The Effects of Traditional Versus Contemporary Urban Form on Parking: A Case Study of New England Centers

Wesley E. Marshall, P.E.
University of Connecticut
Civil and Environmental Engineering
U-37, Storrs, CT 06269-2037
TEL: (203)715-4548 FAX: (860)486-2298
wesley.marshall@uconn.edu

Norman W. Garrick, Ph.D.
University of Connecticut
Connecticut Transportation Institute
Civil and Environmental Engineering
U-37, Storrs, CT 06269-2037
TEL: (860)486-2990 FAX: (860)486-2298
norman.garrick@uconn.edu

November 30, 2007

ABSTRACT

In this paper we look at the influence of specific urban design factors on parking in three traditional and three contemporary New England commercial centers. We found that the character and structure of the centers in terms of building density, street and sidewalk design, and the management and organization of parking as well as the population densities and street structure of the surrounding neighborhoods result in very different transportation outcomes. Nearly 25% of the users at the traditional downtowns travel by means other than the automobile compared to only 9% at the contemporary sites. Additionally, 70% of those at the traditional sites always park once and walk to multiple errands while only 25% of the people at the contemporary places did so. These differences resulted in traditional centers that were much more vibrant than their contemporary counterparts; in fact, the traditional centers had 250 more pedestrians on their streets at any one time and averaged 1.80 people per car on site compared to only 1.06 people per car at the contemporary sites.

1. INTRODUCTION

In this paper we examine how urban design factors affect parking in six small New England commercial centers. Three of these centers, Brattleboro, VT, Northampton, MA and West Hartford, CT, are traditional New England downtowns with mixed land uses supported by an organized system of parking. The other three, Avon Center, CT, Glastonbury Center, CT and Somerset Square in Glastonbury, CT, are more contemporary, automobile-oriented sites that are of similar size to the traditional centers. The specific urban design factors that were compared included

- The character and structure of the centers in terms of building density, street and sidewalk design, and the management and organization of parking,
- The neighborhoods and street network of the surrounding residential areas in terms of population densities and street structure.

We collected data to characterize the supply, management and usage of parking, mode choice for travel to the centers, and level of pedestrian activities for each site. Finally, we conducted on-site surveys to characterize how users perceive and use the sites. This data helped assess whether or not there are systematic differences in parking between the traditional and contemporary centers.

2. BACKGROUND

For decades, we have allowed minimum parking requirements to shape how we build our urban centers even though we know that urban character should be the controlling factor. In his recent book titled *Parking Management Best Practices*, Litman explains how urban design factors might affect parking demand (1). He rationalizes that better urbanity and improved walking conditions help increase the functional parking supply by extending the effect of shared parking. In fact, he suggests reducing parking requirements by 5 to 15% in more walkable areas where people have the ability to park once and walk to multiple errands. The problem is that very few if any studies quantify these concepts.

Most parking ordinances are based on those from nearby towns or reference books such as the ITE *Parking Generation* manual. While the introduction to *Parking Generation* mentions that land use density, pedestrian-friendly design, and multi-stop trip making have the potential to influence parking, ITE makes no attempt to quantify or even give informal instructions as how to account for such factors. And although the latest edition of the manual is beginning to categorize parking demand for single land uses into one of five area types (rural, suburban, suburban center, central city, and central business district), the ITE approach continues to focus on gathering more data (2). The bigger issue is that even with more data points, this approach still fails to truly consider the effect of urban design on parking.

Knowledge of the relationship between urbanism and parking has been around far longer than the regulations themselves. In fact, the Highway Research Board's 1971 book on the principles of parking supports most of Litman's ideas about how urban design affects parking. Repeatedly ignoring the intricacies of this connection has pushed us into the predicament where we continue to allow parking to control the urban form. Our goal is to reset this balance by conducting research that investigates the extent to which urban design is important in parking for the six New England centers we studied.

3. CHARACTER & STRUCTURE OF THE CENTERS

We compared the urban character of the traditional and contemporary centers by looking for differences in character and structure in terms of land use density, how the parking lots are managed and organized, and in the design of the streets and sidewalks. These differences are summarized in the following sections.

3.1 Density Within the Town Centers

There were distinct differences in both land use densities and floor area ratios (FAR) between the traditional and contemporary sites. The traditional sites achieved higher density and provided more usable building space. Table 1 shows that the building density was nearly 58% higher for the traditional sites and the FAR was 176% greater. These higher densities at the traditional sites resulted in over 90% more leasable building space.

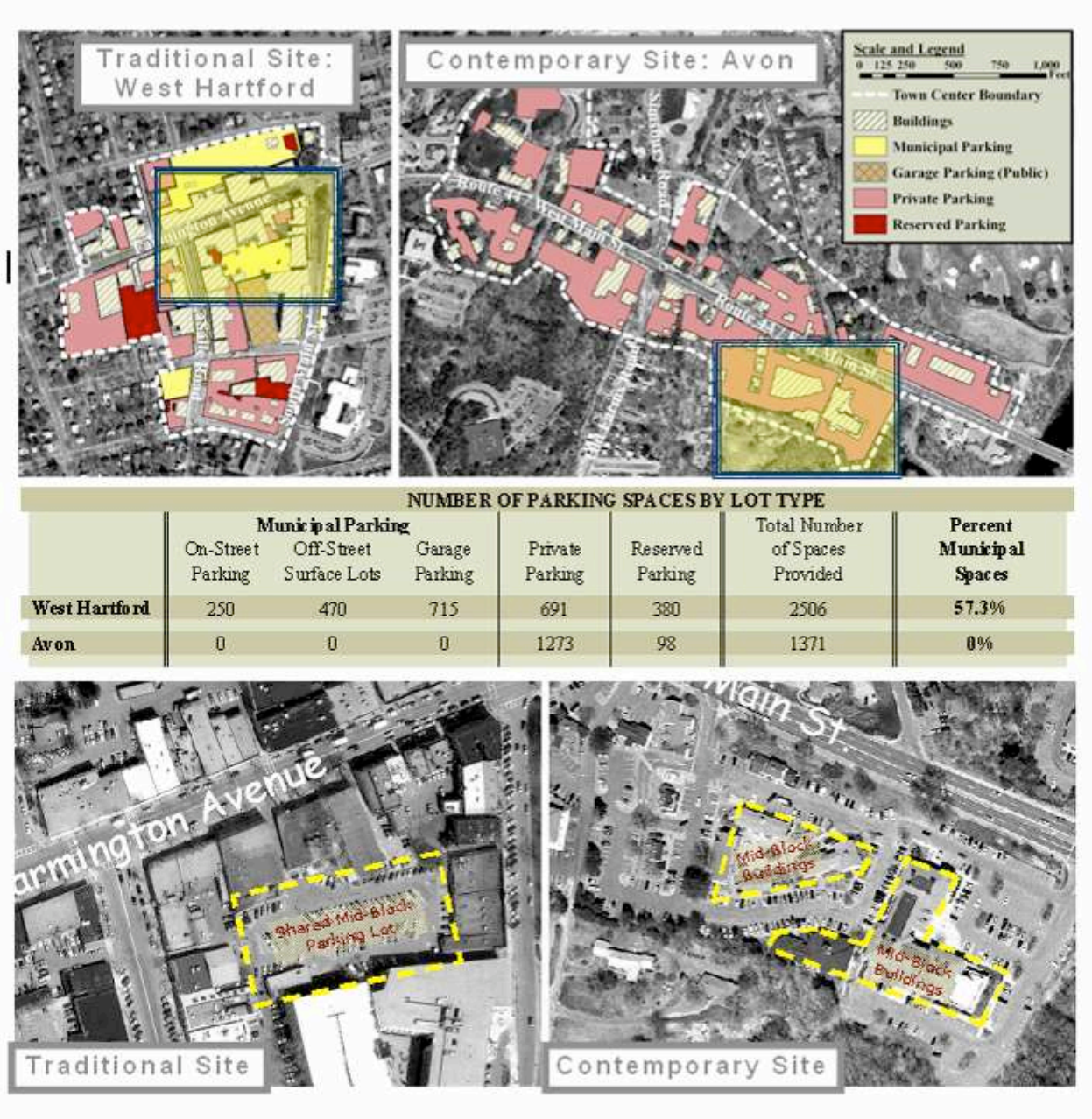
Table 1 Characteristics of the Contemporary & Traditional Sites

	CONTEMPORARY SITE AVERAGE	TRADITIONAL SITE AVERAGE	DIFFERENCE
TOWN CENTER COMPARISON			
Total Downtown Land Area	2,573,432 SF	2,010,601 SF	-21.9%
Total Building Footprint	392,065 SF	492,239 SF	25.6%
Total Building Space	460,598 SF	869,487 SF	88.8%
Building Density	0.16	0.25	57.9%
Floor Area Ratio	0.17	0.47	175.7%
Pedestrian Level of Service	3.09 = C	2.38 = B	-23.0%
WALKABLE ZONE COMPARISON			
Walkable Zone Population	2,049	8,328	306.5%
Walkable Zone Area (sq. mi.)	2.6	2.2	-15.1%
Walkable Zone Density (pop. / sq. mi.)	802.7	3764.5	369.0%
Total Length of Highways (mi.)	1.36	0.63	-53.9%
Total Length of Major Roads (mi.)	1.61	3.06	90.7%
Total Length of Minor Roads (mi.)	11.11	19.75	77.8%
Minor Road Density (street miles / sq. mi.)	4.26	8.91	109.3%
Minor-Major Road Ratio	4.14	11.07	167.6%
Total No. of Intersections	103.50	218.67	111.3%
Intersection Density (intersections / sq. mi.)	39.66	98.65	148.8%
Total No. of Dead Ends	19.50	25.33	29.9%
Dead-End Density (dead ends / sq. mi.)	7.47	11.43	53.0%
Intersection-Dead End Ratio	5.32	16.04	201.5%
TOWN COMPARISON			
Town Population	26,528	34,857	31.4%
Town Area (sq. mi.)	42.6	30.2	-29.2%
Town Density (pop. / sq. mi.)	622.6	1154.7	85.5%
Density of Walkable Zone Vs. Town	28.9%	226.0%	681.2%

3.2 Management & Organization of Parking

The traditional sites supplied a broad range of parking options with on-street parking, private and municipal off-street surface parking, and a parking garage at each site. Parking at the contemporary sites was predominantly privately-owned, off-street, surface lots. Figure 1 depicts these parking lot types for one traditional and one contemporary site. Municipal spaces made up more than half of the parking at the traditional centers. In terms of layout, the surface lots at the contemporary sites surrounded and separated buildings. Conversely, the surface parking lots at traditional sites were often located mid-block, which typically allowed for a single lot to supply a greater number of buildings.

Figure 1 Traditional & Contemporary Site Parking Lot Types Comparison



NUMBER OF PARKING SPACES BY LOT TYPE

	Municipal Parking			Private Parking	Reserved Parking	Total Number of Spaces Provided	Percent Municipal Spaces
	On-Street Parking	Off-Street Surface Lots	Garage Parking				
West Hartford	250	470	715	691	380	2506	**57.3%**
Avon	0	0	0	1273	98	1371	**0%**

Figure 2 illustrates parking lot types and peak occupancy counts for two traditional sites. Overall, municipal parking experiences the greatest demand. At a peak occupancy, these shared, often centralized, spaces were over 90% full while the private spaces were less than 60% full.

Figure 2 Parking Lots Types & Demand for Traditional Sites

CHARACTERIZATION OF THE PROVISION OF PARKING

	Municipal Parking					Percent Municipal Spaces
	On-Street Parking	Off-Street Surface Lots	Garage Parking	Private Parking	Total No. of Parking Spaces	
West Hartford						
No. of Spaces	250	470	715	1071	2506	**57.3%**
% of Total Spaces	10.0%	18.8%	28.5%	42.7%	-	
Peak Demand % Occupancy	**98.8%**	**97.9%**	**68.1%**	**57.1%**	**72.1%**	
Northampton						
No. of Spaces	309	548	394	1034	2359	**54.7%**
% of Total Spaces	13%	23%	17%	43.8%	-	
Peak Demand % Occupancy	**98.7%**	**98.9%**	**100.0%**	**62.0%**	**85.9%**	

3.3 Street & Sidewalk Design

Figure 3 Traditional & Contemporary Site Street & Sidewalk Comparison

Traditional Site
Street & Sidewalk

Contemporary Site
Street & Sidewalk

Figure 3 depicts the disparities between the typical streets and sidewalks through the traditional and contemporary sites. The pedestrian environments were very different even though every site featured high intensity automobile traffic. In many cases, the streets shaping the contemporary sites served as significant pedestrian obstacles. With regard to consistency, the sidewalks at the traditional sites were typically wide with high connectivity throughout the entire center. Alternatively, the contemporary sites provided wide, landscaped walkways within

individual plazas but rarely were the sidewalks continuous between plazas. Figure 4 shows some typical traditional site pedestrian connections from a mid-block parking lot.

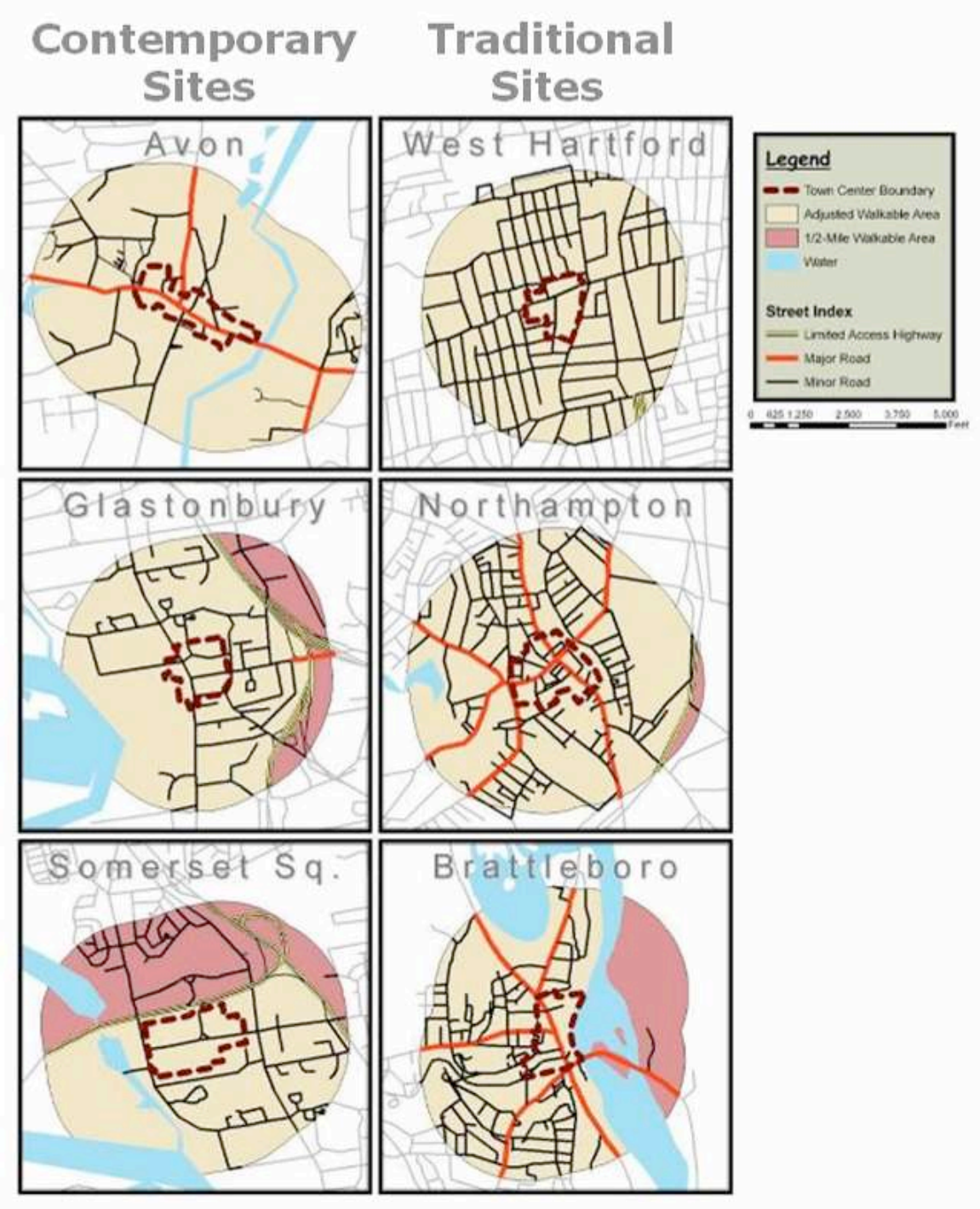
Figure 4 Pedestrian Connections from Mid-Block Parking for a Traditional Site

The major streets at each of the traditional site received a level of service (LOS) B based upon the popular Landis model while two contemporary sites received LOS C and the third LOS D as shown in Table 1. These values indicate that the traditional sites provide pedestrians with safer and more comfortable surroundings, results further confirmed by the user survey that we discuss later in this paper (3).

4. THE WALKABLE ZONE

Another set of factors potentially influencing parking is the makeup of the surrounding residential zones (especially the areas within a reasonable half-mile walking distance) and the extent to which they are connected to the commercial centers (4). The half-mile zones were adjusted to exclude areas beyond major pedestrian obstructions such as highways or rivers.

Figure 5 Walkable Zone Street Structure Comparison



4.1 Density Around the Town Centers

Overall, Table 1 shows that the 1/2-mile walkable zones surrounding all the town centers were denser in population when compared to the rest of the town. However, while the contemporary sites were only 27% denser, the traditional towns were over 180% denser than the rest of their respective towns. Secondly, the traditional walkable zones were 369% denser in population than the contemporary site walkable zones. This was the case even though the traditional towns themselves were only slightly more than twice as dense. Consequently, more than 6,200 additional people lived within walking distance of each of the traditional town centers.

4.2 Street Structure

Table 1 also quantifies the walking environment based upon the surrounding road networks shown in Figure 5. The traditional sites averaged an 86% denser network of minor roads and almost double the total length of roads suitable for a pedestrian. In terms of the overall street network, the traditional sites had 111% more intersections and a 129% higher intersection density. The appreciably higher intersection density typically correlates to more direct pedestrian routes (5).

5. TRANSPORTATION RESULTS RELEVANT TO PARKING

The differences in the character and structure of the sites and surrounding neighborhoods corresponded with very different transportation results. The objective in this section is to determine the transportation choices of the users of these centers and how these decisions impact parking. When assessing the transportation outcomes, we need to bear in mind that urban design factors are interrelated; each feature is part of a total package that helps facilitate the functionality of the traditional sites.

5.1 Alternative Modes

While only 9% of those surveyed traveled to the contemporary sites via a mode other than the automobile, this number reached 25% for the traditional sites. Other than driving, walking was the most important mode in each of these town centers. Our user survey showed that at the traditional sites, almost 15% of trips to the town center were walking trips while at the contemporary sites, only 7 % walked to the site. Bike use reached 2.5% in the user survey at the traditional sites compared to a negligible bicycle use at the contemporary sites. In terms of public transportation, nearly 7% of those at the traditional sites used transit compared to only 1.4% at the contemporary sites. The difference was noteworthy because both the contemporary and traditional sites had similar levels of transit available (6).

We also compared the survey results to the U.S. average found in the 2001 National Household Travel Survey (NHTS) (7). The users of the traditional sites walked more than twice the national average, used public transit more than four times the national average, and biked more than eight times the national average. With an extra 15% of people reaching the town centers by means other than a car, this equates to a 15% reduction in the parking needed or 300 unnecessary parking spaces in the average 2,000-space center. Our research found that off-street surface parking averaged 525 SF per space (including driveways, access lanes, and parking lot islands); based upon this number, 300 unnecessary parking spaces could result in over 3.6 acres of land no longer needed for parking. When most surface lots cost between $3,000 and $5,000 per space, this would save between $900,000 and $1.5 million.

Table 2 Transportation Results Relevant to Parking

	CONTEMPORARY SITE AVERAGE	TRADITIONAL SITE AVERAGE	DIFFERENCE
MULTI-STOP TRIP MAKING			
Always Park Once & Walk	25%	70%	180.0%
Sometimes Park Once & Walk	43%	23%	-46.5%
Never Park Once & Walk	32%	7%	-78.1%
MODE CHOICE: U.S AVG. FOR SHOPPING TRIPS (2001 NHTS)			
Driving	91.5%		
Public Transit	1.4%		
Bicycling	0.3%		
Walking	6.5%		
MODE CHOICE: USER SURVEY			
Driving	91.0%	75.2%	-17.4%
Public Transit	1.4%	6.9%	392.9%
Bicycling	0.2%	2.5%	1150.0%
Walking	7.4%	14.8%	100.0%
MODE CHOICE: 2000 CENSUS WORK TRIPS BY TOWN			
Driving	92.1%	83.4%	-9.4%
Public Transit	1.1%	2.3%	109.1%
Bicycling	0.4%	1.6%	300.0%
Walking	0.7%	8.3%	1085.7%

5.2 Multi-Task Trip Making.

When asked whether they always, sometimes, or never park once and walked to multiple errands, over 70% of traditional site drivers said that they *always* compared to only 25% at the more contemporary sites. Furthermore, while only 7% of those at the traditional sites *never* parked once and walked, this number exceeded 32% at the more contemporary sites. Table 2 shows these results.

With regard to parking, this distinction is noteworthy. Parking once and running multiple errands within a downtown as opposed to driving from store to store results in less parking being required to accommodate the same activity; this is a more efficient use of resources. Litman suggested reducing parking requirements by 5 to 15% in more walkable communities where parking once and running multiple errands is favored. Our results suggest that this potential for increased efficiency in parking is far greater than 15%. If just 35% of users parked once and walked to only two destinations, we could reduce parking by that same percentage. In an average 2,000 space center, 35% less parking is 700 fewer spaces. This could save up to 8.4 acres of land and between $2.1 and $3.5 million for a typical surface lot.

5.3 Parking Supply & On-Site Activity

Combining the effects of the distinctions we found in mode choice and multi-task trip making between the traditional and contemporary sites, this greater degree of urbanity should be accompanied by at least 50% fewer parking spaces. In fact, this is exactly what the traditional sites did to the tune of 2.3 spaces provided per 1,000 SF of building space compared to 4.6 spaces per 1,000 SF of building space provided at the contemporary sites (6). Even at this rate of supply, the traditional sites did not even reach 80% capacity during a peak occupancy count, which suggests that the number of spaces provided could be reduced even more. It is interesting to note that the standard zoning regulations for both the traditional and contemporary towns required over 5 parking spaces per 1,000 SF of building space.

In terms of on-site activity, the traditional sites averaged over 300 pedestrians and the contemporary sites less than fifty as well as twice the number of people in stores on similar weekday afternoons. Combined with an estimate of the on-site employees, the traditional sites averaged 1,300 more people on site; a level of activity successfully sustained with only 400 more parked cars. This means that the traditional sites averaged 1.80 people per car on site compared to 1.06 people per car at the contemporary sites on a typical day.

6. CONCLUSIONS

Our research illustrates how some typical urban design factors influence parking. The character and structure of the traditional centers in terms of higher densities, shared mid-block municipal parking lots, and a better pedestrian environment help impact parking by increasing the opportunities and instances where town center users could park once and run multiple errands. These improving conditions that are favorable to multi-task trip making can reduce parking requirements by more than 35%.

The places that are able to provide significantly less parking with respect to the number of people on site were able to do so not only because of the character and structure of the centers themselves, but also that of the surrounding walkable zone. A center can effectively operate with less parking in situations where the opportunity to travel via mode other than the automobile exists. The traditional sites in our study possessed a higher density of residential development and a much denser network of minor roads. Such palpable differences resulted in over 15% more trips to the traditional centers by way of a mode other than the automobile and consequently far less parking.

At first glance, it might be surprising that these traditional town centers were able to attract 1,300 more people with only 400 more cars on site on an average day. Better urban design helps make this possible. Our results suggest that the supply of parking can reduced by more than 50% with only a moderate degree of urbanity. This difference in supply could result in saving twelve acres of land from life as a parking lot and between $3 and $5 million in construction costs, land and money that would better serve these downtowns in another fashion.

7. REFERENCES

1. Litman T: Parking Management Best Practices. Planners Press, 2006
2. Institute of Transportation Engineers: Parking Generation, 3rd Edition. Washington, D.C., 2004
3. Landis B, Vattikuti V, Ottenberg R, McLeod D, Guttenplan M: Modeling the Roadside Walking Environment: A Pedestrian Level of Service. Transportation Research Board Annual Meeting CD-ROM 2001
4. Litman T: Parking Management: Strategies, Evaluation and Planning, Victoria Transport Policy Institute, 2006
5. Marshall S: Streets & Patterns. New York, Spon Press, 2005
6. Marshall W, Garrick N: Parking at Mixed-Use Centers in Small Cities. Transportation Research Record 2006
7. Bureau of Transportation Statistics: National Household Travel Survey, 2001