland. *ITE Journal*, May 1995.
13. Timmermans, H., X. van der Hagen, and A. Borgers. Transportation Systems, Retail Environments and Pedestrian Trip Chaining Behaviour: Modelling Issues and Applications. *Transportation Research, Part B*, Vol. 26, 1992, pp. 45–59.
14. Levinson, D., and A. Kumar. Activity, Travel and the Allocation of Time. *APA Journal*, autumn 1995, pp. 458–470.
15. Supernak, J. Temporal Utility Profiles of Activities and Travel: Uncertainty and Decision Making. *Transportation Research, Part B*, Vol. 26, 1992, pp. 61–76.
16. Slade, L. J., and F. E. Gorove. Reductions in Estimates of Traffic Impacts of Regional Shopping Centers. *ITE Journal*, Jan. 1981.
17. Kittleston, W. Y., and T. K. Lawton. Evaluation of Retail Center Trip Types. *ITE Journal*, Feb. 1987.
18. *Trip Generation*, 4th ed. ITE, Washington, D.C., 1987.
19. Hazel, G. M. The Estimation and Effect of New, Transferred and Pass-By Private Car Trips to Retail Centres. *Highway Appraisal, Design, and Management*. Vol. P324. PTRC Education and Research Services, Ltd., 1989.
20. Toth, Z. B., D. M. Atkins, D. Bolger, and R. Foster. Regional Shopping Center Linked Trip Distribution. *ITE Journal*, May 1990.
21. Moussavi, M., and M. Gorman. A Study of Pass-By Trips Associated with Retail Developments. *ITE Journal*, March 1991.
22. JHK & Associates and K. T. Analytics, Inc. *Analysis of Indirect Source Trip Activity: Regional Shopping Centers—Final Report*. California Air Resources Board, Nov. 1993.
23. *The Yearbook of Transportation: Prague 2001*. Institute of Transportation Engineering of the City of Prague, Czech Republic, 2002.
24. *Shopping Mall 2002*. Incoma Research, Prague, Czech Republic, 2003.

The Transportation in the Developing Countries Committee sponsored publication of this paper.