Parking Lots

Where Motorists Become Pedestrians

John A. Stark
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Introduction

When thinking about the interaction between automobiles and pedestrians, most discussions revolve around how to separate the two modes of traffic or how to make street intersections between the two safer. What is often overlooked, however, is the subtle yet obvious fact that every motorist must be a pedestrian before and after every motorized trip. It is here, in parking lots, that safety and integration are often overlooked.

Many of us do not think about the fact that as a motorist, we drive right down the middle of a pedestrian path when searching for a space to park our cars. Likewise, as pedestrians we are often forced to walk down the middle of a traffic lane and share the space with moving vehicles operated by distracted drivers. While cars typically travel at slower speeds in parking lots, they also move in all directions including backwards, which can be the most dangerous and unpredictable aspect of a parking lot. When walking toward the destination (whether a store, stadium, office or outdoor festival), a pedestrian must be aware of cars travelling directly toward them from the front and rear. There is an additional hazard that any car could reverse out of a parking spot, which means a pedestrian must constantly be aware of traffic from all four directions simultaneously. Furthermore, right before the storefront there exists yet one more obstacle; there is still a busy traffic lane, which is often times the direct route by which automobiles enter or exit the property.

Other than pedestrian safety, many other aspects of parking lots add to the overall experience of pedestrians and drivers. Zoning, landscaping, the environment and physical design are all factors that can contribute to a parking lot's success.

Several things can be done to improve a parking lot to make motorists more aware of pedestrian crossings. From signage and painted stripes to configuration of aisles, many details should be considered when improving any parking lot. The next section of this document will examine existing research on parking lots pertaining to safety, environmental consciousness, model zoning and design standards. To better understand the context of the research, a thematic analysis of existing parking lots will be discussed in the subsequent section in the form of case studies. Lastly, the final section will discuss the conclusions of the research and case studies to consider in future parking lot improvements.

While there is a body of literature and numerous examples that posit parking lots as a significant aspect of American culture (e.g., farmers' market, concerts, sports, etc), the aim of the document is to mainly discuss the physical design components of parking lots through the lenses of safety, environmental protection and a shared experience between cars and pedestrians.

Existing Research

A breadth of literature from a variety of sources has been published on parking lots regarding history, safety, psychology, environmental concerns and zoning challenges associated with these urban pastures. The next few sections will summarize the most significant points used in analyzing the case studies and determining a set of conclusions and best practices

Making the Case for Safety

While statistics are rarely recorded or analyzed for parking lot accidents, Montgomery County, Maryland was able to shed some light on the hazards of parking lots when they reported that 22% of their total pedestrian-automobile accidents between January 2006 and June 2008 occurred in parking lots.[1] When the time range is extended to include crashes from January 2004 – September 2009, the number increases to above 23%, which indicates a fairly consistent metric.[2] The saddest, and probably most surprising, statistics are related to the severity of the collisions. Figures 1 and 2 are excerpts from a Montgomery County presentation that demonstrate the level of injury sustained from parking lot collisions.[3] Figure 1 demonstrates that 19%, almost 1-in-5, of all pedestrian-related parking lot accidents

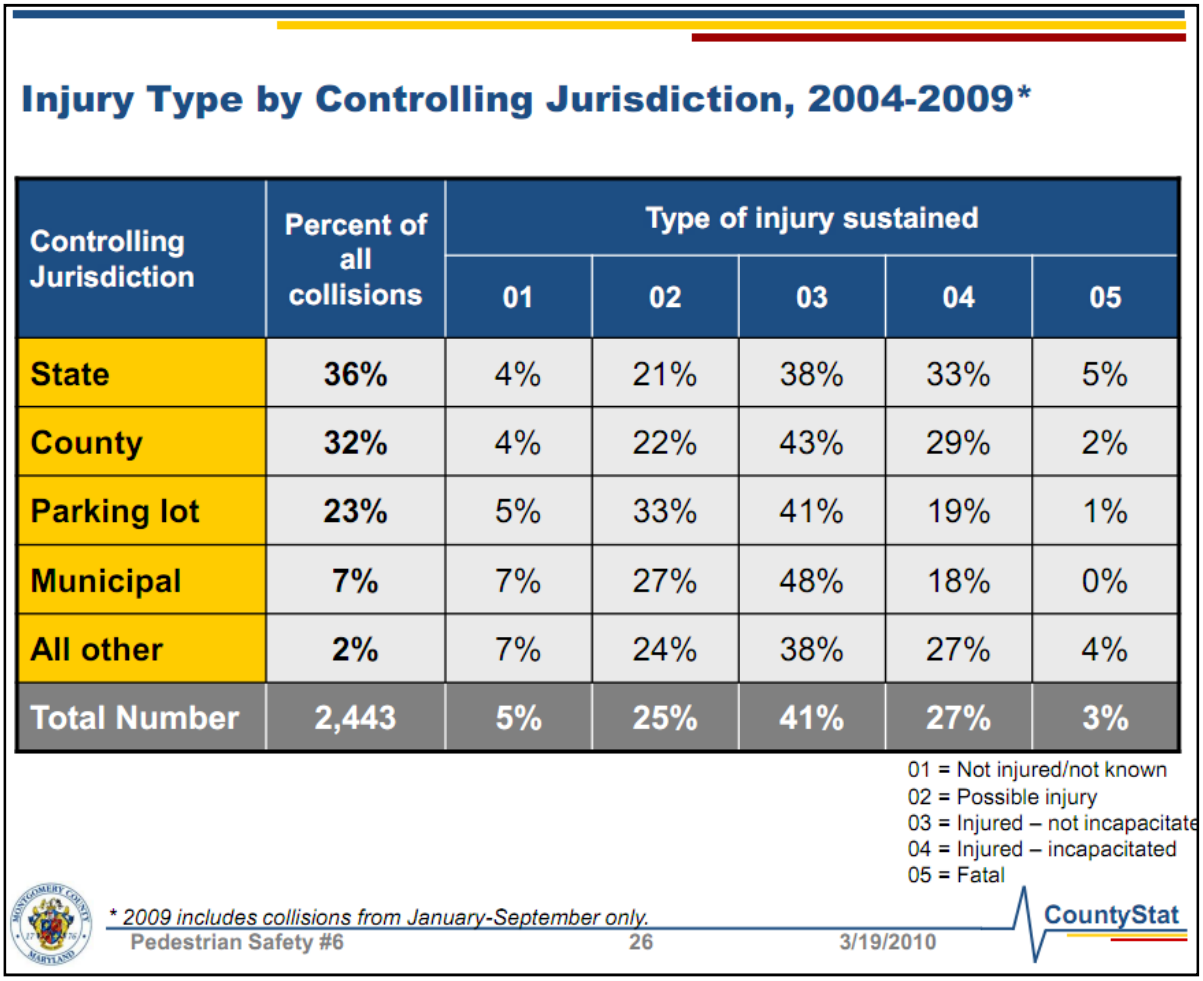
[1] Megan Greenwell, "Montgomery to Launch Campaign On Parking Lot Safety," Washington Post, October 29, 2009. http://www.washingtonpost.com/wp-dyn/content/article/2009/10/28/AR2009102803314.html?hpid=newswell (accessed April 14, 2012).

[2] County Stat, "Pedestrian Safety: Initiative Meeting #6" (lecture, Montgomery County Council, Montgomery County, MD, March 19, 2010), PDF file, http://www.montgomerycountymd.gov/content/exec/stat/pdfs/03_19_2010_ppt.pdf (accessed April 14, 2012).

[3] Ibid.

resulted in incapacitating injuries, which underscores the importance of parking lot safety. Additionally, Figure 2 graphs the percentage of incapacitating and fatal injuries by jurisdiction from 2004-2009. While the graph shows that parking lots usually contribute the lowest number of severe collisions by comparison, parking lots still comprise 15%-30% of severe injuries.

Figure 1: Injury Type by Controlling Jurisdiction, 2004-2009



Injury Type by Controlling Jurisdiction, 2004-2009*

Controlling Jurisdiction	Percent of all collisions	Type of injury sustained				
		01	02	03	04	05
State	36%	4%	21%	38%	33%	5%
County	32%	4%	22%	43%	29%	2%
Parking lot	23%	5%	33%	41%	19%	1%
Municipal	7%	7%	27%	48%	18%	0%
All other	2%	7%	24%	38%	27%	4%
Total Number	2,443	5%	25%	41%	27%	3%

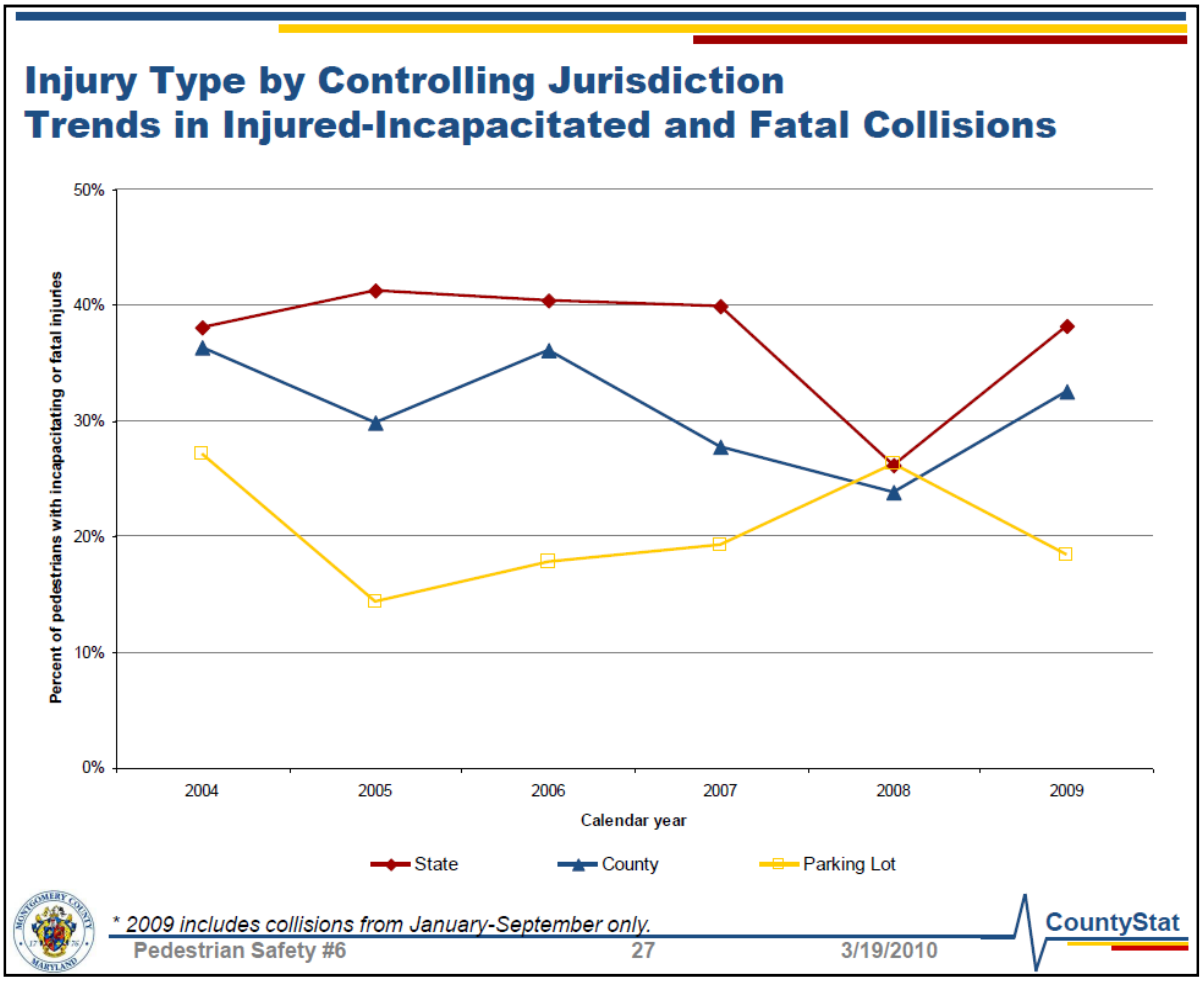
01 = Not injured/not known
02 = Possible injury
03 = Injured – not incapacitate
04 = Injured – incapacitated
05 = Fatal

* 2009 includes collisions from January-September only.
Pedestrian Safety #6 26 3/19/2010
CountyStat

Source: Montgomery County, MD[4]

[4] Ibid.

Figure 2: Percentage of Pedestrians with Incapacitating and Fatal Injuries, 2004-2009



Source: Montgomery County, MD[5]

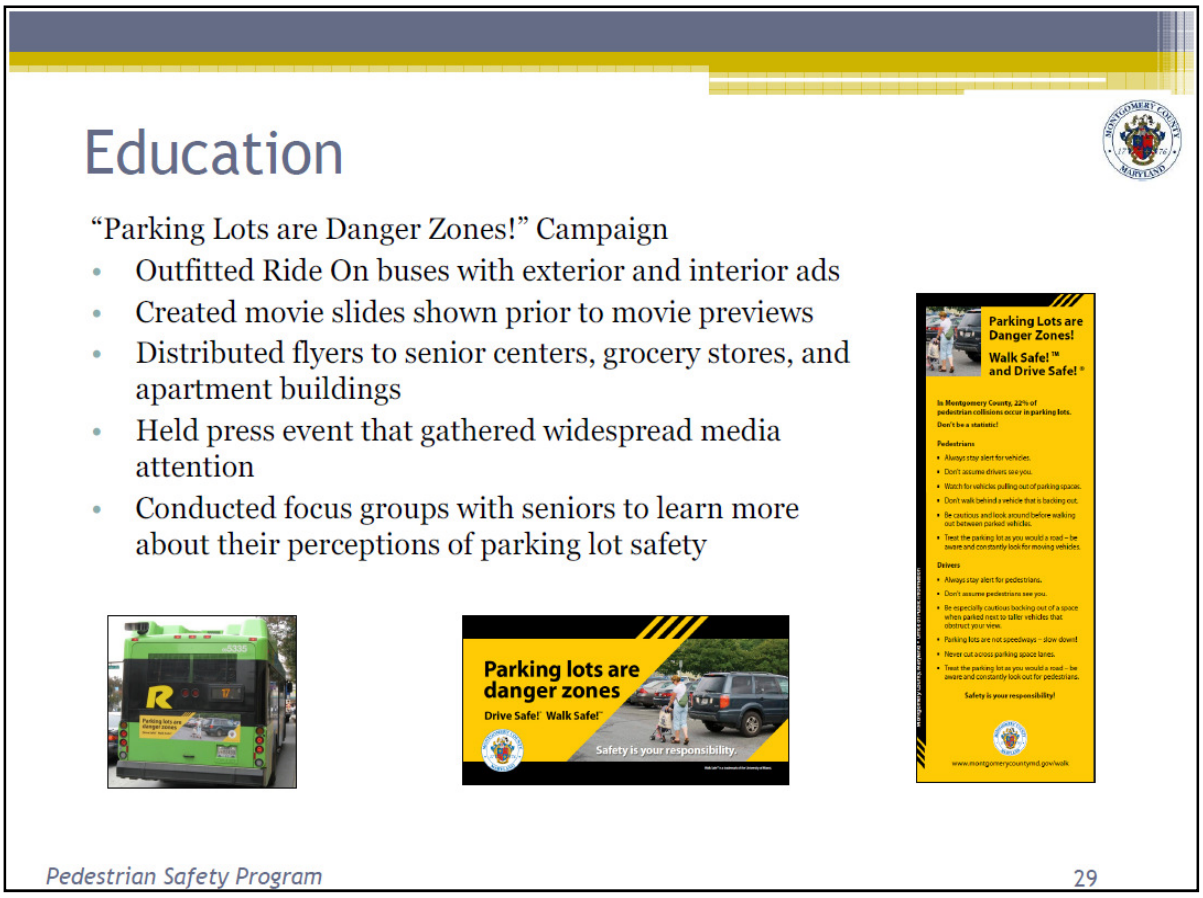
Montgomery County, MD has taken a proactive approach in pedestrian safety for both streets and parking lots. With educational and awareness campaigns, advertisements can be seen throughout the county, from the exterior of transit busses to pamphlets in grocery stores and living centers as seen in Figure 3.[6]

[5] Ibid.

[6] Montgomery County Council, "Montgomery County Pedestrian Safety Program" (lecture, Montgomery County, MD, October 21, 2010), PDF file, http://www.montgomerycountymd.gov/content/DOT/Dir/pedsafety/pdf/pedestrian_safety_review_slides_10_20_10.pdf (accessed April 14, 2012).

Because elderly and young adults are disproportionally involved, the education campaign also tries to target those demographic groups.[7]

Figure 3: "Parking Lots are Danger Zones!" Campaign



Source: Montgomery County, MD[8]

This strategy makes the campaign visible for both drivers and non-drivers. After all, most storefronts are graced with a parking lot in the front, which means that non-motorists still have to traverse a parking lot even though they may not

[7] Robert Thomson, "The Plight of Pedestrians in Parking Lots," *Washington Post*, October 29, 2009, http://voices.washingtonpost.com/getthere/2009/10/the_plight_of_pedestrians_in_p.html (accessed April 14, 2012).

[8] Montgomery County Council, "Montgomery County Pedestrian Safety Program" (lecture, Montgomery County, MD, October 21, 2010), PDF file, http://www.montgomerycountymd.gov/content/DOT/Dir/pedsafety/pdf/pedestrian_safety_review_slides_10_20_10.pdf (accessed April 14, 2012).

have driven or ridden in a car. This further emphasizes the point that parking facilities should not focus primarily on driving convenience, but also consider pedestrian safety throughout the entire parking lot. The Federal Highway Administration recommends the placement of parking lots behind commercial buildings to open up store fronts for all pedestrians and reduce the amount of pedestrian-vehicle interactions.[9] By placing parking lots in the rear of the building and not between the storefront and sidewalk, a safer and more vibrant commercial streetscape can be achieved.

Insurance companies, such as State Farm, warn of the dangers of parking lots and the complacency experienced by both drivers and pedestrians.[10] State Farm cites that 20% of all vehicle accidents occur in parking lots, and that drivers and pedestrians should "be extra alert" because often times the most dangerous aspect is other drivers.[11] This offers another example of education and outreach regarding parking lots safety.

Psychology and the Experience of Parking Lots

If we consider that injured pedestrians were in parking lots when struck by a car, it makes it even more perplexing when we realize many of these pedestrians either just got out of their car or were just about to enter their car. Furthermore the

[9] FHWA, "Chapter 3. Integrating Pedestrians Into the Project Planning Process," Designing Sidewalks and Trails for Access: Part II of II: Best Practices Design Guide, http://www.fhwa.dot.gov/environment/sidewalk2/sidewalks203.htm (accessed April 14, 2012).

[10] Nate Granzow, "Prevent Parking Lot Accidents," State Farm, http://learningcenter.statefarm.com/safety-2/auto-2/prevent-parking-lot-accidents-1/ (accessed April 4, 2012).

[11] Ibid.

opposite could be said of the drivers involved. Being in a parking lot, either as a motorist or pedestrian, means that people are fulfilling both roles within a matter of minutes, yet seem to ignore that subtle dichotomy. It almost seems as if people turn on and off a switch somewhere between unbuckling their seatbelt and closing their door, and when they look up at their destination and think ahead of the movie they are about to see or the shopping list they forgot or notice the out-of-state license plate from far away. Whatever the case may be, it seems as if motorists quickly become distracted pedestrians within a very short period of time. On the flip-side of the coin, drivers are often looking for that golden parking spot and looking through cars and across aisles to see if they can hurry down the lane and turn into the adjacent row to snag that last good spot they just noticed hoping they are not delayed by some inconsiderate pedestrian or that some other speeding car does not get there first. No matter the situation, most people have probably been both a driver in a hurry and a distracted pedestrian.

The psychology and thought process of a driver in question depends largely on familiarity of a parking lot and the purpose of the trip. According to a study conducted by researchers at TNO (Netherlands Organization for Applied Scientific Research), parking behavior and choosing a parking space can be categorized as either habitual or reasoned intention decision processes.[12] If a driver is performing a routine task or visiting a frequented destination, then the parking choice may largely

[12] H.J. Griffioen-Young, "The Psychology of Parking" (Lyon, France, 2004), http://www.epomm.eu/ecomm2004/workshops/anglais/GriffioenJanssen.pdf (accessed April 15, 2012).

be out of habit. Intentional parking decisions, however, were further categorized by "situation" and "attitude." Situational context can vary depending on the number of passengers, the presence of awkward or heavy cargo in the vehicle, weather conditions, destination and/or traffic volume. A driver's attitude of a parking facility may affect choices and behavior depending on the driver's perception of its safety and security, its location or other attitude-based formations.[13]

In the framework of habitual or automatic behavior, it is, "neither conscious nor intentional, and needs little attention in its execution."[14] In the context of pedestrian safety in a parking lot, it is conceivable that a driver exhibiting automatic or habitual behavior may not be focused on the act driving or parking, which raises a concern for the driver's awareness of pedestrians. In the context of reasoned intentional behavior, however, it is also conceivable that a driver focused on choosing an optimal parking space through careful calculation may also be unaware of pedestrian movement. As a demonstration of both of these concepts, it would be interesting to note the number of single car accidents that occur in parking lots (e.g., hitting a light pole).

In Eran Ben-Joseph's book *Rethinking A Lot*, he describes how drivers often ignore the painted markings and take a direct path across the parking lot to their destination. The result of this erratic behavior produces the choreography of an

[13] Ibid.

[14] Ibid.

"unorchestrated ballet of machines and people."[15] The "psychological transformation" in parking lots leads to passive-aggressive behavior and a sense of territorial entitlement where there is a hierarchical social-structure defined by the car as a status symbol.[16] These two examples demonstrate the competitive mind-set that drivers exhibit in parking lots. These behaviors often exist regardless of the presence of pedestrians, which further exacerbates the hazards of the shared space.

Dutch traffic engineer Hans Monderman posited that the relationship between the "traffic world" and "social world" needed to change its focus to a shared space.[17] While he implemented his methods to a roundabout and plaza, his principles may be just as applicable to parking lots. In Drachten, The Netherlands, his design replaced a traditional four-way intersection of 2 four-lane streets and stop lights in each direction with an innovative roundabout featuring almost no signage, striping or any other traditional traffic infrastructure. Unlike, but also similar to, the unorchestrated ballet of parking lots discussed earlier, the roundabout in Drachten, named the *Laweiplein*, was described more as a "social ballet" from the confluence of motorists, cyclists and pedestrians.[18] This idea was rooted in the notion that there existed a dichotomy between the rigid traffic world and the fluid social world.

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[15] Eran Ben-Joseph, ReThinking a Lot: the Design and Culture of Parking (Cambridge, MA.: The MIT Press, 2012), 45.

[16] Ben-Joseph references a study in the *Journal of Applied Social Psychology* that demonstrated that a parked driver preparing to exit "took longer to leave when another car was present, and even longer when the intruder honked. Males left significantly sooner when intruded upon by a higher – rather than lower – status car, whereas females' departure time did not differ as a function of the status of the car." Ibid.

[17] Tom Vanderbilt, "The Traffic Guru," *Wilson Quarterly*, Summer 2008, 26-32 http://www.wilsonquarterly.com/article.cfm?AID=1234 (accessed April 3, 2012).

[18] Ibid.

When asked why he didn't want traffic infrastructure at this particular intersection, his response was succinct, "I don't want traffic behavior, I want social behavior."[19] As an intersection with no street signs, poles, stop lights or restrictive arrows, but numerous fountains, landscaping and dense activity, it fulfilled its purpose to feel more "villagelike," which fosters more social behavior. With behavioral traffic calming as opposed to physical calming features, Monderman's intersection has proven to be a success with less congestion, a third more traffic volume and half the amount of accidents and collisions. Busses navigated the intersection more quickly and students from a local engineering college observed the intersection before and after the changes and reported that more drivers and cyclists used turning signals (electronic and manual respectively). Additionally, many local residents "perceived" the intersection to be more dangerous, which was Monderman's exact intent; if people felt it were safer, they might be less careful and more reckless.[20] As discussed earlier, perceptions are likely to shape people's attitudes and likely dictate their behavior, and in the case of Drachten, perceived danger translated into more awareness.

Coined "Shared Space," this concept is "successful because the perception of risk may be a means or even a prerequisite for increasing safety," whereas, "what feels safe is not necessarily safe."[21] Although pioneered by Monderman, he

[19] Ibid.

[20] Ibid.

[21] Eran Ben-Joseph, ReThinking a Lot: the Design and Culture of Parking (Cambridge, MA.: The MIT Press, 2012), 107.

"wouldn't trust this solution" in every scenario and that every intersection should be given a careful traffic study before employing the Shared Space concept.[22] Despite the proven success of Monderman's concept, many critics question how well this concept would work in busier cities with much higher traffic volumes. Although Monderman himself said that it is best suited for only specific locations, a project in London applied the model in a busy commercial district on Kensington High Street by removing signs, traffic lights and a barrier railing between the sidewalk and street. The result was a "dramatic cut in accidents, down 44% against a London average of 17%."[23] Even though pedestrians now cross midblock without crosswalks, car speeds have been decreased and there are now fewer accidents.[24]

With consistent positive results in different types of settings, countries, cultures and varying degrees of traffic intensity, it is hard to argue that the theory does not work. Nonetheless, successful implementation of the Shared Space concept would require sweeping changes in legal code as well as a transformation of informal institutions that drive cultural norms. Tom Vanderbilt, however, posits that built context can influence behavior and thus norms. He provides the example of parking at a county fair where there is typically just an empty field without any formal infrastructure, but contends that "there is no great epidemic of traffic

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[22] Tom Vanderbilt, "The Traffic Guru," *Wilson Quarterly*, Summer 2008, 26-32 http://www.wilsonquarterly.com/article.cfm?AID=1234 (accessed April 3, 2012).

[23] Simon Jenkins, "Rip out the traffic lights and railings. Our streets are better without them," *Guardian (London)*, February 28, 2008. http://www.guardian.co.uk/commentisfree/2008/feb/29/guardiancolumnists (accessed April 22, 2012).

[24] Tom Vanderbilt, "The Traffic Guru," *Wilson Quarterly*, Summer 2008, 26-32 http://www.wilsonquarterly.com/article.cfm?AID=1234 (accessed April 3, 2012).

fatalities at county fairs."[25] Considering that parking lots at county fairs are simply empty pastures, drivers manage to navigate the field, arrange their vehicles in orderly (albeit, usually crooked) rows, and avoid pedestrians and other cars by simply following individually self-imposed cues. Applying the concepts of Hans Monderman to parking lots might not only improve safety, but could also enhance parking lots as a public space.

Environmental Mitigation

Parking lots are an attributable cause of many of today's environmental concerns. Because of the heat-absorbing construction materials and lack of vegetation, parking lots are a large contributor of the Urban Heat Island Effect (UHI). Because parking lots are typically impermeable and displace large areas of pervious soils, stormwater run-off has increased, which negatively impacts water absorption. Given that parking lots are such a salient feature in our modern urban landscape, innovative solutions provide the capacity to find a functional compromise between the necessity of the automobile and the imperative need to protect the environment.

The Urban Heat Island Effect (UHI) is the phenomenon of increased air temperatures over urban areas compared to nearby rural areas.[26] UHI is primarily the result of the displacement of natural land covers, such as vegetation, soil and

[25] Ibid.

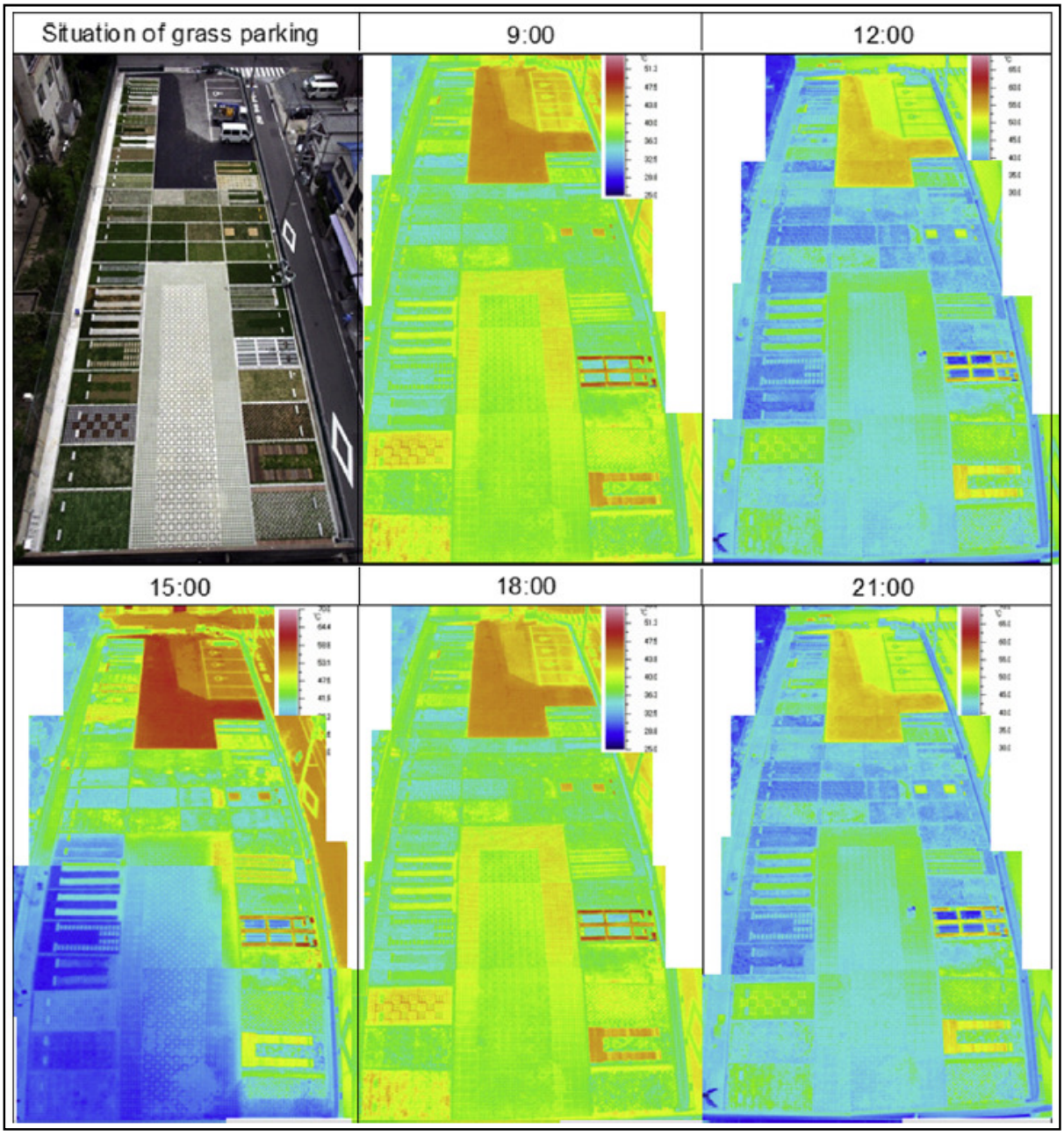
[26] U.S. Environmental Protection Agency (EPA), "Heat Island Home," Heat Island Effect, http://www.epa.gov/hiri/index.htm (accessed April 19, 2012).

water, with impervious materials like asphalt, concrete and metal.[27] Researchers at Kobe University in Japan used infrared cameras to measure the temperatures on a variety of grass and asphalt surfaces and concluded in their study that "the mean surface temperature of a parking space [decreases] with an increase in the green coverage ratio."[28] Figure 4, below, shows the infrared images of the parking lot tested with various types of grass coverings in 3 hour intervals from 9:00 am to 9:00 pm. Using the first image as a photographic reference, it is easy to see that the grass coverings remain cooler (blue and green) than the asphalt sections (red and yellow) throughout the day.

[27] Akio Onishi et al., "Evaluating the potential for urban heat-island mitigation by greening parking lots," *Urban Forestry and Urban Greening* 9, no. 4 (8 October 2010): 323-332, http://www.sciencedirect.com/science/article/pii/S1618866710000403 (accessed April 19, 2012).

[28] Hideki Takebayashi and Masakazu Moriyama, "Study on the urban heat island mitigation effect achieved by converting to grass-covered parking," *Solar Energy* 83, no. 8 (August 2009): 1211-1223, http://www.sciencedirect.com/science/article/pii/S0038092X09000309 (accessed April 19, 2012).

Figure 4: Surface Temperature Distribution



Photos by: Hideki Takebayashi and Masakazu Moriyama[29]

In a related study, researchers in Indiana used sub-pixel analysis of Marion County (Indianapolis) from 1991-2000 to measure LST and evaluate the long-term

[29] Ibid.

effects of increased development and impervious surfaces.[30] Using Landsat infrared imagery from the summers of 1991, 1995 and 2000, it was determined that there was an increase in impervious surfaces and an increase in temperatures creating multiple UHI across the county. In Figure 5, below, the green pixels indicate the areas with the coolest temperatures in the county and are used as a baseline by which the warmer temperatures are measured. The warmer colors are measured as percentages of an increase in temperature above the baseline (green) allowing for a normalized spectrum across all the maps regardless of what the actual temperatures might have been on those isolated days.[31] This analysis demonstrates the relationship between impervious surfaces (e.g., parking lots) and vegetation and other natural forms of land cover on a regional scale.

Both studies used infrared technology to observe the differences between asphalt and vegetation, and used the findings to analyze the existing connection between surface temperature and land cover. Because the two studies observed these relationships on wildly different scales, the results are more strongly affirmed. Barren parking lots with little to no vegetation significantly contribute to the ubiquity of the urban heat island effect.

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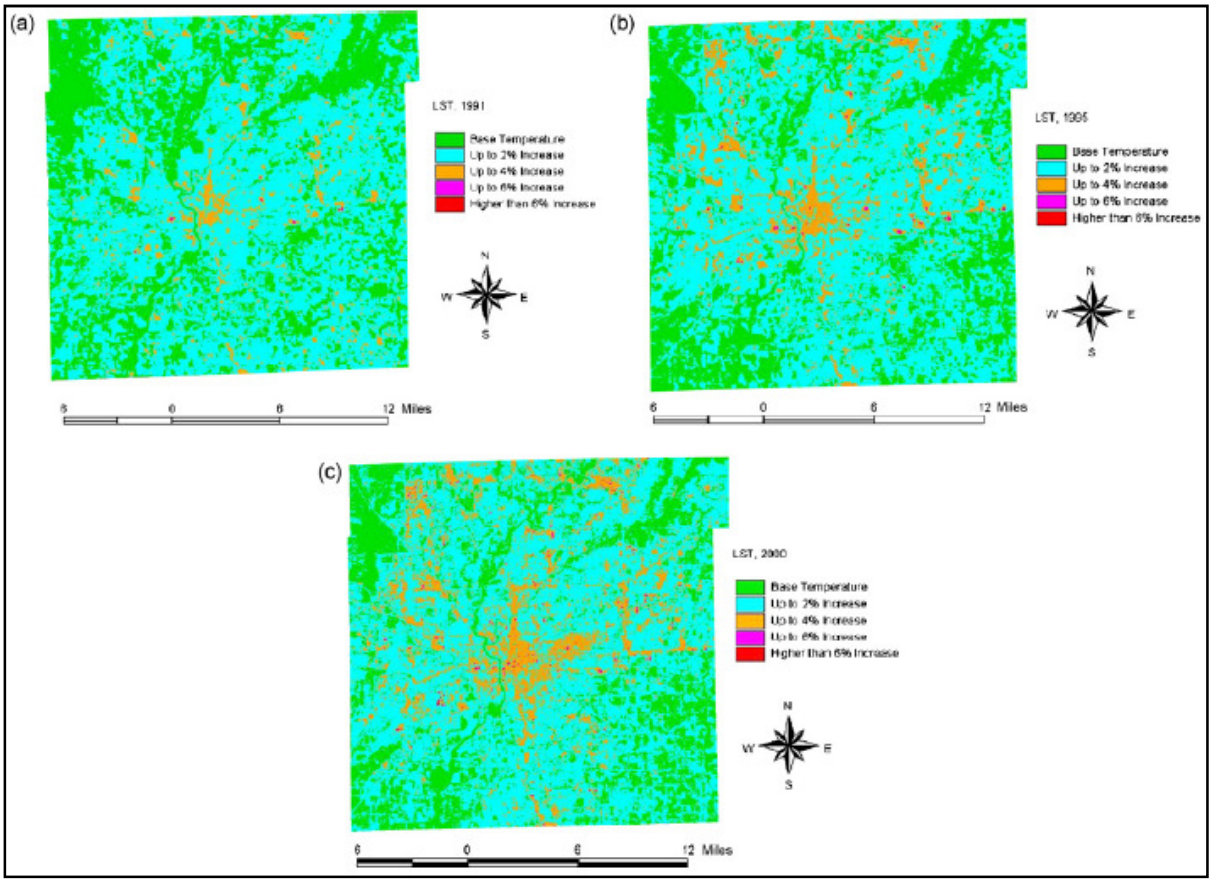
[30] Qihao Weng and Dengsheng Lu, "A sub-pixel analysis of urbanization effect on land surface temperature and its interplay with impervious surface and vegetation coverage in Indianapolis, United States," *International Journal of Applied Earth Observation and Geoinformation* 10, no. 1 (February 2008): 68-83, http://www.sciencedirect.com/science/article/pii/S0303243407000384 (accessed April 19, 2012).

[31] Ibid.

Figure 5: Maps of UHIs in the years (a) 1991, (b) 1995, (c) 2000.



Maps by: Qihao Weng and Dengsheng Lu[32]

The environmental degradation from increased surface temperatures alone is significant enough to raise alarm; however, the impermeability of most parking lots is also striking. Increased urbanization has recently led to a surplus of impervious surfaces, which distorts the amount of runoff collected in streams and other aquatic channels.[33] As a result, flooding is more frequent and the damage and pollution of stream channels, aquatic habitats and recreational areas are amplified.[34] Through

[32] Ibid.

[33] Brooke Asleson et al., "Performance Assessment of Rain Gardens," *Journal of the American Water Resources Association (JAWRA)* 45, no. 4 (August 2009): 1019-31, http://onlinelibrary.wiley.com/doi/10.1111/j.1752-1688.2009.00344.x/abstract (accessed April 19, 2012).

[34] Ibid.

advances in technology, porous asphalt surfaces prove to be a better alternative over the traditional parking lot surfaces that dominated twentieth century urban sprawl. Pervious surfaces like porous asphalt are effective at managing stormwater management without the negative effects of natural land cover displacement.

An experiment by the Stormwater Center at the University of New Hampshire tested the efficacy of porous asphalt and found the material efficiently allowed for water to drain and infiltrate into the subsurface. "This significantly reduces runoff volume, decreases its temperature, improves water quality, and…speeds snow and ice melt, dramatically reducing the salt required for winter maintenance."[35] From the time the parking lot was constructed in 2004 to the time the report was written at the end of 2007, no surface runoff was observed nor was any maintenance performed on the lot beyond routine vacuuming 2-4 times a year to keep the pores cleared. Additionally, the area experience two 100-year rain-events in that period and in both instances, groundwater recharge was achieved despite the presence of clay soils underneath the parking lot.[36]

Because of New Hampshire's cold-weather climate, this particular study was especially useful and surprising in examining the effects of winter conditions on porous asphalt. The parking lot was able to endure the freeze/thaw cycles without

[35] University of New Hampshire Stormwater Center, *2007 Annual Report* (Durham, NH: University of New Hampshire Stormwater Center, 2007), http://ciceet.unh.edu/unh_stormwater_report_2007/SC_Report_2007.pdf (accessed April 19, 2012).

[36] Ibid.

developing frost heaves.[37] Moreover, it was observed that only 0% - 25% of normal amounts of salt and deicer was required compared to impervious parking surfaces. Because the pores within the asphalt remained open throughout the winter, freezing and thawing did not affect the ability for infiltration, which meant year-round drainage and enhanced durability throughout the winter.[38] In fact, it has been found that infiltration rates in impervious parking lots during periods of prolonged freezing are higher than summer months further demonstrating the all-season durability of this technology.[39] Compared with more rigid and traditional pavements, pervious surfaces last much longer in northern climates. Normal parking lots may survive 12-15 years whereas permeable surfaces can last 30 years.[40]

In addition to improving stormwater management and reducing runoff, pervious surfaces can also improve water quality through the design of the multiple support and subsurface layers underneath permeable asphalt and concrete. As shown in Figure 6, after rainwater falls onto the parking lot surface, it travels downward through a filter course before recharging the native soils.[41]

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[37] Ibid.

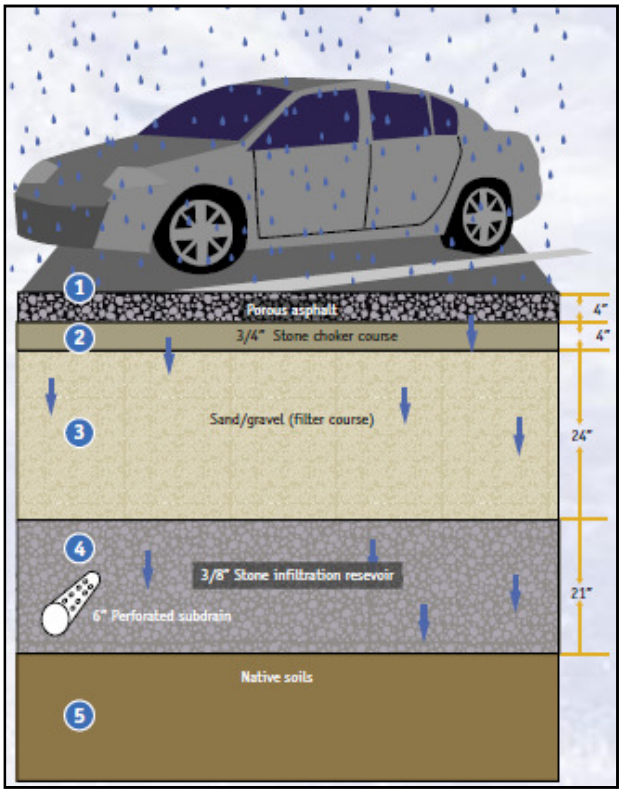
[38] Ibid.

[39] Jeff Gunderson, "Pervious Pavements: New findings about their functionality and performance in cold climates,"*Stormwater*, September 2008, page nr. http://www.stormh2o.com/SW/Articles/1071.aspx (accessed April 19, 2012).

[40] Ibid.

[41] University of New Hampshire Stormwater Center, *2007 Annual Report* (Durham, NH: University of New Hampshire Stormwater Center, 2007), http://ciceet.unh.edu/unh_stormwater_report_2007/SC_Report_2007.pdf (accessed April 19, 2012).

Figure 6: Water Quality Treatment Process in Porous Asphalt



Graphic by: University of New Hampshire Stormwater Center[42]

In addition to porous asphalt and permeable concrete, other materials and methods can be used to mitigate the destructive impact of parking lots. In a 6-year study just outside Seattle, WA, researchers from University of Washington tested Grasspave2®, Gravelpave2®, Turfstone® and UNI Eco-Stone® against traditional pavement for durability, infiltration and water quality.[43] Turfstone® and UNI Eco-Stone® both appeared to be just as durable as traditional asphalt pavement after 6 years of daily use.[44] While the test site did not experience the winter conditions that

[42] Ibid.

[43] Benjamin Brattebo and Derek Booth, "Long-term stormwater quantity and quality performance of permeable pavement systems," *Water Research* 37, no. 18 (November 2003): 4369-76, http://www.sciencedirect.com/science/article/pii/S004313540300410X (accessed April 19, 2012).

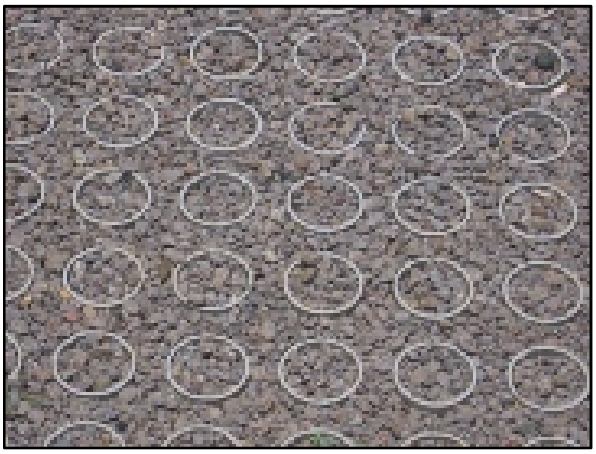
[44] Ibid.

the New Hampshire study endured, the four pavement systems studied here provided other benefits that the porous asphalts may lack. Figures 7 – 10 below are examples of the four pavement systems described above.

Figure 7: Grasspave²®

Photograph by: San Francisquito Watershed Council[45]

Figure 8: Gravelpave²®



Photograph by: Jeff Siegel[46]

Figure 9: Turfstone®

Photograph by: Blocks and Rocks[47]

Figure 10: UNI Eco-Stone®

Photograph by: Interlocking Paving Systems Inc.[48]

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[45] "Installing Grasspave" (2005), Palo Alto, CA, JPEG file, http://www.sanfrancisquito.org/runoff/demo/735Homer/vtour/2pavers-grasspave/pages/10-installing-grasspave.htm (accessed April 21, 2012).

[46] Jeff Siegel, "Gravelpave System" (2009), Kauai, HI, JPEG file, http://www.examiner.com/article/green-building-kauai (accessed April 21, 2012).

[47] Blocks and Rocks, "Turfstone 2" (2012), Lethbridge, AB, JPEG file, http://www.blocksandrocks.com/Default.aspx?PageID=8171889&Page=2&A=PhotoGallery&PID=21522&Items=15 (accessed April 21, 2012).

Grasspave²® and Gravelpave²® essentially utilize the same technology, except the filling is different. However, because the Grasspave²® and Gravelpave²® are made of a flexible plastic infrastructure, they are less durable than the other two technologies.[49] Turfstone® is comprised of sections of pre-fabricated concrete lattice with about 60% impervious coverage filled with grass in the remaining 40% of the area. UNI Eco-Stone® is made of concrete as well and covers about 90% of the surface with the smaller spaces filled with gravel or crushed stone.[50] Grasspave²® and Turfstone® both employ grass, which helps counteract the urban heat island effect. While this study did not test these surfaces in winter conditions, it is conceivable that UNI Eco-Stone®, and possibly Turfstone®, would fare the best under a snowplow. Compared to the traditional asphalt, all four strategies were effective in water filtration. In 89% of water samples taken from the traditional asphalt runoff, whereas not one water sample from any of the four permeable pavements contained motor oil.[51]

Multiple studies indicate that porous asphalt and other permeable surfaces provide solutions to mitigate UHI, excess stormwater runoff, and water quality issues generated by typical parking lots. Implementing these changes on a large

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[48] Interlocking Paving Systems Inc., "Uni Eco-Stone" (2007), Hampton, VA, JPEG file, http://www.interlockonline.com/uni_eco.html (accessed April 21, 2012).

[49] Benjamin Brattebo and Derek Booth, "Long-term stormwater quantity and quality performance of permeable pavement systems," *Water Research* 37, no. 18 (November 2003): 4369-76, http://www.sciencedirect.com/science/article/pii/S004313540300410X (accessed April 19, 2012).

[50] Ibid.

[51] Ibid.

scale though requires education and outreach for the general public as well as well formulated ordinances, zoning and other written policies and legislation.

Ordinances, Zoning, and Other Legal Considerations

In order to advance permeable parking surfaces, improve safety conditions and increase density, zoning and ordinances need to promote progressive practices. There is a history of zoning ordinances and practices that directly concern parking lots. Minimum and maximum spaces, accessibility and environmental protection are all examples of specific ordinances and legislation pertaining to parking lots.

The growth of parking lots exploded after World War II when many cities developed zoning ordinances that required minimum thresholds of off-street parking spaces to meet the parking demands of new development in order to diminish externalities of suburban growth.[52] Zoning requirements regarding off-street parking were "an attempt to minimize spillover parking on public streets and to ensure safe and efficient movement of traffic."[53]

Although parking lot policies are beginning to be more progressive and environmentally sensitive, there still appears to be disagreement on parking lot standards and design. Authored by the Urban Land Institute (ULI) in 1947, the *Community Builders Handbook* referred to parking lots as an essential element in shopping center development, but was only concerned with the size and most

[52] Michael Davidson and Fay Dolnick, eds., *Parking Standards* (Chicago, IL: American Planning Association (Planners Press), 2002), 5.

[53] Ibid., 5.

efficient arrangement of the parking stalls.[54] According to Eran Ben-Joseph, ULI's 1957 edition quotes a developer as saying, "the smaller the center, the more parking space you should devote to it. You can't be overly generous."[55] Because cities and developers anticipated expansive residential growth in the suburbs, shopping and retail followed suit in the form of outdoor strip malls and, later, large indoor malls with air conditioning. To accommodate these large commercial developments typically located on a city's fringe, expansive parking lots were built to hold as many cars as possible for peak hours during peak seasons (e.g., holiday shopping) in order to "[adequately] meet demand."[56] As observed in Olympia, WA, commercial land use is dominated by parking lots. Figure 11 effectively illustrates this point. Although ULI has reduced their recommendation of 10 spaces per 1,000 square feet of leasable space down to 4 spaces per 1,000 square feet, it still recommends more parking than necessary. The *Dimensions of Parking, 5th Edition* (published in 2010) was jointly published by the ULI and the National Parking Association and advocates that a parking lot should provide an "effective-supply cushion – the difference between the actual number of spaces and the effective supply – [which] reduces the need to search an entire system for the last few available spaces."[57]

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[54] In referencing the 1947 edition of the *Community Builders Handbook*, Ben-Joseph quotes the manual, "In providing the indispensable parking, the only questions are how much area to provide and how best to arrange the space to be so laid out." Eran Ben-Joseph, ReThinking a Lot: the Design and Culture of Parking (Cambridge, MA.: The MIT Press, 2012), 85.

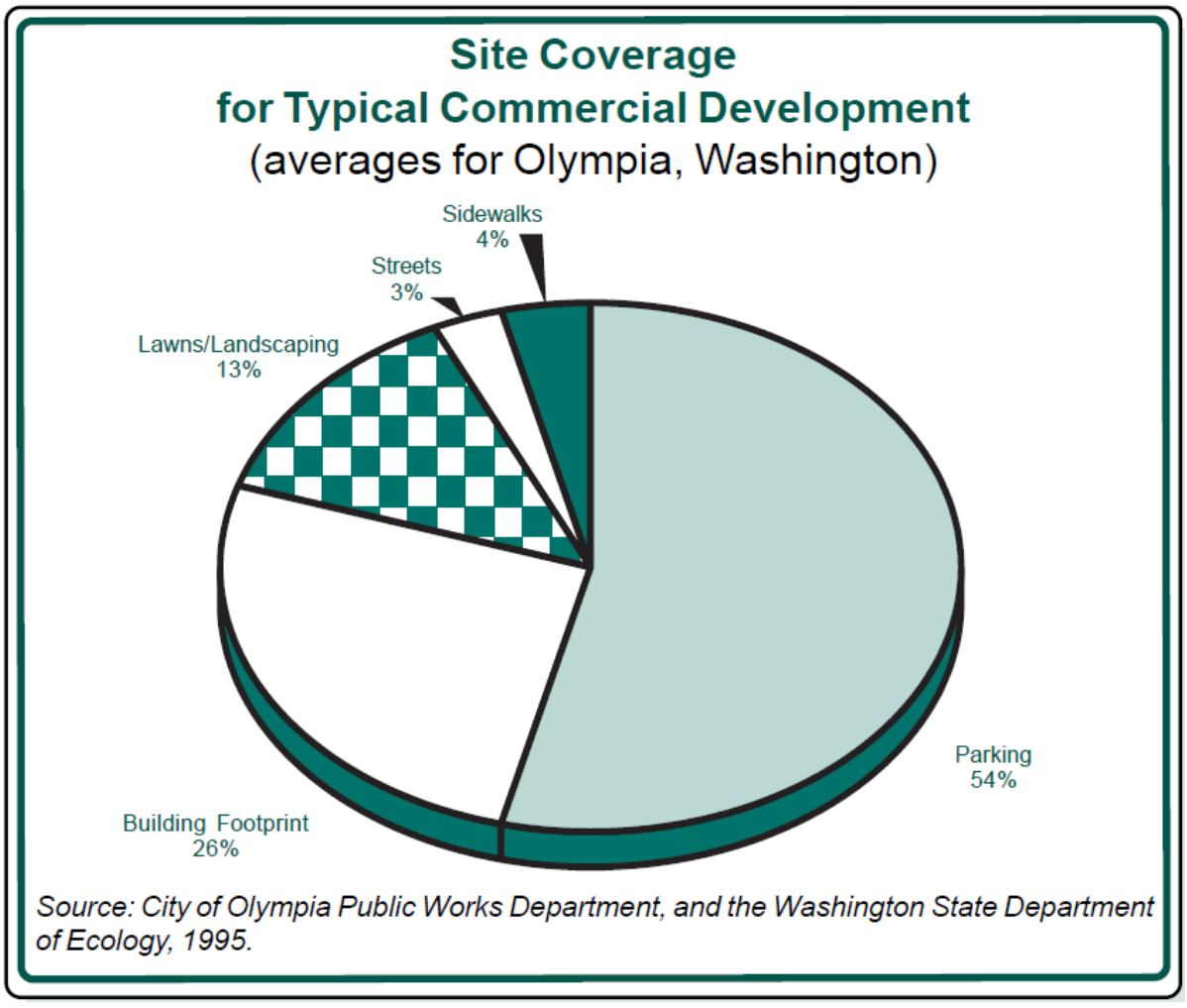
[55] Ibid., 85.

[56] Michael Davidson and Fay Dolnick, eds., *Parking Standards* (Chicago, IL: American Planning Association (Planners Press), 2002), 5.

[57] Urban Land Institute, and National Parking Association, *The Dimensions of Parking*, 5th ed. (Washington: Urban Land Institute, 2010), 10.

Essentially, the effective-supply cushion allows for a cushion of extra parking spaces so that drivers do not develop the "perception" that a parking lot is at capacity when only a few spaces remain.[58] This type of policy and mind-set undermines environmental protection efforts and further institutionalizes the ubiquity of parking lots and suburban sprawl.

Figure 11: Parking as a Percentage of Commercial Land Use, Olympia, WA



Graph by: United States Environmental Protection Agency (EPA)[59]

[58] Ibid., 10.

[59] U.S. Environmental Protection Agency (EPA), *Parking Spaces/Community Places: Finding the Balance Through Smart Growth Solutions*, prepared by Development, Community, and Environment Division, EPA 231-K-06-001 (Washington, DC, 2006), 7.

To limit the size of parking lots and eliminate the usage of an effective supply cushion, some cities have implemented maximum parking requirements, in addition to the customary minimum requirements. Several methods have been employed to determine maximum parking limitations. Helena, MT calculates its maximum parking capacities based on an additional percentage of the minimum.[60] In this scenario, parking lots between 21-50 spaces may not exceed 120% of the minimum requirement while parking lots containing 51+ spaces may not exceed 110% of the minimum.[61] Cambridge, MA, however, allots a maximum number of spaces for a defined district, allowing each lot a percentage of that share based on square footage.[62] A third method to limit off-street parking, as seen in Pittsburgh, PA, is to simply calculate a maximum as a ratio to the square footage of a building much in the same way as minimum requirements are determined.[63] San Antonio, TX, which also has maximum requirements, allows exemptions for structured parking and parking lots with pervious pavement.[64] This type of strategy encourages denser parking facilities with smaller footprints as well as environmentally sensitive lots that effectively have no footprint.

Some cities do not employ parking requirements at all for certain districts and zones. Portland, OR does not have minimum requirements in several commercially

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[60] Michael Davidson and Fay Dolnick, eds., *Parking Standards* (Chicago, IL: American Planning Association (Planners Press), 2002), 14.

[61] Ibid.

[62] Ibid.

[63] Ibid.

[64] Ibid.

zoned districts that are intended to be dense and smaller in scale.[65] Albany, NY, however, has no parking requirements in "fully developed residential districts" such as those with rowhouses.[66] Albany also has no minimum off-street parking requirements for C-3 zones, which are designated as Central Business District.[67] This type of policy is certainly progressive and promotes pedestrian activity in downtown or commercially dense areas.

Around the same time of expansive suburban growth, downtown areas and warehouse districts were declining and left many buildings vacant. As vacant buildings fell in disrepair, many were razed and replaced with surface parking lots as a two-fold strategy.[68] Firstly it provided a quick and cheap transformation of use with the potential for direct income and secondly, it provided a means for auto-centric suburbanites to visit the city center in hopes of economic recovery.[69] But because of the intention that these downtown parking lots were "temporary," many lots were neglected or poorly maintained, which slowly set a "low standard for design and investment" in downtown lots.[70] The following comparison, Figure 12 and Figure 13, show the same view of a district in Cleveland, OH in the 1960s and

[65] Ibid., 17.

[66] *Albany, New York Municipal Code* part II, ch. 375, art. XIX, § 375-187 (1993).

[67] *Albany, New York Municipal Code* part II, ch. 375, art. XIX, § 375-173 (1993).

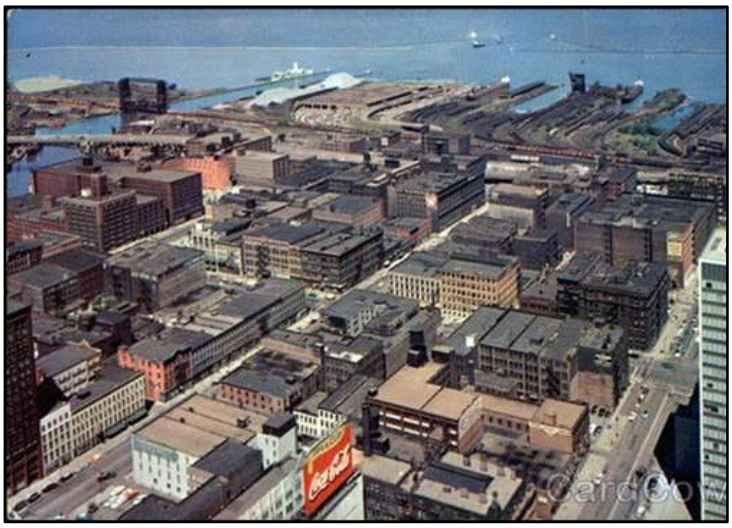
[68] Eran Ben-Joseph, ReThinking a Lot: the Design and Culture of Parking (Cambridge, MA.: The MIT Press, 2012), 73.

[69] Ibid.

[70] Ibid., 76.

today. These remarkable photos clearly demonstrate this transformative urban history.

Figure 12: Cleveland, 1960s



Photograph by: Kaid Benfield[71]

Figure 13: Cleveland, today

Photograph by: Kaid Benfield[72]

Because of the "temporary" mind-set about parking lots, parking lots were poorly designed and presented a perpetual challenge for city planners because

[71] Ken Benfield, "Cleveland, then and now" (2011), Cleveland, OH, JPEG file, http://switchboard.nrdc.org/blogs/kbenfield/how_the_hell_did_we_let_this_h.html (accessed April 19, 2012).

[72] Ibid.

owners and public officials anticipated imminent reuse.[73] According to Ben-Joseph, a 1947 study by the Eno Foundation concluded that "the parking problem can be effectively tackled through zoning requirements. Sufficient experience has been gained to show that the requirement of off-street parking by zoning provides a uniform, impartial and effective means to improving terminal facilities in cities."[74] While design concepts will be discussed later in this document, it is important to note that zoning requirements were still controversial during this period, and that the fate and influence of the automobile in American society had yet to be realized. In 1959, the Colorado Supreme Court held that zoning for parking requirements was "out of harmony with fundamental constitutional concepts."[75] In 1966, however, the Massachusetts Supreme Judicial Court offered a differing opinion about off-street parking requirements, and by 1975, the Colorado Supreme Court overturned its 1959 decision.[76]

In an odd saga, it seems that minimum parking requirements originally met resistance by property owners that did not want to be responsible for the costs of providing off-street parking. In time, however, the appetite for parking and building expansive lots was insatiable as suburban America cultivated the

[73] Eran Ben-Joseph, ReThinking a Lot: the Design and Culture of Parking (Cambridge, MA.: The MIT Press, 2012), 76.

[74] Ibid., 78.

[75] Ibid.

[76] Ibid., 79.

ubiquitous auto-culture, which has recently led to a reduction of minimum thresholds and the introduction of maximum parking requirements.

Because American commerce and culture are now so intertwined with the automobile, only creative solutions can cultivate economic growth and vibrancy in dense downtown areas. In a case study by the U.S. Environmental Protection Agency, Portland was examined for its creative use of Transferable Parking Rights.[77] Portland, OR tailored the idea of Transfer of Development Rights for their parking requirements to densify an older area and accommodate for the Portland Hilton Executive Tower. By their normal zoning requirements, the project would have been limited to 312 parking spaces in their garage; however, because of the transfer of the parking "entitlements" from nearby buildings, the garage touts 680 spaces, of which, they are able to collect parking revenues from tenants and customers of Pioneer Place Mall and nearby commercially-zoned historic buildings in addition to hotel guests.[78] Essentially, the agreement is a "win-win" for all parties involved including the City of Portland since a larger parking garage provides increased access to the area and additional economic growth while utilizing the same footprint.

The Americans with Disabilities Act of 1990 (ADA) imposed new federal parking requirements for handicap accessible parking spaces (among other

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[77] U.S. Environmental Protection Agency (EPA), *Parking Spaces/Community Places: Finding the Balance Through Smart Growth Solutions*, prepared by Development, Community, and Environment Division, EPA 231-K-06-001 (Washington, DC, 2006), 36-39.

[78] Ibid.

accessibility requirements). The ADA Regulations, which were updated in 2010, go so far as to include detailed minimum specifications for stall width, slope of the parking space and design guidelines for ramps onto sidewalks and other pedestrian facilities.[79] The implementation and enforcement of ADA Guidelines set a precedent that existing parking lots (and other existing public or commercial facilities) were required to comply in addition to new construction projects. Any "alteration" to a structure or facility after January 26, 1992 shall fully comply with ADA standards "to the maximum extent feasible," which, while subjective, is enforceable on a case-by-case basis.[80] As applicable to parking lots, the Department of Justice considers routine repaving or restriping of a parking lot as an event that would automatically require ADA compliance.[81] Additionally, "readily achievable barrier removal" is covered in Title III of the ADA Regulations. "Readily achievable" is defined by the Department of Justice as "easily accomplishable and able to be carried out without much difficulty or expense" without providing an undue burden.[82] After the 2010 revisions, March 15, 2012 was set as the "compliance date" for the 2010 Standards by which accommodations must be met.[83] Simple alterations and improvements such as signage and striping are arguably achievable without much "difficulty of expense."

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[79] ADA specifications have been revised and updated in 2010. For a complete design guidelines and specifications, consult §208 and §502 of the *2010 ADA Standards for Accessible Design* (2010), which can be found at http://www.ada.gov.

[80] Ibid.

[81] *ADA Technical Assistance*, (1996).

[82] *Americans with Disabilities Act, Title III Regulations*. (2010).

[83] *Revised ADA Requirements: Effective and Compliance Dates*, (2010).

An example of environmental action against outdated parking lot design can be found in a Sacramento, CA ordinance passed in 1983 requiring all paved areas (existing and future) be 50% shaded within 15 years after development.[84] A study was conducted in 2001 evaluated the cost-effectiveness of the ordinance and concluded that, while the intentions to mitigate stormwater runoff and UHI effects are good, the ordinance was ineffective. The ordinance does, however, offer an aggressive example of municipal action to protect the environment and mitigate the destructive impacts of ordinary parking lots. The study also offers several recommendations on how to improve the code as well as other types of requirements and strategies that would achieve the same goals without the burdens to property owners or the public.[85]

In some instances of development, parking areas allow for more creative solutions that street and roadway regulations would otherwise prohibit. Ben-Joseph references Seaside, FL where the development team made streets denser and more pedestrian friendly by labeling the residential streets as "parking areas" rather than designating them as streets.[86] While this scenario may not always be appropriate, it certainly turns the thought of parking lot zoning upside down by relying on the lack of, rather than the presence of, institutional enforcement to implement safer designs.

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[84] E. Gregory McPherson, "Sacramento's parking lot shading ordinance: environmental and economic costs of compliance,"*Landscape and Urban Planning* 57, no. 2 (2001): 105-23, http://www.sciencedirect.com/science/article/pii/S0169204601001967(accessed April 16, 2012).

[85] Ibid.

[86] Eran Ben-Joseph, ReThinking a Lot: the Design and Culture of Parking (Cambridge, MA.: The MIT Press, 2012), 108.

By studying the history of zoning through the lens of parking lots, the precedent has been established for state and local regulation over private parking lots. With the passage of the Americans with Disabilities Act of 1990, federal purview over parking lot design has also been accepted. When considering the enforcement and implementation of city ordinances and zoning, it is not inconceivable that a framework of regulatory compliance and implementation similar to federal ADA guidelines could be applied to mandate and enforce a variety of parking lot improvements. Safety of pedestrians, protection of environmental and human health, as well as the economic and general welfare of the public are all reasonable goals that are consistent with the basis, purpose and aims of governmental directives and authority.

Summary

Through a myriad of sources, it is evident that parking lots serve as an intersection of vehicles and pedestrians where people exhibit unique and challenging behaviors. Additionally, parking lots present a significant barrier to environmental protection due to increased heat and poor runoff management. Through a precedence of a zoning and regulations at all levels of government, communities can stipulate certain requirements to improve parking lots to mitigate environmental and safety concerns. The case studies that follow highlight examples of some of the features presented in the research that have been implemented in order to illustrate the viability of smart parking lot design.

Case Studies

In this section, a number of parking lots have been examined and analyzed in order to identify those key elements uncovered in the research that can make parking lots safer, environmentally friendly, and unique as a public space. While individual parking lots may have an interesting and noteworthy history, locating background information on any one particular lot is often times unobtainable and ancillary to the aims of this document. In most cases, a visual inspection of the existing conditions of a parking lot is sufficient in understanding the distinct features and dynamics of that parking lot. Due to the these circumstances and the focus of this document, these case studies have not been organized geographically by place, but rather thematically by attribute to better illustrate the various elements and lessons presented in the research.

"Centerwalks" and Pedestrian Access

There are currently many different solutions that have been implemented regarding parking lot design. A multitude of striping schemes and signage and other unique approaches can be seen in various locations throughout the United States. One approach is to provide a raised dedicated walking aisle between the cars running the length of the parking aisle. In this scenario, motorists can exit their vehicles and proceed to the front of the car where they can access a sidewalk, or more aptly, a centerwalk. This pedestrian artery typically leads directly to their destination without any conflict with moving vehicles, except for a crosswalk to

access the storefront. Coined a "centerwalk" in this document, there can still be some potential design challenges associated with these pedestrian lanes.

Figure 14: Pedestrian "Centerwalk," Target, New Braunfels, TX

Photo by: John Stark

In one instance, the centerwalk pictured in Figures 14 and 15 is at the same grade as the parking surface and is only demarcated with painted stripes. While this makes for easy accessibility and is ADA compliant, it also opens up the possibility for people to park over the painted lines and block the walkway. Additionally it potentially defeats any safety features by giving drivers the opportunity to drive over the lines and possible cause an accident or injure a pedestrian as described with the parking lot "ballet."

Figure 15: Dedicated "Centerwalk," Target, New Braunfels, TX

Photo by: John Stark

Figures 16-19: Dedicated "Centerwalk" & Bus Stop Connection, Colonie Center, Colonie, NY

Photos by: Bing Maps, John Stark

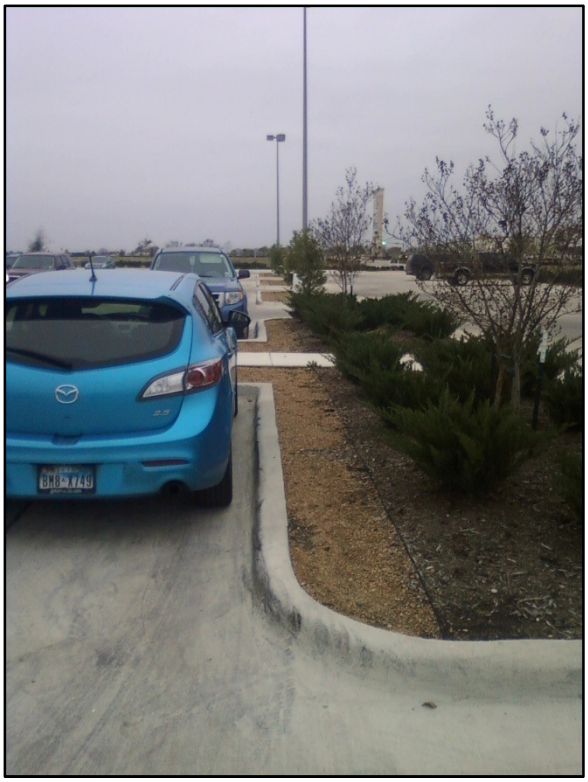
Figures 16-19 show a much more attractive centerwalk with landscape borders running the length of the facility. Additionally, accessible parking has at grade access to the walking aisle as well. While the landscaping is aesthetic and helps maintain a certain level of environmental responsibility (albeit minimal), however, the mulch and plants hinder access from the parking stalls to the raised walkway. Additionally, blue sign posts are cemented between the ADA walkway and the centerwalk, which defeats the purpose of the at-grade accessibility. While the sign might be in accordance with ADA standards, there are always creative solutions to any problem. The one triumph of this centerwalk is that it connects the store front to the street sidewalk on Wolf Road where there is a nearby bus stop, which helps separate non-motorist pedestrians from the large parking avenues.

Figure 20: Dedicated "Centerwalk," Creekside Cinemas, New Braunfels, TX

Photo by: John Stark

Figure 20 shows another centerwalk with visual character. While there is not much vegetation to improve the environmental quality of this example, the crushed granite is permeable arguably serves as a better walking surface than mulch in all weather conditions. Figures 21 and 22 extends this feature for certain parking stalls that abut curbs and planters to allow passengers room to open the door and step out of the car.

Figures 21 & 22: Pedestrian Access, Creekside Cinemas, New Braunfels, TX



Photos by: John Stark

Figure 23 shows three key concepts. The walking aisle running left to right (in the bottom parking lot) runs parallel to the dorm buildings it serves, which is sure to discourage any practical use since the walkway does not lead to the destination. In the upper right of the photo, there is a painted crosswalk connecting the storefront

directly to the sidewalk, which shows a positive approach despite a parking lot in front. Lastly, the parking lot behind the blue-roofed building shows access to the shops directly from the sidewalk while providing space for motorists to park their cars.

Figure 23: Pedestrian Access, San Marcos, TX

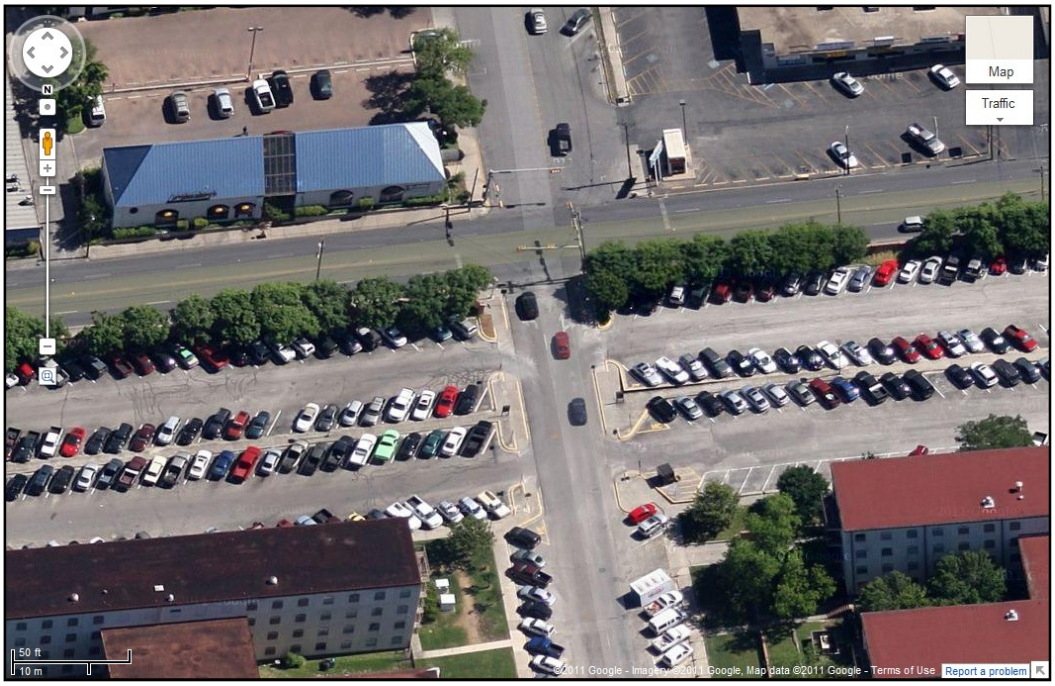


Photo by: Google

Finally, one of the more creative adaptations for pedestrian access can be found at Hotel Northampton in Northampton, MA. Pictured in Figures 24-26, this feature informs drivers that the hotel is in some ways is probably most direct and unabashed about pedestrian traffic in their parking lot. Winding through the parking lot connecting two buildings on the property is a brightly painted walkway. Green with white borders, the walkway stands out upon driving into the parking lot and is obvious about its purpose – it connects two buildings by providing a clear walking path for anybody that finds themselves in the parking lot. Because the

parking lot is located behind the main portion of the hotel, the pathway helps to give a sense of completion by making it obvious where the back entrance to the main building is located. Additionally, it makes abundantly clear that there exists a building at the other end of the walkway at the back of the parking lot and that it is also part of the hotel.

Figure 24: Green walkway, Hotel Northampton, Northampton, MA

Photo by: John Stark

Figure 25: Green walkway, Hotel Northampton, Northampton, MA

Photo by: John Stark

Figure 26: Green walkway, Hotel Northampton, Northampton, MA

Photo by: John Stark

The green walkway at Hotel Northampton stands out in contrast to the black pavement making it clear to motorists that there is regular foot traffic in the parking lot and to watch for pedestrians. Conversely, the pathway complements the property's sense of place and makes it clear for pedestrians to watch for motorized traffic and provides direction. While the parking lot does not separate pedestrians from cars, the walkway affects the psychology of drivers by creating the *perception* that it is a dangerous parking lot. From the perspective of territorial behavior, the delineated walkway clearly suggests the presence of pedestrians by denoting an exclusively pedestrian path. While the designers of this walkway may not have been certain this strategy would work, the pathway certainly combines the lessons of parking lot psychology with the theories of Hans Monderman and Shared Space.

Environmental Consideration and the Parking Lot Experience

In a historic district in Gruene, TX, a parking facility shown in Figure 27 incorporates larger green spaces in the middle of a contemporary parking lot to preserve the charm and identity associated with the historic area. In a great example of preserving the environment rather than maximizing space, the redevelopers of this historic sire were able to provide parking in an environmentally friendly fashion while preserving the charm of the historic district. By maintaining the natural environment (or at least the illusion), Gruene helps to create a sense-of-place consistent with its identity and culture in order to revitalized a small Texas ghost town. By giving the parking lot an atmosphere consistent with the overall theme, Gruene maintains the rustic appeal from the beginning to the end of the visit.

Figure 27: Landscaped Parking Lots, Gruene, TX

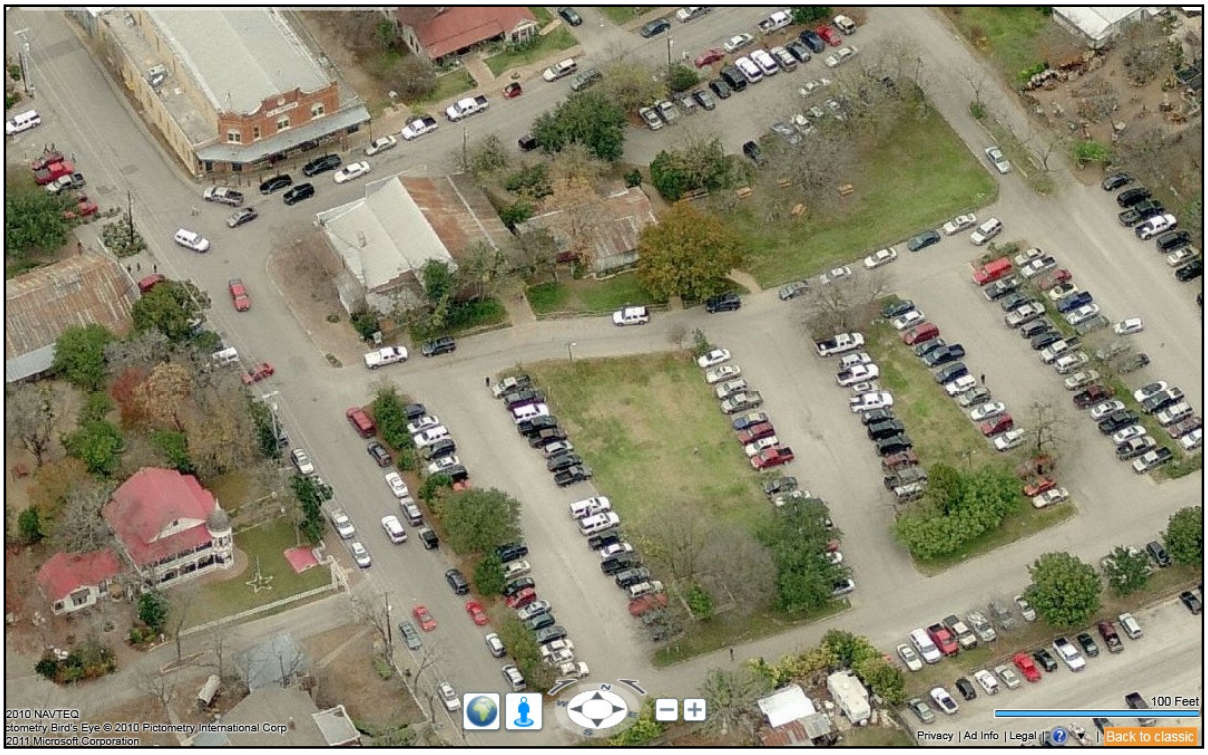


Photo by: Bing

Another creative way to promote a business's identity and culture can be seen at the Yankee Candle Flagship Store in South Deerfield, MA. Illustrated in Figures 28-31, it appears at first glance that the crosswalk is dashed on each side to help provide direction and flow and give definition to the crosswalk, but upon further inspection the "dashes" reveal themselves to be painted in the shape of the iconic Yankee Candle Jars. In addition to maintaining pedestrian safety, this creative promotion, if noticed, helps to both excite customers and show a sense of pride and identity, which further contributes to a sense of place.

Figures 28-30: Yankee Candle Crosswalk, South Deerfield, MA

Photo by: John Stark

Photo by: John Stark

Figure 31: Yankee Candle Jar

Photo by: John Stark

Photo by: Yankee Candle Company

Zoning and Enforcement

Figure 32, right, shows the ability of the local municipality to enforce regulations and fulfill its function as a governing body. Guilderland's jurisdiction is clearly evidenced on this sign, which speaks to the authority of a town's ability to enforce smart parking lot design even though the property is privately owned.

Figure 32: No Parking Sign, Guilderland, NY

Photo by: John Stark

Looking Forward

Implementing progressive designs into parking lots is achievable through a set of best practices and guiding themes. Because parking lot design is subjective to each site and scenario, a formulaic catalog of elements cannot, and should not, be codified as an exhaustive list of design standards. Rather, a versatile set of principles and guiding themes is more appropriate as it can be adaptable to implement smart parking lot design for any situation.

Many facets of parking lots, however, have yet to be thoroughly examined, but may otherwise prove valuable to the scope of this document. While this document attempts to reach a set of conclusions and best practices for parking lot design, there are still relevant aspects that can enhance and expand the roles and uses of parking lots including transit connectivity and farmers markets.

Parking lots are easily identifiable as a significant component of transit and intermodal connectivity. Because of the dominant presence of cars in American society, many policies integrate parking lots as a strategy to incorporate the automobile into a larger intermodal transportation network. Park & Ride programs, like the example in Minneapolis/St. Paul, MN, allow for commuters to park their cars for free at a parking lot connected to a bus stop or train station and ride the transit system to their destination.[87] Marriott sponsors a "Park Here, Fly There" campaign to offer overnight accommodations, free parking and airport shuttle as a

[87] Metro Transit, "Park for Free Then Ride the Smart Way," Metro Transit, http://metrotransit.org/park-ride-lots.aspx (accessed May 12, 2012).

means for customers to "save time, money and stress."[88] While a good business strategy, this is undoubtedly and an attractive option for those who live a substantial distance from a major airport and need accommodations the night preceding an early flight. Furthermore, parking lots can be seen as host to off-street bus stops. CDTA (Capital District Transportation Authority) busses have multiple parking-lot-based stops throughout Albany as seen below in Figures 33 and 34.

Figures 33, 34: Parking Lot Bus Stops, Stuyvesant Plaza, Guilderland, NY; Crossgates Mall, Albany, NY

Photo by: John Stark

Photo by: John Stark

In *Hot Peppers & Parking Lot Peaches*, Andy Fisher reviews shoppers' perceptions and the different policy barriers that stifle the success of farmers markets and the subsequent impacts on diet and health in low-income communities.[89] In a study in Maryland, it was found that farmers markets held in

[88] Marriott, "Hotel Deals," Park here, Fly There...US and Canada!, https://www.marriott.com/specials/mesOffer.mi?marrOfferId=617300 (accessed May 12, 2012).

[89] Andy Fisher, "Hot Peppers and Parking Lot Peaches: Evaluating Farmers' Markets in Low Income Communities" http://www.foodsecurity.org/HotPeppersPeaches.pdf (accessed May 12, 2012).

WIC (Women, Infant and Children) parking lots on check disbursement days boosted vendor revenue, which indicates an increase in participation. University of Maryland Extension (Baltimore County) educators guided participants on "how to shop at farmers markets, know what is in season, and how to choose, store and prepare fresh produce."[90] Because farmers markets are typically seasonal and temporary events, they often take place in multipurpose venues such as parking lots.

The versatility of parking lots allows for a unique multi-use function as an intermodal connection and venue for farmers markets and other special community events. While further research is certainly required to determine the extent to which parking lots fulfill these roles, incorporating these activities into a set of guiding themes will help to improve the functionality of parking lots. Listed below is a set of guiding themes and considerations for parking lot design based on the research and case studies discussed in this document and should not be considered exhaustive:

LIST OF GUIDING THEMES & CONSIDERATIONS

- Pedestrian Safety & ADA Accessibility
  - Centerwalks
  - Painted Walkways
- Local Zoning & Ordinances
- Parking Lot Psychology & Behavior
- Environmental Considerations & Local Climate
  - Vegetation (Reduce Urban Heat Island Effect)
  - Permeability (Stormwater Runoff & Management)
- Multi-Use Adaptability
- Transit Connectivity

[90] Mary Concannon, "Farmers' Markets in Women, Infant and Children Clinic Parking Lots Increase Access to Fresh Fruits and Vegetables," abstract, *Journal of Nutrition Education and Behavior* 43 (July 2011): S2-S3, http://www.sciencedirect.com.libproxy.albany.edu/science/article/pii/S1499404611001114 (accessed May 12, 2012).

Conclusions

Parking lots are often overlooked as a critical intersection that facilitates the transition between two modes of transportation. The fact that we are all pedestrians on some level makes the issue that much more important. Airports and train stations are constantly being improved to handle the flow between passengers and drivers. Even drop-off lanes and pedestrian facilities exist to help move the flow of pedestrian traffic through security and in between termini. Restaurants, shopping and other amenities can be found to facilitate what has become an obvious pedestrian demographic in airports. Everywhere people go, they go as a pedestrian at some point along the way. As a society, we generally cater to the pedestrian world that many of us take for granted. Given that foot traffic is such an integral part of our economy and way of life, it is a huge oversight of the twentieth-century that pedestrians in parking lots are largely overlooked, which begs the question: Are parking lots simply parking lots or a place where pedestrians store their cars?

As demonstrated through research and a few case study examples, pedestrian safety and environmental responsibility are both achievable goals in parking lots. Due to the overwhelming precedents for zoning and regulations at all levels of government, it is possible to mandate and implement almost any desired feature. In designing parking lots, it is important to consider the experience of the drivers as well as pedestrians to facilitate a safe and welcoming shared space. While "centerwalks" still lack design standards and are not yet universal, they help

integrate pedestrians into a vehicular landscape and will hopefully be every bit as ubiquitous as parking lots themselves. The same can be said for permeable surfaces as they have proven to be effective in mitigating several environmental concerns. Because parking lots are the first and last place people see when entering and exiting a building. Smart parking lot design can help complement the use of the building it serves by creating a shared space that is safe, responsible, functional and attractive.

Bibliography

Asleson, Brooke, Rebecca Nestingen, John Gulliver, Raymond Hozalski, and John Nieber. "Performance Assessment of Rain Gardens." *Journal of the American Water Resources Association (JAWRA)* 45, no. 4 (August 2009): 1019-31. http://onlinelibrary.wiley.com/doi/10.1111/j.1752-1688.2009.00344.x/abstract(accessed April 19, 2012).

Ben-Joseph, Eran. *ReThinking a Lot: the Design and Culture of Parking*. Cambridge, MA.: The MIT Press, 2012.

Brattebo, Benjamin, and Derek Booth. "Long-term stormwater quantity and quality performance of permeable pavement systems." *Water Research* 37, no. 18 (November 2003): 4369-76. http://www.sciencedirect.com/science/article/pii/S004313540300410X (accessed April 19, 2012).

County Stat. "Pedestrian Safety: Initiative Meeting." Lecture, Montgomery County, MD, March 19, 2010. PDF file. http://www.montgomerycountymd.gov/content/exec/stat/pdfs/03_19_2010_ppt.pdf (accessed April 14, 2012).

Davidson, Michael, and Fay Dolnick, eds. *Parking Standards*. Chicago, IL: American Planning Association (Planners Press), 2002.

EPA. "Heat Island Home." Heat Island Effect. http://www.repa.gov/hiri/index.htm (accessed April 19, 2012).

FHWA. "Chapter 3. Integrating Pedestrians Into the Project Planning Process." Designing Sidewalks and Trails for Access: Part II of II: Best Practices Design Guide.http://www.fhwa.dot.gov/environment/sidewalk2/sidewalks203.htm (accessed April 14, 2012).

Fisher, Andy. "Hot Peppers and Parking Lot Peaches: Evaluating Farmers' Markets in Low Income Communities." http://www.foodsecurity.org/HotPeppersPeaches.pdf (accessed May 12, 2012).

Granzow, Nate. "Prevent Parking Lot Accidents." State Farm. http://learningcenter.statefarm.com/safety-2/auto-2/prevent-parking-lot-accidents-1/ (accessed April 4, 2012).

Griffioen-Young, H.J. "The Psychology of Parking." Lyon, France, 2004. http://www.epomm.eu/ecomm2004/workshops/anglais/GriffioenJanssen.pdf (accessed April 15, 2012).

Gunderson, Jeff. "Pervious Pavements: New findings about their functionality and performance in cold climates."*Stormwater*, September 2008. http://www.stormh2o.com/SW/Articles/1071.aspx (accessed April 19, 2012).

McPherson, E. Gregory. “Sacramento's parking lot shading ordinance: environmental and economic costs of compliance.” *Landscape and Urban Planning* 57, no. 2 (2001): 105-23. http://www.sciencedirect.com/science/article/pii/S0169204601001967 (accessed April 16, 2012).

Metro Transit. “Park for Free Then Ride the Smart Way.” Metro Transit. http://metrotransit.org/park-ride-lots.aspx (accessed May 12, 2012).

Montgomery County Council. “Montgomery County Pedestrian Safety Program.” Lecture, Montgomery County, MD, October 21, 2010. PDF file. http://www.montgomerycountymd.gov/content/DOT/Dir/pedsafety/pdf/pedestrian_safety_review_slides_10_20_10.pdf(accessed April 14, 2012).

Onishi, Akio, Xin Cao, Takanori Ito, Feng Shi, and Hidefumi Imura. “Evaluating the potential for urban heat-island mitigation by greening parking lots.” *Urban Forestry and Urban Greening* 9, no. 4 (2010): 323-332. http://www.sciencedirect.com/science/article/pii/S1618866710000403 (accessed April 19, 2012).

Takebayashi, Hideki, and Masakazu Moriyama. “Study on the urban heat island mitigation effect achieved by converting to grass-covered parking.” *Solar Energy* 83, no. 8 (August 2009): 1211-1223. http://www.sciencedirect.com/science/article/pii/S0038092X09000309 (accessed April 19, 2012).

U.S. Environmental Protection Agency (EPA). “Heat Island Home.” Heat Island Effect. http://www.epa.gov/hiri/index.htm (accessed April 19, 2012).

U.S. Environmental Protection Agency (EPA). *Parking Spaces/Community Places: Finding the Balance Through Smart Growth Solutions*, by Development, Community, and Environment Division. EPA 231-K-06-001. Washington, DC, 2006.

University of New Hampshire Stormwater Center. *2007 Annual Report*. Durham, NH: University of New Hampshire Stormwater Center, 2007.http://ciceet.unh.edu/unh_stormwater_report_2007/SC_Report_2007.pdf (accessed April 19, 2012).

Urban Land Institute, and National Parking Association. *The Dimensions of Parking.* 5th ed. Washington: Urban Land Institute, 2010.

Vanderbilt, Tom. “The Traffic Guru.” *Wilson Quarterly*, Summer 2008. http://www.wilsonquarterly.com/article.cfm?AID=1234 (accessed April 3, 2012).

Weng, Qihao, and Dengsheng Lu. “A sub-pixel analysis of urbanization effect on land surface temperature and its interplay with impervious surface and vegetation coverage in Indianapolis, United States.” *International Journal of Applied Earth Observation and Geoinformation* 10, no. 1 (February 2008): 68-83. http://www.sciencedirect.com/science/article/pii/S0303243407000384 (accessed April 19, 2012).