Form Follows **Parking**

using shared parking to mitigate negative impacts of excess parking

Greenest City Scholars Final Report 08.14.2015 Neal T. Abbott

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CITY OF VANCOUVER

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PART I -- INTRODUCTION

Introduction

For over two decades parking research and policy recommendations have focused on one primary item, reducing the oversupply of off-street parking. For nearly just as long, the City of Vancouver has been outlining strategies to maximize the use of existing parking structures without encouraging further car ownership[1]. Vancouver, like many other cities, has come to recognize the ill effects of automobile dependence and is now focused on taking steps towards mitigating the negative impacts of the overabundance of parking infrastructure. The following document examines strategies used by cities from around the world to maximize the use of existing parking infrastructure in an effort to reduce the need for future parking construction and promote other forms of travel. These outlined strategies will then be applied to the West End neighbourhood in Vancouver in order to demonstrate how progressive parking policies can relieve parking shortages while still promoting the City's sustainable transportation initiatives.

1.1 Significance of Parking in the United States & Canadian Cities

Land dedicated exclusively for moving and housing automobiles is often found to be the largest allocation of city space in most North American cities[2]. Though much of this valuable land is now dedicated to the storage of private automobiles, it is rarely utilized. While the City of Vancouver has done a better job than most North American cities at limiting the overabundance of parking, there is still much room for improvement. In Metro Vancouver alone, parking in strata properties were found to have vacancy rates ranging from roughly 20-40% [3]. Excess parking not only encourages driving by increasing the opportunities to find parking at the beginning and end of trips, but also dissuades other forms of travel by making the built environment only hospitable to private motor vehicles. With so much area dedicated to automobile travel, disproportionately high automobile mode shares should not come as any surprise. By liberally distributing parking infrastructure throughout the built environment, walking, cycling, and transit become less practical, as right of ways become more concerned with vehicle flow rather than pedestrian safety. Likewise, urban design is jeopardized as buildings are broken up by parking lots and sidewalks interrupted by curb cuts.

The sheer size of space allotted to vehicular parking often goes unquestioned. Parking supply is often placed at the forefront of the design process, ensuring vehicular navigation and storage is always easy and efficient. Diagram 1 depicts how much space is consumed to produce relatively small amounts of parking. While lot designs and the dimensions for parking stalls, stall angles, and aisle widths vary, the subsequent illustration demonstrates how quickly parking demand can shape the environments we live and work in.

1.1.1 Burdens of Off- Street Parking

Overabundance in parking supplies not only dictates mode choice, but creates a series of serious financial burdens through direct construction costs, lost opportunity costs, and even negative health implications. In Metro Vancouver, construction of on-site parking can range from $20,000 to $45,000 per stall, in addition to maintenance and operation costs[4]. These high costs can be exacerbated even further within the City of Vancouver where parking is often required to be built underground and where the price of land is at a premium. With parking requirements reaching over 1 stall per residential unit, housing affordability can often be sacrificed for ample off-street parking. In King County, Washington parking was found to be anywhere from 10-20% of the total construction costs[5]. Even with parking making up such a large portion of construction costs, minimum parking requirements often force developments to build excessive parking. The same King County study found

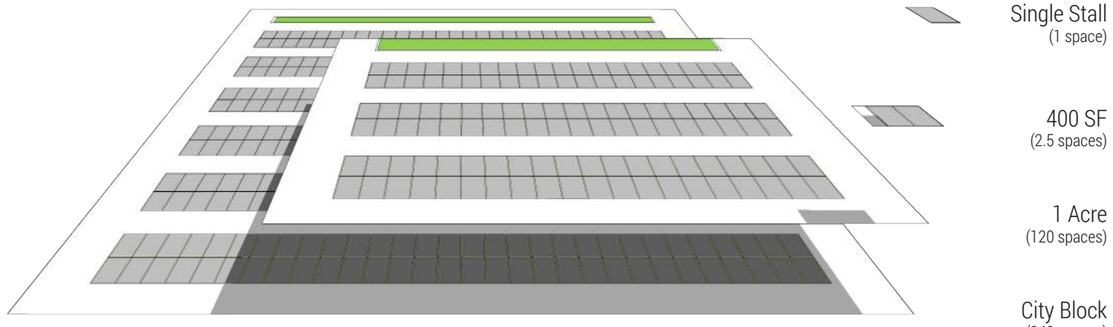

Diagram 1: Parking Stall Size Comparisons

that this excess parking development, on average, added $400,000 per development. Although parking was found to make up 10-20% of the construction costs, only 6% was recovered through parking fees, which, unless absorbed by the developer, would end up adding to a future tenant's rent[5].

The following table details the estimated costs of parking per stall throughout the King County region and what those figures end up meaning for future tenants[6]. To calculate these figures the Right Size Parking Project assigned an average land value cost based on location, job / residential density, and street network density. Average operation and maintenance costs for each of these types of parking facilities were then added to the capital costs and divided by the parking stall / unit ratio to determine the monthly costs per residential unit.

In a 2014 interview, Donald Shoup, well-known parking researcher, was quoted in saying "[the United States] is the Saudi Arabia of developable land"[7]. By this Shoup implied that many cities in America are sitting on an vast supply of potential wealth in the form of underutilized land. Without developing on these highly valuable pieces of property, cities forego the potential the revenue earned through property taxes and other fees. Research from the University of Connecticut concluded that the City of Hartford had lost $21 million annually in tax revenue by increasing its parking supply from 1950s levels[8]. Not only would developing on these valuable parcels increase revenue, but it would increase the city's density - making walking, biking and transit much more feasible in these otherwise car dependent environments.

The health implications of sedentary lifestyle brought on by automobile use are now well founded. A 2004 study in Atlanta found that with each additional hour in the car there was a 6% increase in the likelihood of obesity, while each additional kilometer walked showed a 5% reduction in obesity[9]. Diseases directly linked to sedentary lifestyle, such as diabetes and cardiovascular disease, are now annually costing hundreds of millions of dollars to treat. Reducing excess parking and other factors that perpetuate automotive travel will be important steps in reducing the costly impacts of these preventable diseases.

1.1.2 How Parking and Parking Requirements Shape Urban Form

Parking not only consumes large areas of usable land within a city, it dictates how developing buildings and structures will be made as well. Cities, such as Vancouver, often require a building's parking stock to be located on-site. While seemingly reasonable to want parking to be near the building it is intended to serve, these types of requirements can radically alter the form or cost of a project. Projects may need to buy neighbouring lots, excavate for expensive underground parking, change building material in order to build taller structures, or reduce the project's overall footprint in order to reduce the parking requirement. Many of these options produce undesirable results for a city's overall form. Buying neighbouring lots or shrinking the project's scale will reduce the area's overall residential and job density (and the project's floor to area ratio (FAR)), making walking, cycling, or transit less feasible. If the project elects to raise or bury its parking supply, the additional costs of supplying structured parking will likely be passed onto the building tenants. Through minimum and on-site parking requirements, cities are effectively lowering their densities and overall affordability.

Diagram 2 illustrates how these different strategies for meeting parking requirements impact the proposed lot and its surrounding block. While this example uses a relatively small parking requirement (1 stall per unit), it can be seen that if the requirement was raised to a not uncommon rate of 1.5 or 2 stalls per unit, and implemented over the entire block, the neighbourhood's form and character would be dramatically altered.

Table 1: Parking Costs by King County Region

		Total Capital Costs		Monthly Costs per Unit	
Suburban	Surface	Total Stalls x	$7,069	Parking Ratio x	$76
	Structured	Total Stalls x	$26,950	Parking Ratio x	$242
Urban	Surface	Total Stalls x	$23,269	Parking Ratio x	$177
	Structured	Total Stalls x	$31,583	Parking Ratio x	$275
CBD	Surface	Total Stalls x	$40,817	Parking Ratio x	$344
	Structured	Total Stalls x	$72,166	Parking Ratio x	$480

Note:
Total Capital Costs = Land & Construction **Monthly Costs per Unit** =Land, Construction, Operation, and Maintenance

1.1 - Summary

- In King County, parking construction was found to add between $76 and $480 to monthly rent depending on parking type and suburban or urban location

- Parking breaks up city streets and sidewalks, lowers area densities, and creates inhospitable pedestrian environments

- Occupying urban areas with parking costs cities tax revenue. Estimates in Hartford, CT concluded the city loses $21 million annually from lots added since 1950.

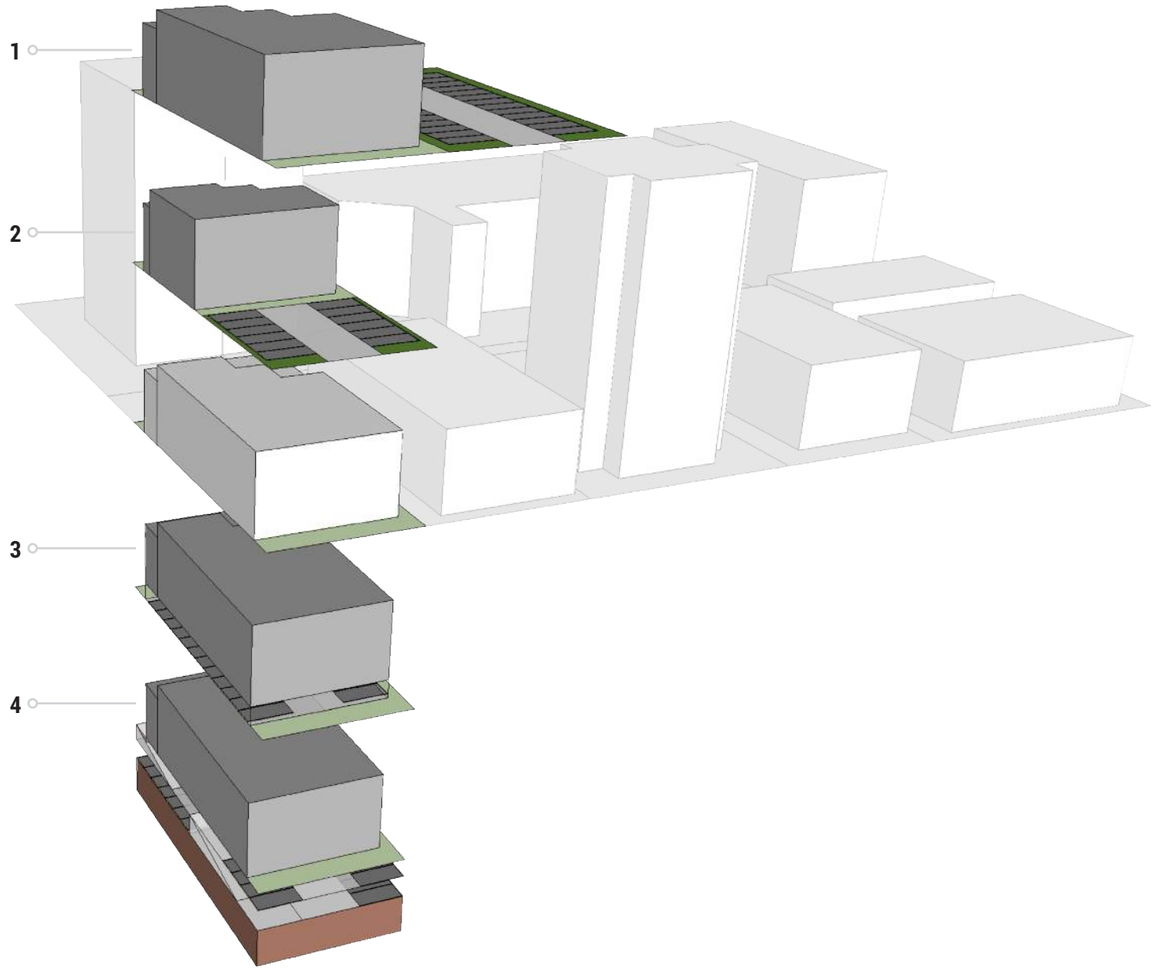

Diagram 2: Strategies for Meeting Parking Requirements

(1) Acquire Neighbouring Lots
- Reduces area density
- Shrinks housing stock or office / commercial floor space
- Creates undesirable walking environments

(2) Reduce Project's Floor to Area Ratio
- Reduces area density
- Separates building from street
- Creates undesirable walking environment

(3) Elevate Building Above Parking
- Creates undesirable walking environment
- Increases construction costs
- Reduces building accessibility

(4) Excavate Site for Underground Parking
- Increases construction costs
- Reduces building affordability

1.2 Vancouver's Parking Policies & Their Relations with Larger Planning Initiatives

1.2.1 How Parking Impacts both Land Use and Transportation

The City of Vancouver, like most North American cities, has historically been shaped by projects centered on appeasing automobile traffic. More so than any other mode of travel, cars require large swathes of land for navigation and more importantly storage. Requirements for accommodating vehicular travel often leave the surrounding landscape barren and inhospitable for pedestrian, bicycle, or transit use. Inevitably, dedicating large percentages of thoroughfares and right of ways to cars leaves little for any other use. Opportunities for vegetation, sidewalk amenities, or bike lanes are quickly eliminated as roads are widened to achieve maximum vehicular flow. Unsurprisingly, these types of environments generally have relatively low pedestrian, cyclist, and transit mode share numbers. Pedestrians are asked to walk alongside speeding cars, yield to cars entering and exiting numerous cuts in sidewalks, and walk along hollow cityscapes - void of street activity as large expanses of surface parking breaks up building facades. The City of Vancouver has identified these conditions as serious hindrances for achieving its transportation initiatives and has outlined several key strategies for reducing the negative repercussions of excess parking and automobile dominance.

In Transportation 2040, the City identifies parking management as "one of the biggest opportunities to support a smart and efficient transportation system"[10]. With this approach in mind, the City of Vancouver has outlined several key provisions that are needed in order for the City to accommodate vehicular travel without promoting it as the sole form of travel. Particularly relevant to utilizing parking as a shared resource are the proposed motor vehicle policies: M2.1 (Use off-street parking requirements to support reduced auto ownership and use), M2.4 (Approach parking as a shared district resource), and M2.7 (Manage parking in neighbourhoods).

Parking is, and will remain, an essential element of the City's transportation infrastructure. What these three policies, in partnership with Vancouver's other parking and transportation initiatives, allow for is assurance that parking will not dictate a city's mode choice. Utilizing parking as a shared resource permits parking to be managed at neighbourhood and district levels, reducing the amount of overall land dedicated to parking infrastructure as creative partnerships are formed. In turn, this means more land can be put towards future developments or can be made into valuable pedestrian amenities. Through these changes the City is better equipped to meet its larger mode share goals, as people trade car trips for new, hospitable pedestrian and transit opportunities.

1.2.2 Overview of Current Bylaws, Requirements, and Exemptions

Current City of Vancouver bylaws offer some progressive approaches for reducing parking's impacts on the urban realm, but more can be done to ensure all forms of transportation can thrive throughout the city. As seen in Table 1, the City of Vancouver offers several different opportunities for developers to reduce the amount of parking required for a given project. That said, Vancouver still has relatively high parking requirements, especially for how little most of the city relies on the automobile. Using the present day West End neighbourhood as sample area, Table 2 examines how different bylaws have resulted in varying amounts of parking supply. Using the current number of units and residential square footage, this table examines what would happen if all of the multi-family buildings in the West End adhered to

Parking Reductions and Exemptions in the City of Vancouver (2015)

Allowance	Reduction
Shared Vehicles / Shared Parking Stalls (City Wide)	1:5 Ratio (maximum of 1 shared vehicle / stall per 50 DUs)
Shared Vehicles / Shared Parking Stalls (Downtown)	1:5 Ration (no maximum)
Shared Vehicles / Shared Parking Stalls (Market Rental)	Market Rental - 1:5 Ratio (4 shared vehicle + 4 shared stalls per 100 DUs)
Within Two Blocks of Rapid Transit / FTN	10% reduction of minimum parking requirement
Small Car Spaces	Up to 25% of parking requirement (up to 40% with city approval)
Senior Housing	1 stall per 6 DUs
Low Income Housing	1 stall per 2 DUs
Payment in Lieu	$20,200 per stall removed from requirement (contingent on City approval)
Transit Passes for Secured Market Rental Units	Buildings that reduce their minimum parking requirement by having close proximity to transit must offer residents passes for the life of the building

Table 2: Parking Reductions & Exemptions in Vancouver, B.C. (2015) [DU = Dwelling Unit / FTN= Frequent Transit Network]

Multi-family Parking Space Requirements In the West End for Different City of Vancouver Bylaws

Multi-family Housing Type	Number of Buildings (2015)	Number of Units (2015)	Residential SF (2015)	1956	1964	1975	1986	1987	1995	2000	2015
Market CO-OP	15	640	626,408	447	550	712	737	727	727	768	768
Non-Market Rental	38	1,654	1,042,548	745	915	827	827	827	827	827	827
Strata	159	6,136	6,151,861	4,394	5,398	6,991	7,237	7,144	7,144	6,890	4,082
Stratified Market Rental	12	324	300,018	214	263	341	353	348	348	336	199
Unstratified Market Rental	412	19,293	12,814,841	9,153	11,245	14,563	15,076	14,882	14,882	14,352	8,504
Non-Profit Rental	3	137	68,571	49	60	69	69	69	69	69	46
Other Rental	16	1275	842,770	602	740	958	991	979	979	979	559
Totals	**655**	**29,459**	**21,847,017**								
Total Number of Stalls Required Under Each Bylaw				**15,605**	**19,170**	**24,460**	**25,291**	**24,976**	**24,976**	**24,220**	**14,985**
Average Number of Spaces per Unit Under Each Bylaw				**.53**	**.65**	**.83**	**.86**	**.85**	**.85**	**.82**	**.51**

1956 Compared to 2015	**104.27%**
1964 Compared to 2015	**128.09%**
1975 Compared to 2015	**163.25%**
2000 Compared to 2015	**161.47%**

Table 3: Changes in Required Parking Spaces for Different Parking By-laws in the West End Neighbourhood

Municipal Policies Currently Used for Reducing Excess Parking				
Strategy	**Description**	**City**	**Impact**	**References / Examples**
Zero Parking Minimums	Buildings within specified districts need not construct parking	Seattle, WA Denver, CO San Francisco, CA	Seattle parking construction decrease chart	Seattle, WA: Municipal Code 23.54.015 Denver, CO: Zoning Code 7.4 San Francisco, CA: Section 151
Unbundled Parking	Parking Stalls are required to be sold separately from residential units	Bellevue, WA San Francisco, CA	Residents can choose wether or not to purchase parking with their property. In Bellevue, properties must sell the parking spaces for more than the price of a transit pass.	Bellevue, WA: Section 14.60.080(B)(1)(c) San Francisco, CA: Section 167
Shared Parking	Owners of underutilized spaces may lease stalls to neighbouring residents or businesses	Long Beach, CA Seoul, South Korea	Utilization of existing parking is increased while the need for new parking decreases	Long Beach, CA: Community Parking Seoul, SK: Barter, 2011, p. 46
Parking Benefit Districts	On-street or off-street parking facilities pool the revenue and apply the earnings towards common amenities (security / cleaning / transit)	Boulder, CO Pasadena, CA Barcelona, Spain	blocks or neighborhoods can directly see the revenue being applied to added security or beautification efforts	Boulder, CO: Weinberger, 2010, p. 56-49 Pasadena, CA: Kolozsvari & Shoup, 2003 p. 2-7 Barcelona, SP: Kodransky & Hermann,2011,p.34-37
Parking Scans	Require projects to scan the surround area for potential shared parking arrangements before construction	Stockholm, Sweden	Utilization of existing parking is increased while the need for new parking decreases	Stockholm,SE: Kodransky & Hermann,2011,p.56-61
Parking Supply Cap	A certain stock of on-street and off-street parking is determined and old spaces must be removed in order to construct new parking	Zurich, Switzerland Hamburg, Germany	Both Zurich and Hamburg have been able to transform reclaimed spaces into bike lanes and other amenities	Zurich, CH: Kodransky & Hermann,2011,p.68-72
On-Street / Off-Street Price Leveling	On-street parking prices are increased to comparable levels of surrounding off-street facilities	Stockholm, Sweden	Spillover from off-street facilities is reduced as street parking becomes less advantageous	Stockholm, SE: Kodransky & Hermann,2011,p.56-61
Restrict on-street parking	Residents with off-street parking access cannot purchase on-street passes	Vancouver, WA Tokyo, Japan Toronto, ON	Ensures neighbourhood residents are not competing against multi-family residents for cheap on-street parking. In Toronto, a three level tier system gives priority to residents who do not have access to off-street parking. Afterwards, If permits are still available, those who have off-street parking access may apply.	Vancouver, WA: Section 19.08.010 Tokyo, JP: Barter, 2011, p. 73 Toronto, ON: On-Street Permit Parking

Table 4: Current Parking Reduction Strategies, National and International

the respective year's bylaw. The other years listed in the table either mark dates where the parking bylaw was altered or offer snapshots of how parking requirements compared during a given decade. In 1964, the parking bylaws requirements were increased. In 1975, specific parking regulations were introduced for the downtown region. 1986 and 1987 mark the years before and after Vancouver made parking its own bylaw (6059). Parking requirements remained steady throughout the 1990s and then began to decrease in the 2000s. Ultimately, after nearly 60 years of parking regulation changes, Vancouver has returned to where it originally began with parking regulations and continues to search for the appropriate parking requirements.

In comparison to other North American cities, Vancouver lacks several key parking provisions other transit oriented cities are pursuing. Most notably Denver, CO; Portland, OR; and several cities in Washington state all have ambitious policies and strategies geared towards reducing or eliminating the need to construct new parking. These comparable cities have either established shared / district parking systems or they have implemented other reduction strategies that Vancouver could use to improve its current parking framework. On a global level Stockholm, Zurich, Belgium, and several Asian cities also offer progressive parking policies for ways to encourage transportation alternatives through parking reform. As a brief overview of how other cities approach parking strategies, Table 3 compiles methods used by North American, European, and Asian cities to mitigate excess parking and on-street parking spillover. It should also be noted that while the City of Vancouver has relatively low single occupancy vehicle mode share, it, by comparison to other North American cities, has fairly high parking requirements[11].

1.2.3 Fitting in with Transportation 2040 Goals

Outlined in Transportation 2040, the City of Vancouver acknowledges that parking is intrinsically tied to numerous facets of the City's larger goals associated with transportation, safety, and land use. The listed strategies establish how parking can be used to reduce car ownership, improve the pedestrian realm, and promote other modes of travel. These provisions recognize that parking, in order to promote more compact, pedestrian friendly, environments, must be seen as a shared and flexible resource. This will lessen the amount of land dedicated to parking and reduce the amount of potential conflict points along thoroughfares where sidewalks are broken by curb cuts. Through these improvements, Vancouver will take large strides towards achieving its overall safety goal of zero traffic related fatalities. Likewise, creating safer walking and cycling environments will be essential for meeting future mode share goals. Parking is a resource that will not, nor should, disappear from cities. What this document, in partnership with Transportation 2040, aims to do is examine how to mitigate the negative impacts parking imposes on other modes of travel, land use, and the overall urban realm.

In addition to aiding other transportation initiatives, efforts to reduce parking also support Vancouver's three pillars of sustainability - economy, people, and the environment. Parking management strategies, like district and shared parking, not only reduce the demand for off-street parking facilities, but also provide economic benefits through new opportunities. As some parking facilities become underutilized, or unnecessary, lots in highly developable areas will become available for either new developments or community amenities. Not only can these reductions in parking create more pedestrian amenities, but can also make urban environments safer through reducing the likelihood and severity of collisions through lighter and slower automobile traffic. Ultimately, all of these positive externalities connected to reduced parking also benefit the surrounding environment. Reduced reliance on automobiles, denser communities, and an overall reduction of surface area dedicated to impermeable surface parking will lessen the burden urban environments place on natural systems.

1.2 - Summary

- Parking impacts both land use and transportation as it hollows out cityscapes while promoting auto use and deterring other forms of travel.

- Vancouver's parking requirements have returned to levels found in the 1950s, but are still quite high when compared to comparable cities

- Parking policy, specifically promoting shared parking, will be an important steps in achieving Vancouver's larger transportation, safety, and land use initiatives.

Mode Split (Commute to Downtown Houston)
SOV - **56.8%** Carpool - **9.3%** Transit - **32%** (P&R - 25.8%) Walk **1.2%** Bicycle **0.3%**

Houston, TX
1000 m

Vancouver, BC
1000 m

Mode Split (Commute to Metro Core)
Auto Driver - **29%** Auto Passenger - **8%** Transit - **25%** Walk **33%** Bicycle **5.2%**

Diagrams 3 and 4 - Comparing Mode Splits to Land Dedicated to Parking

1.3 Shared / District Parking Overview

1.3.1 What are Shared and District Parking?

Shared parking is not a new idea. Ad hoc parking relationships have existed for just as long as off-street parking itself. Simply put, shared parking is the practice through which two or more businesses use the same parking stalls to meet their parking requirements. Facilities with additional parking either sell their excess to neighbouring businesses, or partner with a building or service that has a different parking schedule. While traditional shared parking strategies have involved churches, movie theatres, or other venues with irregular hours, growing costs of parking construction and improved technologies are even making creative partnerships between standard business hour facilities more feasible. Similar to shared parking, district parking pairs nearby businesses and residential properties together to maximize the use of parking spaces in order to alleviate the need for new construction and reduce current on-street parking congestion. In doing so, parking can be viewed as a holistic, system-wide utility - allowing parking to be constantly utilized and building owners to maximize the return of their investments on parking infrastructure.

King County Metro's Right Size Parking study, and numerous other parking utilization projects, demonstrate that parking is both oversupplied and inconsistently utilized. Shared parking looks to make use of this stagnant resource in order to prevent future waste. In 2011, Metro surveyed nearly 240 residential developments and found that parking is, on average, oversupplied by 40% (supplied at 1.4 spaces per unit, but utilized at only 1 space per unit)[5,12]. In comparing suburban areas to the CBD, it was found that suburban developments built parking at a rate of 1.6 stalls per unit with a 1.2 stalls per unit utilization, while the CBD had a .8 and .59 stalls per unit supply and utilization rate. As residents leave for work, daytime utilization rates drop even further. Without proper planning, these spaces will continue to go underutilized or completely unoccupied. This will lead to further demand for new parking facilities that will only see similar utilization rates. Shared parking looks to address this wasteful practice by using the vacant supplies- thus reducing, or eliminate, the need for developments to dedicate land and funds to unneeded parking.

Chapter 2 of this report will detail five different approaches to shared parking currently being used in North America and abroad. These five strategies include:

Alternate Schedule Partnerships,
Mixed Use Development,
On- Street + Off- Street / Leased Parking Strategies,
District Parking, and
Capped Parking.

Alternate schedule partnerships include some of the more traditional approaches to shared parking. In this strategy, buildings whose occupants require parking for differing days of the week, or times of the day, can group some or all of their parking supply at the same facility. Traditionally, this would require both parties' minimum parking requirement to be individually met within the same lot. What this partnership allows is for the two facilities to only have to accommodate the peak parking demand between the two operations. In doing so, both parties not only save money by not having to construct unneeded parking, but can also split the operation and maintenance costs for the parking facility.

Similar to the alternate schedule partnership, **mixed use development strategies** allow parking minimums to be reduced for land uses with differing parking needs. The premise behind mixed use development shared parking is to reduce the quantity of parking stalls before a structure is even built. In addition to the numerous other benefits that come with mixing land uses is the potential to reduce the amount of required parking. If a building can successfully demonstrate that the two separate elements of a building (office/commercial, commercial/residential, residential/office) need less parking than their combined minimums through parking time table studies, then the project can elect to build just the amount of stalls needed to satisfy peak occupancy.

On- Street + Off- Street / Leased Parking Strategies look to make unoccupied, private stalls available to commuters or relieve congested city streets. By allowing building owners to rent currently vacant parking supplies, cities can address concerns about inadequate parking opportunities without having to invest further in expensive parking construction. Additionally, building owners are able to maximize on their investments by turning a profit on stalls that were previously empty. Depending on the business model of the program, these unlocked private stalls can either be used to target specific issues within a city (expand commuter parking opportunities or relieve on-street parking congestion) or can be opened to the general public.

District parking is a strategy based around the idea of using parking as a communal utility. If a new project requires parking for its occupants, it can partner with surrounding properties to satisfy this need so long as the partnering facility is within an established walkable distance, can prove their excess parking exists, and signs a covenant to guarantee the use of the parking. In order to make these policies feasible, properties must be permitted to establish parking outside of the parcel.

The final strategy discussed in the next section is c**apped parking.** Like district parking strategies, capped parking views parking as a holistic, systemized component. A city identifies a certain quantity of parking for an area and new projects must remove existing stalls if it is to place parking within the development. In doing so, parking supply can be efficiently controlled, and curbside parking can be reclaimed for other civic amenities.

1.3.2 Why Shared Parking is Necessary for Vancouver's Transportation, Land Use, and Affordability Goals

Land use and transportation are intrinsically tied. Land use patterns can inform how successful different styles of travel perform and, in turn, different forms of transportation nurture varying styles of spatial layout. Inherently, those areas that choose to invest heavily in auto-infrastructure will have to dedicate substantial areas of land to housing these vehicles. Studies examining Houston, TX's downtown urban fabric determined that surface parking alone made up between 21-27% of all surface area[13]. When combined with roads, surface areas dedicated exclusively to automobiles jumps to nearly 51%[13]. With so much area dedicated to automotive travel, Houston's commute rates for walkers and cyclists (1.2% and 0.3% respectively) are understandably low[14]. While not an exclusive reasoning for why Vancouver's Metro Core has larger shares of walking, biking, and transit than Houston, these surface area percentages are telling figures for what mode of travel each city has elected to support.

From an aerial view, Vancouver, especially the Metro Core, does not appear to dedicate the same excessive amounts of land to parking. Even so, current parking supplies in Vancouver have been found to be underused, or are unavailable to potential users. This often leads to on-street parking congestion and perpetuates the perception that the parking supply needs to be expanded. If the demand for parking is able to be consolidated into fewer, shared parking facilities more land could be dedicated to other uses. Further, reductions in parking allotments have the potential to promote more nurturing walking and cycling environments. By steering transportation and land use patterns away from heavily consumptive automobile systems, larger areas will exist for the City of Vancouver's other citywide initiatives.

Despite its mundane image, parking will continue to play a vital role in many of the City's efforts to remain an accessible and affordable community. The high costs of constructing and maintaining parking supplies directly impact a city's ability to remain accessible to all income groups. Todd Litman of the Victoria Transport Policy Institute notes that on the national level in the United States, structured parking costs roughly $15,500 per stall[15]. With these figures in mind, in addition to his estimates that these facilities require resurfacing every 5-10 years and major reconstruction every 20-40 years[15], the prospect of sharing these evermore expensive costs between multiple parties becomes more appealing. Likewise, the opportunity costs of dedicating large areas of land to unproductive parking spaces can be costly for businesses as well. As previously noted, and even without considering maintenance or opportunity costs, parking construction can consume up to 20% of overall building costs. This sizeable increase in cost is often placed on potential buyers, making units that were once within budget no longer financially feasible. Further, these increases are more detrimental for low income housing residents as the increases in construction costs will make up a larger portion of their monthly rent than higher priced apartments.

1.3.3 Current Obstacles for Shared Parking in Vancouver

While shared parking offers a great potential for addressing many transportation and land use issues, there are still hurdles that must be addressed in order for these potential partnerships to flourish. In Vancouver, there remain several key legislative barriers stopping progressive parking strategies, like shared parking, from becoming feasible. Currently, Vancouver's parking bylaw does not permit parking stalls to fulfill parking requirements for multiple uses. Although the bylaw permits parking to be combined in multi-use developments, the minimums for each use must be calculated separately, except when the project is specifically authorized by the Director of Planning and the City Engineer[16]. Provincially, the BC Strata Property Act also causes roadblocks for an efficient parking system. Under this act, parking stalls cannot be sold independently from their paired property[17]. In doing so, excess parking becomes difficult to sell or lease and property owners cannot take full advantage of their stalls. Once these current legal barriers are addressed, new issues may arise with what percentage of parking stalls are eligible to be shared. Will only completely vacant stalls be available, or can stalls left during the day or night be shared as well? These currently blanketed policies do not allow for creative solutions to parking requirements, and do not help promote settings conducive to the City of Vancouver's land use and transportation initiatives. Without reexamining these current bylaws and acts, only so much can be done to improve Vancouver's parking overages.

The next issue Vancouver must address in terms of parking is data collection. Currently Vancouver and the GVRD have little data about the times stalls are used, utilization, or even the number of stalls that exist. All of these pieces of information are necessary not only for developing informed decisions about how to address parking, but are needed to make the case that parking surplus does exist throughout the city and proper alterations could remedy the solution. In order to obtain this much needed data, parking facilities must start installing entrance/exit gates, or at least video surveillance to assess how many cars are in the facility and during what periods of the day. Without these crucial bits of information, Vancouver will continue to oversupply parking at the detriment of all other forms of travel.

Finally, the last obstacle will be convincing property owners and residents. Many owners and residents will be hesitant to let strangers into their building, but, if properly designed, these issues can also be alleviated. Making the parking secure is essential. If possible, residential parking and shared facilities should be on separate floors of parking structures and require keycard access. While this is not always feasible, many building owners and residents may be open to the idea if it is lucrative for all parties - the building owner has the opportunity to maximize on his or her parking investments and residents may be offered a reduced rate if they agree to share their spaces with outside users. Although building owners may be hesitant to be the first to venture into shared parking agreements, traction for shared parking will grow as parking facilities upgrade their monitoring / security and shared parking agreements become a commonplace.

1.3 - Summary

- Shared parking is the practice through which two or more businesses use the same parking stalls to meet their parking requirements.

- District parking is a form of shared parking that uses an zone's parking supply as an area resource. New projects can use current excess from other properties to alleviate the need for new construction and reduce current on-street parking congestion.

- Parking can often range from 10-20% of construction costs, which can greatly impact low income residents who generally place more of their income in housing.

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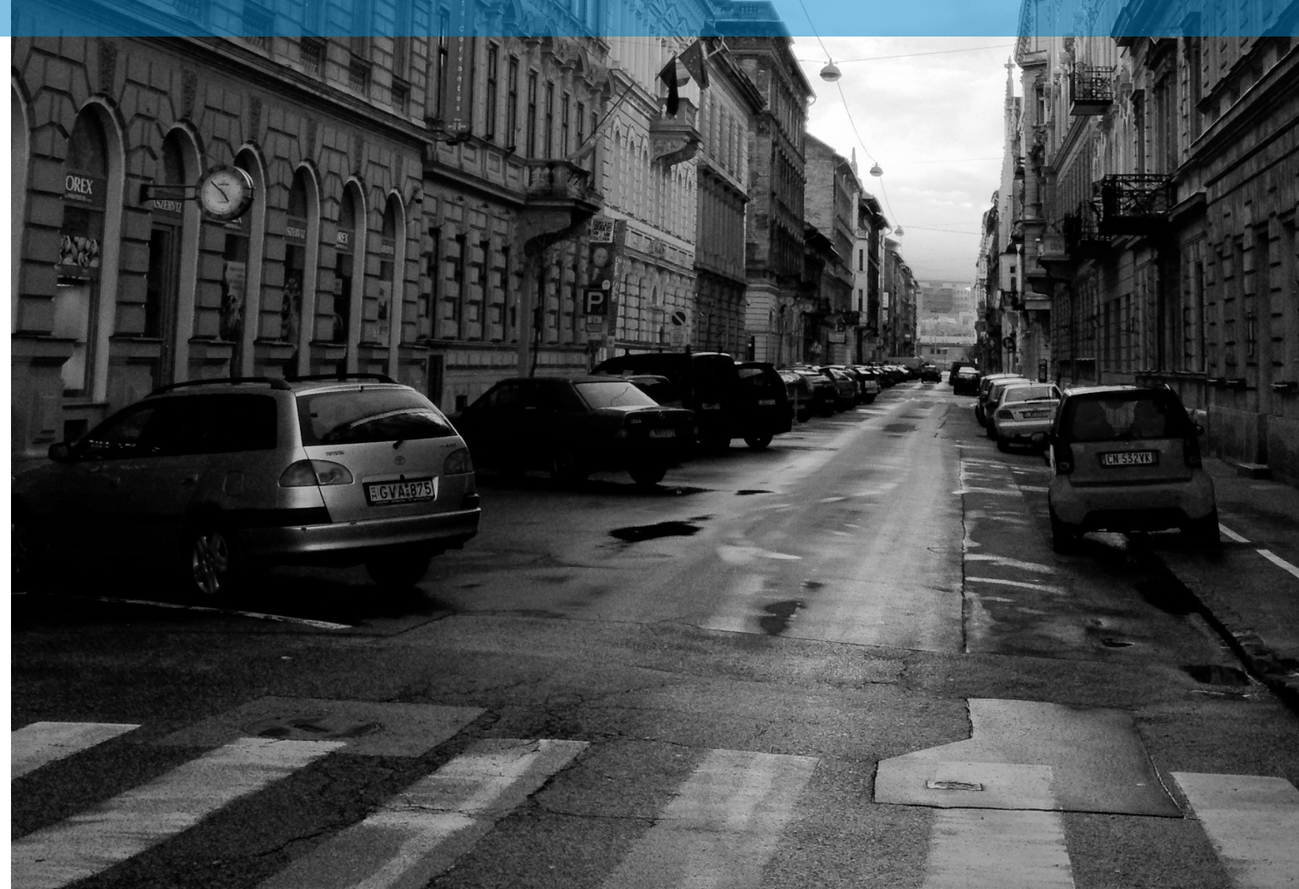
PART I -- SHARED / DISTRICT PARKING STRATEGIES



2.2 --Alternate Schedule Partnerships

Description

Not all land uses have the same parking demands. Because of this, many municipalities have enacted legislation to promote smart pairing of uses in order to reduce overall parking supply. Alternate schedule partnerships is the most traditional form of shared parking and relies on neighbouring land uses having different utilization schedules (traditionally, these pairings have featured daytime facilities such as offices, banks, and schools joined with nighttime or weekend operations such as movie theatres, auditoriums, or churches). Often times municipalities will require either a parking demand study and/or a contract to be signed between the two parties. Demand studies generally assess the current utilization of a parking facility and determine when and how many spaces are available to be shared. Alternatively, cities can establish shared parking reduction calculations to determine how much parking can be eliminated by different partnerships.

Policies Required for Implementation

- Allow facilities to lease excess stalls
- Allow parking supplies lower than the combined individual requirements through shared parking demand studies
- Permit parking to be located outside of the parcel it is intended to serve

Examples

-Waltham, MA: Section 5.2 (Off-street parking requirements)
(Waltham's parking code establishes a "Parking Credit Schedule Chart" to calculate the minimum parking requirements for different combinations of land uses)

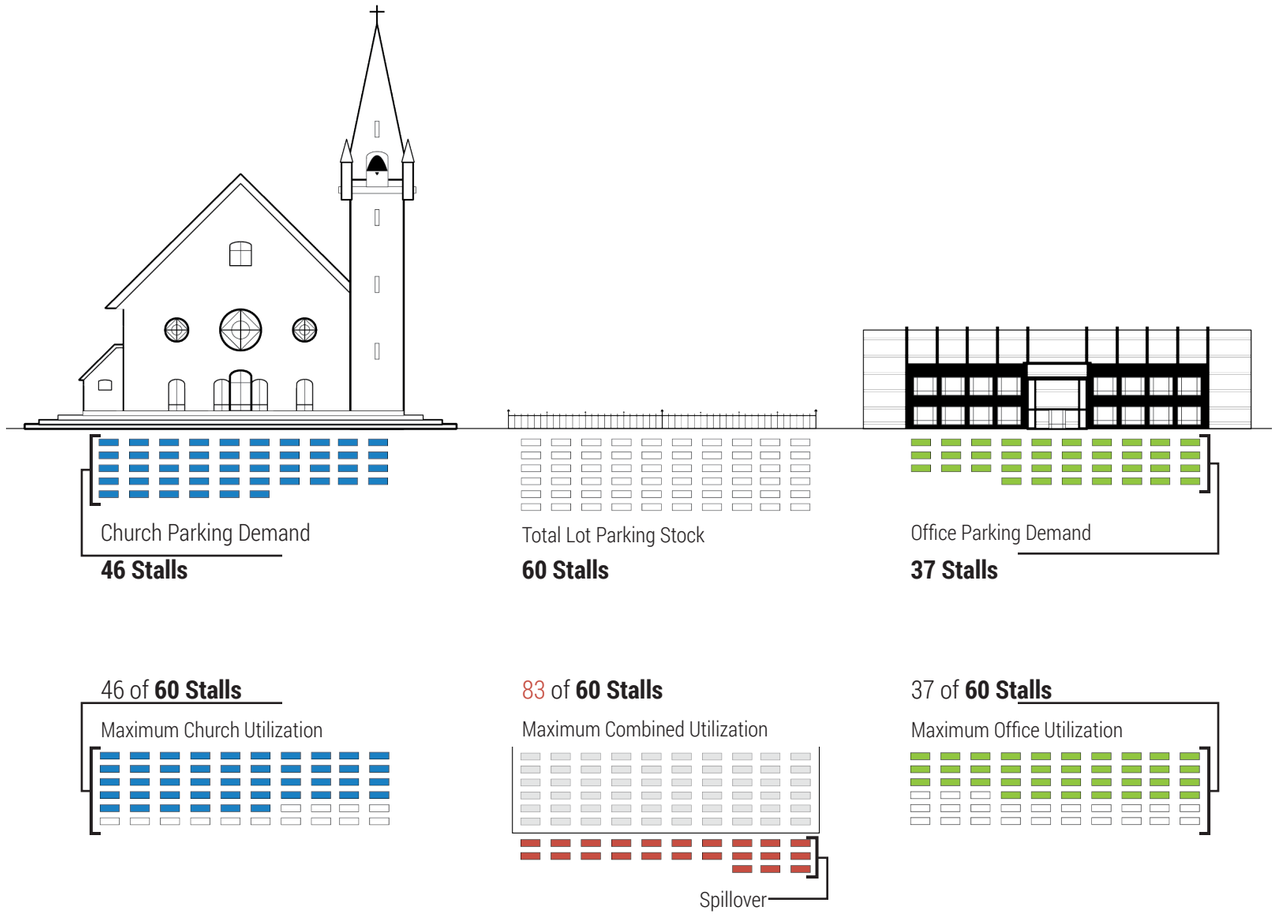
- **San Diego, CA Example Shared Parking Agreement**
(The following link details the standard terms and conditions of shared parking agreements - Example Agreement)

- King County Metro Park-and-Ride: Leased Lots Program
(Metro currently leases nearly 2,600 stalls over 66 lots. Many of these leased agreements are with area churches that are adjacent to major transit corridors. In exchange for small monthly fees, Metro is able to expand its park-and-ride network, giving more area residents the opportunity to use transit and fills otherwise vacant parking lots)

Illustrative Scenario

After expanding its facilities, an office could no longer house all of its parking on their existing lot. Instead of spending large sums of money to construct additional structured parking, the company looked to partner with a neighbouring church with excess parking. The church, having been built during the 1980s, had ample parking due to much higher parking minimums. Recent updates to the local municipal code allowed shared parking to reduce parking requirements by 90% as long as an authorized agreement between the two facility partners was established and a study demonstrated that peak demands did not overlap.

The combined parking demands of both the church and the office building could not be met by the current facility, but, given the varying schedules of use, both building's could meet their individual needs with the lot. As a result of this partnership, the office avoided costly parking investments and the church was able to lower the costs of operating and maintaining its parking facilities.



2.2 -- Mixed Use Development

Description

Modern development continues to shift away from single use projects, and cities are now tasked with developing new policies for nurturing these mixed use developments. As seen in the alternate schedule partnerships example, different land uses can often take advantage of differing parking demand timetables. Knowing these varying demands can also allow new developments to reduce the amount of required parking. By removing parking stall assignments, and allowing business customers or office employees to occupy the same stalls during off-peak residential hours, commercial and residential projects can reduce the amount of needed stalls and save hundreds of thousands in construction costs.

Policies for Implementation

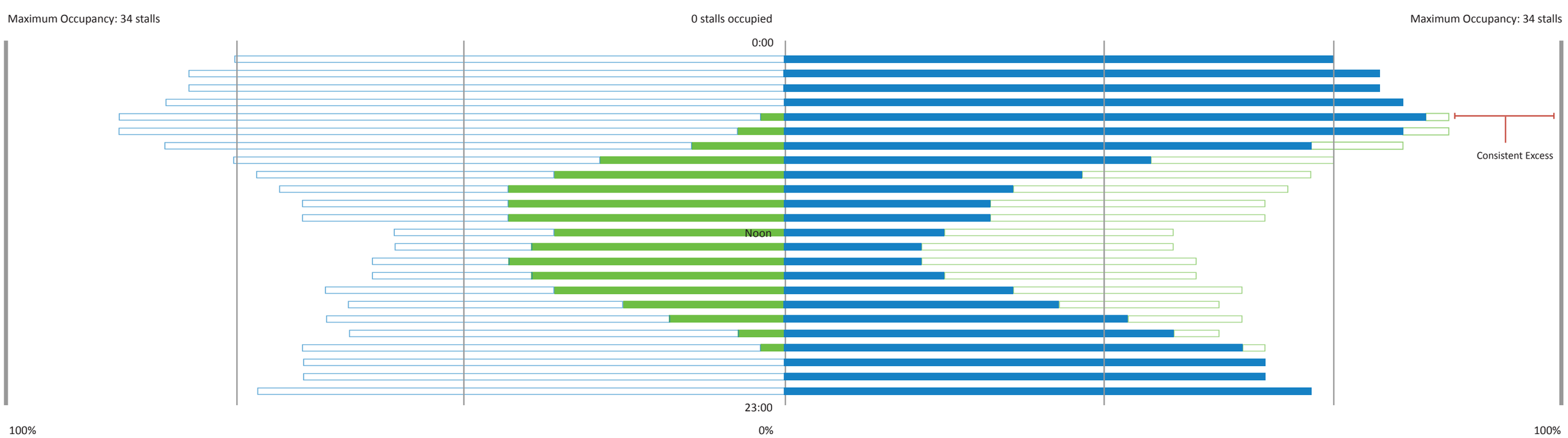
- Allow mixed use properties to reduce their minimum parking requirements based on shared parking standards
- Permit parking stalls to be utilized by the building's different occupants

Illustrative Scenario

The developer of a new mixed use project has determined the project will require 3 underground levels of parking in order to meet the minimum parking requirements for each individual proposed land use. Individually, the proposed 750m^2 of office space would require 12 stalls and the 28 1-bedroom apartments would require 28 stalls. Only 17 stalls can fit on each floor, meaning the third level of parking would be left primarily unused. To avoid this costly excess, the developer explores new legislation allowing land uses to utilize shared parking stalls to meet individual parking requirements. After exploring this new option, and calculating the shared parking requirement with the city's parking credit schedule chart, it was concluded that the project would only need 29 stalls. With this 11 stall reduction, the project only needed to construct 2 levels of parking, saving hundreds of thousands of dollars in construction costs and allowing the building to lower rents for future tenants.

Examples

- **Joule: Seattle, WA** (295 apartment units + 29,000 ft^2 of retail = 370 stalls)
- **300 Ivy: San Francisco, CA** (63 apartment units + 5,465 ft^2 = 35 stalls)
- **Cook Street Apartments: Portland, OR** (206 apartment units + 15,162 ft^2 = 146 stalls)



Utilization by hour of the day over combined parking minimums

Combined Minimum Requirements

	Combined Minimum Requirements	**(40 Stalls)**
750 m² Office Space	**1 stall per 100m² for first 300m² / 1 stall per 50m² after**	**12 Stalls**
28 1-Bedroom Apartments	**1 per unit**	**28 Stalls**

Parking Floor Layout	(**22m** x **40m**)
Parking Stall	**3m** x **6m**
One-way Aisles	**3m**

Shared Minimum Requirements

	Shared Minimum Requirements	**(29 Stalls)**
750 m² Office Space		**1 Stall**
28 1-Bedroom Apartments		**28 Stalls**

Parking Credit Schedule

	Weekday			Weekend	
	Night	Day	Evening	Day	Evening
Residential Requirements	100% (28)	60% (17)	90% (26)	80% (23)	90% (26)
Commercial Requirements	5% (1)	100% (12)	10% (2)	10% (2)	5% (1)
Total Requirements	**29**	**29**	**27**	**24**	**26**

2.3 -- On- Street + Off- Street / Leased Parking Strategies

Description

Excess parking often exists within large groups of buildings. In areas with older building stock, and consequently larger parking requirements, these surpluses can reach disproportionately high percentages. What this third strategy aims to do is unlock many of these currently inaccessible stalls for commuters, neighbouring residents, or visitors to the area. Depending on the target audience, and the desired outcome, business models will vary. The program can be entirely privatized, allowing the building owner to market his or her vacant stalls to the general public or a specific audience. Alternatively, a city could elect to partner with a group of building owners in an effort to supply stalls to certain users, like commuters or neighbouring residents. The city would agree to rent a certain amount of stalls for a fixed price with the owners and then distribute passes to area commuters or neighbourhood residents who would prefer to pay for a reserved parking stall. Regardless of the business model, this strategy is contingent on buildings being able to lease their currently under utilized parking. Cities must also determine if properties can only lease stalls that are vacant throughout the day or if stalls that are empty part of the day can be sold as well. As seen in the subsequent diagrams, allowing buildings to sell daytime vacancies as well can drastically increase the amount of available stalls. With new technologies allowing properties to track real-time usage and sell stalls accordingly, maximizing parking utilization is becoming increasingly feasible.

Policies for Implementation

- Separate housing costs from parking costs
- Allow buildings to sell, lease, or rent excess parking
- Require utilization studies to demonstrate excess parking

Illustrative Scenario

A city recently added a leased parking section to its parking code. This new provision allows new or remodelled properties to meet their parking requirements by partnering with surrounding buildings with excess parking. In order to do so, the new building must first identify potential partnerships through several queries. The property must be within close proximity to frequent transit (200m), designated as a multifamily property, and currently have at least 10+ vacancies. The two properties then calculate their peak demands independently, agree on how much parking can be accommodated within the current facility, and then validate the signed covenant for approval from the city.

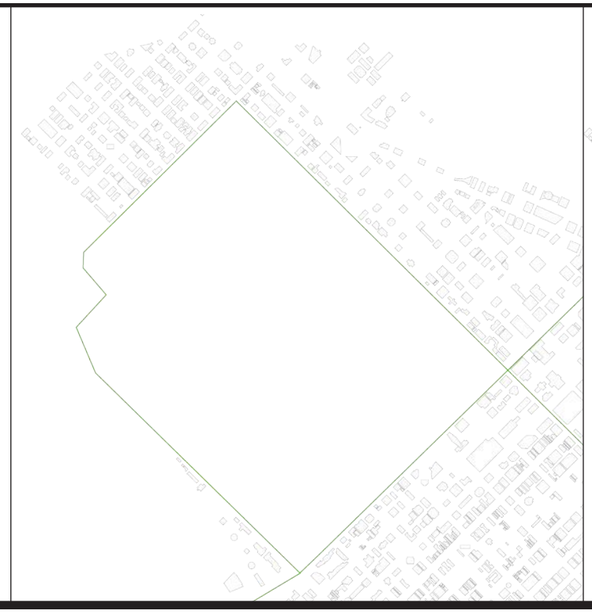
Examples

- Public Model
  - King County Metro: Multifamily Park-and-Ride
- Private
  - Toronto, ON: Rover **//** San Francisco, CA: MonkeyParking **//** Boston, MA: SPOT

Note - The legality of these private models has come into question. Previous models, such as Haystack in Boston, were outlawed because they attempted to profit off public parking. The new models listed above focus on off-street, privatized parking. In doing so, these companies pair owners of private parking with potential buyers instead of relying on public, on-street parking.

Selecting Potential Properties (these three filters demonstrate how cities can target what properties area appropriate for leased parking)

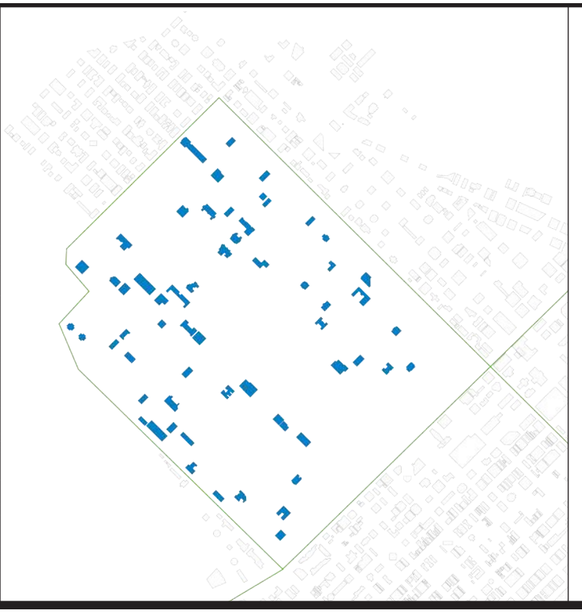
(1) Study Area

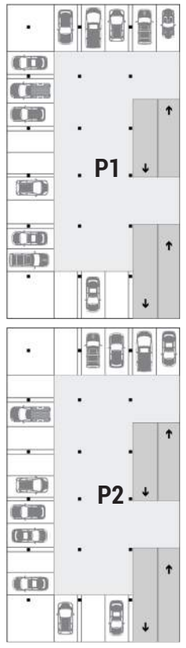


(2) Transit Access Filter (with 200m of frequent transit)

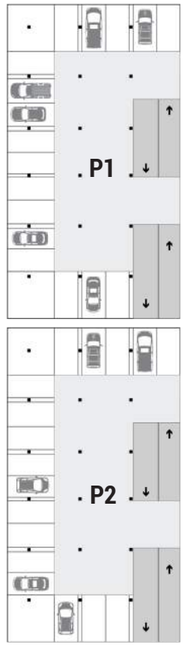
(3) Multi-family Properties Filter

Remaining Buildings with 10+ Parking Vacancies



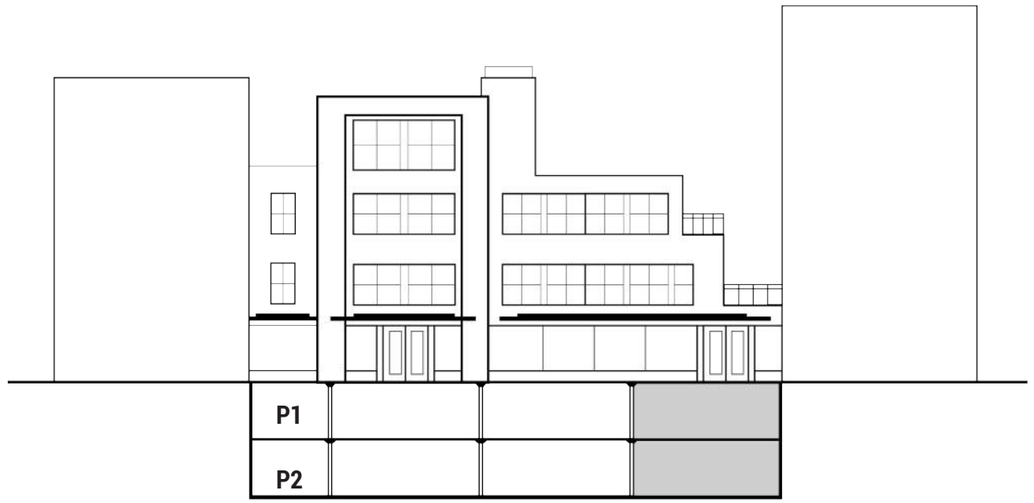


Existing 04:00 Utilization:
23 Vehicles



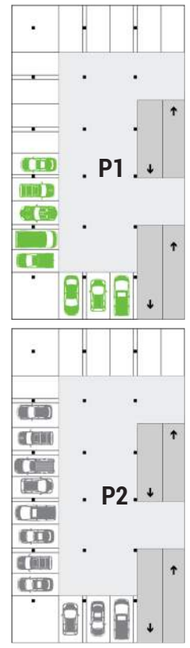
Existing 13:00 Utilization:
11 Vehicles

Differing Leasing Strategies- Depending on the parking demand timetables of the partnering properties, more stalls may be available than just the completely unoccupied stalls. if a residential building owner, and the residents, agree to lease certain stalls only during the daytime, then the available stock dramatically increases and fewer stalls remain unoccupied throughout the day.

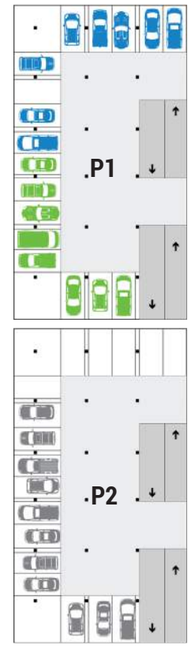


Unoccupied Stalls - A building owner makes the stalls that are currently unoccupied 24/7 available for neighbouring residents and employees to lease.

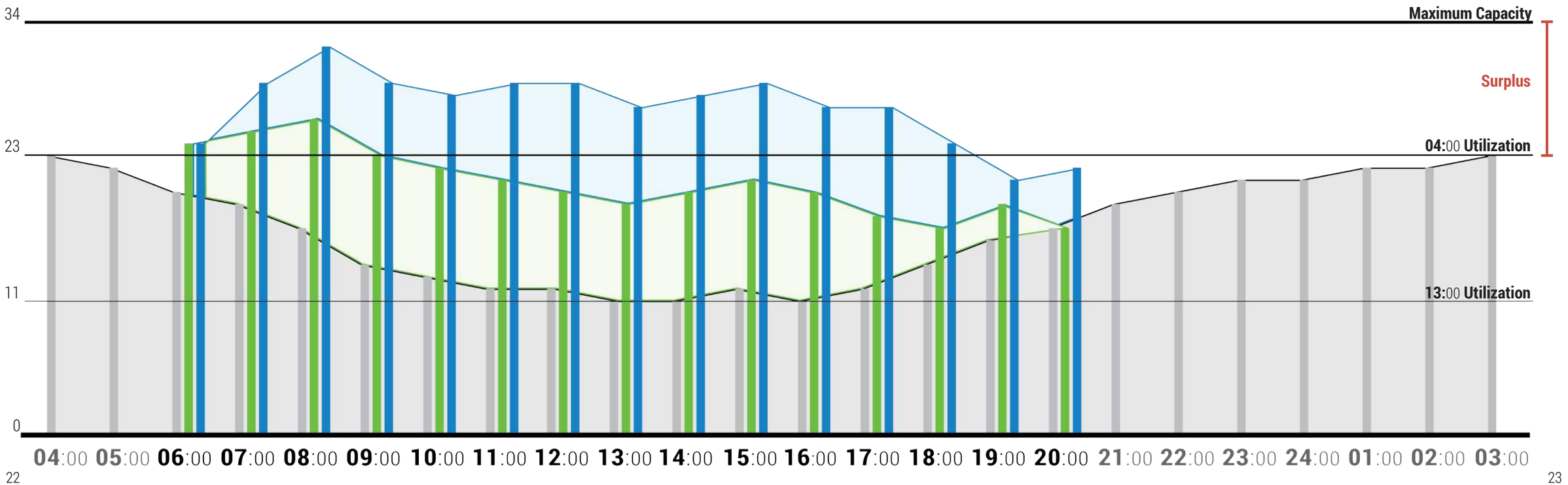
Shared Parking - A building owner reduces the price of parking for residents who are willing to lease their parking stalls between 6:00am and 8:00pm during the work week in addition to leasing unoccupied stalls.



Unoccupied Stalls 13:00
Utilization: **19 Vehicles**



Shared Parking 13:00
Utilization: **27 Vehicles**



2.4 -- District Parking

Description

District parking is a strategy used to make parking into a shared utility. Viewing parking as a shared resource allows properties to maximize their parking stock and reduce the area dedicated to vehicular storage. Every time a building is proposed, it must first search the surrounding area in order to assess if its parking needs might be met with current excess in other buildings. As long as a building can establish a partnership, or several partnerships, to share another building's parking resource, it does not have to construct new parking. These partnerships must be supplemented with a study detailing the current excess parking and also a formal agreement showing the duration of the partnership and how many stalls will be dedicated to each property. Properties can either lease the stalls that we built in addition to the minimum requirement or prove that the minimum required stalls are not being fully occupied through a parking utilization study.

Policies for Implementation

- Require buildings to search for partnerships before constructing new parking
- Allow buildings to supply their parking off-site
- Allow buildings to lease excess parking
- Allow buildings to demonstrate underutilized parking through utilization study.

Examples

- Seattle, WA: Capitol Hill (Pike Pine District Shared Parking)
- Stockholm Sweden (Kodransky & Hermann, 2011, p.56-61)

Illustrative Scenario

A city has recently identified over supply of underpriced parking as a major contributor to automobile use. Surveys of a neighbourhood discovered that buildings were, on average, 40% over supplied with parking. In an effort to curb this trend, and promote other forms of travel, the city is allowing new projects to forego parking construction if they can establish parking partnerships with surrounding buildings. The regulation stipulates that a building must complete a utilization study, sign a contractual agreement, and only partner with properties within 400 meters of the new project.

2.5 -- Capped Parking

Description

In areas where a city has determined that the current supply of parking is sufficient, or over supplied, capped parking can be an effective mechanism for maintaining these desired limits. Capped parking can also be implemented at a variety of scales and enforced in several ways. Limits can be established at a district-wide level, as seen in downtown Zurich, or at a smaller neighbourhood or block level. To enforce these limitations, projects can be required to help finance the removal of on-street parking or surface parking; alternatively, cities can restrict car registration to owners who can prove they have a location to store their vehicle. This approach should be limited to areas where parking supply is well understood and inventoried. In areas selected for this type of program, parking supply can be efficiently controlled and curbside parking can be reclaimed for other civic amenities. As seen through Boston's downtown parking freeze, these efforts can also be focused to specific types of parking or limited to a certain duration.

Policies for Implementation

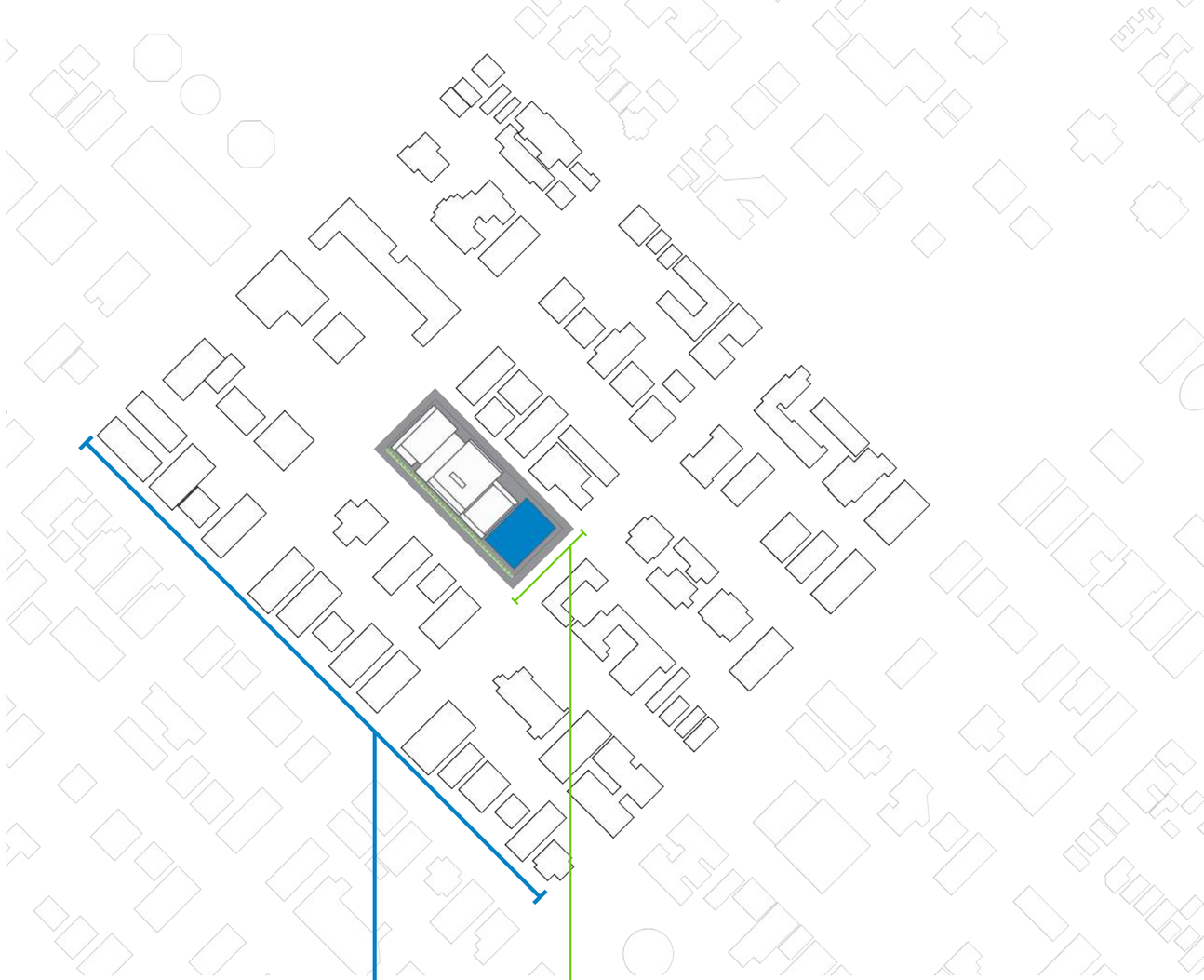
- Establish a maximum number of parking stalls for an area
- Require buildings to record and report parking supplies
- Allow buildings to meet parking requirements off-site

Examples

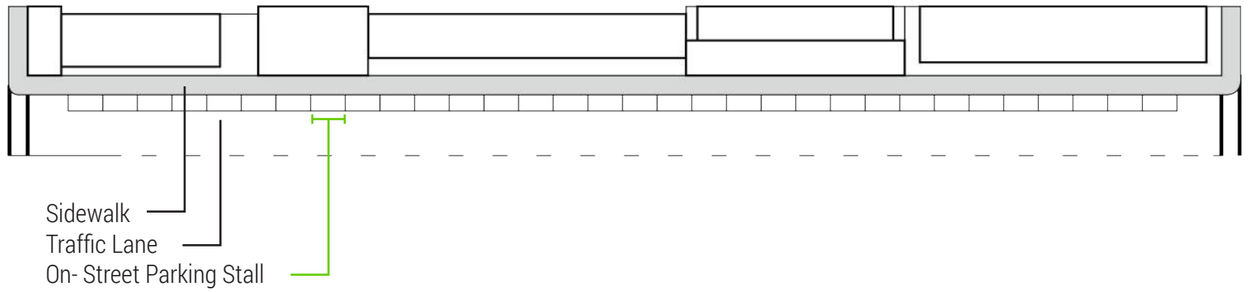
- Zurich, Switzerland (Kodransky & Hermann,2011,p.68-72)
- Tokyo, Japan (Barter, 2011, p. 73)
- Boston, MA (Parking Freeze)

Description

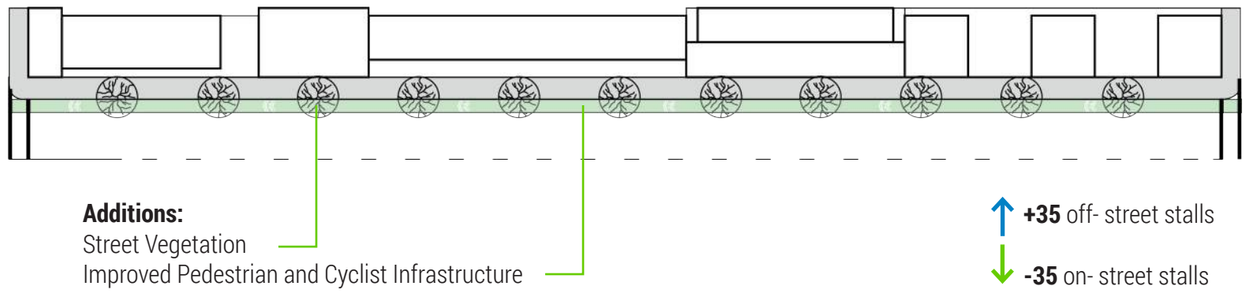
A city has recently conducted a detailed inventory of a neighbourhood's parking supply, finding that the area holds 2500 stalls. The city wants to use this neighbourhood as a pilot for a larger district-wide parking cap program and restricts each block within the area to keep its current stock of parking. A proposed project within the area calls for 35 new parking stalls. As a result of the new parking cap, the project also plans to remove the 35 adjacent street parking stalls. In exchange for being permitted to add off-street parking stalls to the area, the project agrees to help finance the installation of new street amenities including a protected bike lane and new street vegetation.



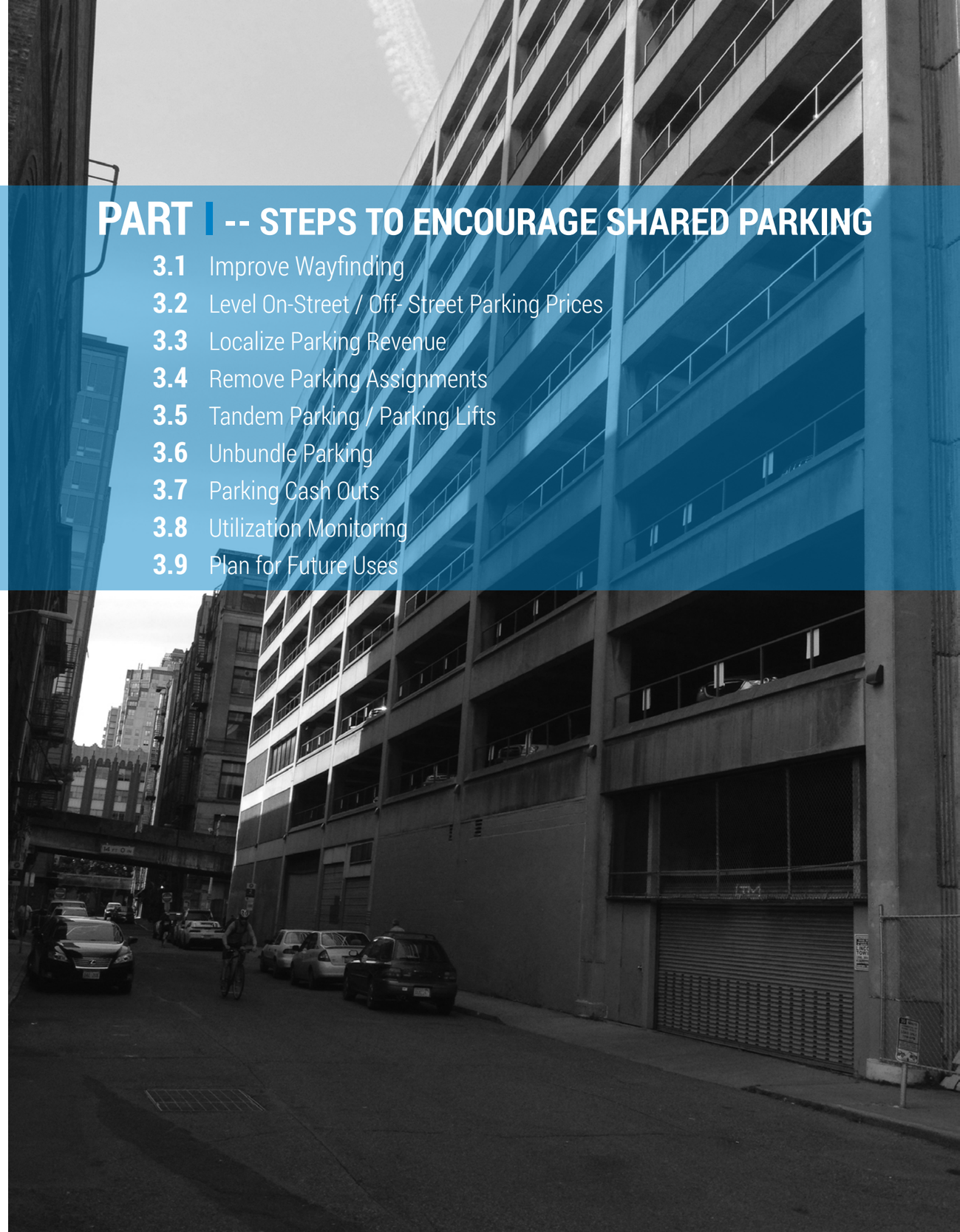
Current Supply by Block: **200 stalls** (35 on-street + 165 off-street)



Proposed Supply by Block: **200 stalls** (0 on-street + 200 off-street)



PART I -- STEPS TO ENCOURAGE SHARED PARKING



Steps to Encourage Shared Parking

Not all approaches to parking will be applicable to every site. Site specific approaches must be applied in order to not falsely predict parking demand, one of the reasons for excess parking supply to begin with. The following section provides an overview of potential strategies that can be used to promote shared parking systems. While none of these approaches offers a silver bullet for addressing parking issues, they do offer opportunities to maximize the potential of current supplies through technological advances and successful policies from an assortment of municipalities.

3.1 -- Improved Wayfinding

By improving wayfinding and signage, both inside and outside parking structures, facilities can reduce the amount of time users spend searching for parking and improve the likelihood their garages are full. Real-time vacancy numbers, price, and simple directions can all be placed at the exterior of buildings to improve user navigation. Once inside, additional parking counts and directions can expedite the parking process while also giving the parking managers better ideas for what their current occupancy rates are and where vehicles are located within the garage. These numbers are essential elements for understanding a facility's usage and assessing what stalls may be available to sell. Once installed, these systems can more accurately assess when and how often a building's parking supplies is used, which, when paired with data from neighbouring buildings as well, can help a city develop more precise codes and policies for parking in certain areas.

This information will also benefit current and developing parking technologies. Sharing this real-time occupancy data with software companies, allows customers to find, purchase, and reserve stalls before even arriving at their selected stall and greatly improves a facility's marketing. Instead of relying on returning customers or passersby, pairing with a parking app would allow buildings with open spaces to market to any interested customer.

Source: AFA Park

Source: Atrim Electronics

3.2 -- Level On-Street / Off-Street Parking Prices

In Vancouver, like most cities, the cost of on-street permit parking falls well below that of off-street parking. While the added security and reliability of off-street parking options should be sold at a premium, the discrepancy between the two options is often so large that even residents who have the option to buy off-street parking will choose the cheaper option outside the building. This leads to two directly related problems - parking shortages on the street and low utilization in off-street garages. In an effort to balance these supplies, Stockholm, like many other European cities, has begun to steadily increase the cost of on-street parking permits. In 2009, the City of Stockholm voted to increase on-street permit costs from 600 SEK to 700 SEK (90 to 105 CAD) /per month[18]. By comparison, off-street parking averages to be around 1200 SEK (180 CAD)[18]. Without increased costs, or restrictions on who is eligible for on-street parking permits, on-street parking congestion will remain a contentious and desirable commodity.

3.3 -- Localize Parking Revenue

Localizing parking revenue is a process to turn the earnings collected through parking fees into tangible benefits for the area the parking is intending to serve. Instead of having these fees return to a larger, city-wide fund, revenue can be used to improve sidewalks, lighting, and any other pedestrian amenities within the surrounding block or neighbourhood through the establishment of parking benefit districts (PBDs). One of the most notable PBD examples is Old Pasadena, CA where the addition of market rate parking meters produced an annual net revenue of $1.2 million per year for the area[19]. This revenue is used to make the annual payment towards the $5 million spent on street improvements, and, with the remaining funds, Old Pasadena can pay for additional services like added security and more frequent sidewalk cleanings[19]. Another successful PBD is found in Boulder, CO where several commercial blocks joined the parking revenue from all the meters in order to fund transit passes for their employees. In doing so, more street parking became available for customers as more employees chose to rider transit with their new Eco Passes. In 2011, $746,000 was put into the Downtown Employee Eco Pass Program and, as a result, pass holders were twice as likely to bike to work and three times as likely to walk or take transit to work[20].

While these programs have historically been focused around on-street parking, off-street shared parking partnerships could also establish benefit programs. If a collection of buildings were to start leasing spare parking to neighbourhood residents or guests, the money earned could be put towards added security for the garages or standard operation and maintenance needs. Through these programs, building owners can reduce the amount they spend annually on facility costs while also using the shared revenue to increase customer and neighbourhood amenities.

3.4 -- Remove Parking Assignments

An approach to quickly promote shared parking opportunities is to remove parking assignments. By having certain stalls assigned to each apartment, a building loses its flexibility for leasing it's available stalls. Alternatively, certain rows or levels can be dedicated exclusively for residents, guests, or leassees. This ensures that stalls are still reserved for residents that use them, but also allows for the occasional error of accident. Inevitably, a car will breakdown or someone will not be able to move their car in time before a resident returns. Having dedicated areas instead of specific stalls means that the arriving resident can still find another stall and won't have to park in another unit's space. Simple operational changes like this greatly improve the fluidity of a shared facility and eliminate many potential headaches of sharing parking with outside users.

3.5 -- Tandem Parking / Parking Lifts

In Vancouver especially, urban land is at a premium. Building owners and developers must now look for new ways to maximize the amount of livable / profitable space within a given parcel. Tandem parking and parking lifts offer ways to utilize previously empty areas. Tandem parking places together in one longer stall in order to maximize space. These spaces are usually occupied by the same tenant, but arrangements can also be made so that the person with the less accessible stall pays a reduced fee or is reserved to rarely used vehicles. Depending on the floor to ceiling heights of a garage, stacked parking can dramatically increase the amount of vehicle storage within a building. The design and capacity of stacked parking systems vary greatly, allowing for these systems to be installed in most buildings. These strategies can either be used to retrofit an existing garage in order to increase a building's parking capacity, or these strategies can be implemented to reduce the amount of area dedicated to parking from the very beginning of the project. In both cases, the land previously slotted for vehicle storage can once again be used for human benefit.


Source: Justin Adams


Source: Andrew Diseker

3.6 -- Unbundle Parking

Including the price of parking within an apartment or strata property is common practice. Inherently this leads to some residents paying for parking they do not use. "Unbundling" parking remedies this problem by selling parking independently from the housing unit. In turn, residents will purchase however much parking they need instead of leaving stalls permanently vacant. Cities, like San Francisco, CA and Bellevue, WA, have begun to require parking to be sold separately for this very reason. However, as previously

noted, provincial law currently prohibits parking spaces being sold separately from the unit they were originally connected to. Without altering this provincial law, many potential solutions for addressing existing parking surpluses will not be feasible.

3.7 -- Parking Cash Outs

Parking cash out is a scheme through which an employee can elect to give up their free parking in exchange for the monthly value of the stall. The logic behind the program focuses on that those who take transit, walk, or bike to work are not receiving the same level of benefit from free parking as those who drive. Additionally, the employers are not spending any more through this process because they no longer have to pay their parking supplier for the employees who elect to "cash out." In 1998, California enacted a law that required large businesses to offer this type of program; to see the impacts of the program, former UCLA professor, Donald Shoup, surveyed 8 of the first companies to participate. In comparing the before and after percentages of solo drivers, Shoup found that single occupancy vehicles decreased, on average, from 76% before the cash out program to 63% after the program[21]. Further, annual employee vehicle miles traveled (VMT) fell from 5,348 to 4,697[21]. As demonstrated by these impressive reductions in both solo driver share and VMT, parking cash outs not only incentivize other forms of commuting, but reduces the overall demand for parking. Programs like these will become increasingly significant for cities trying to control their parking supply and ultimately reduce their automobile dependence.

TABLE 4-2.
SUMMARY OF TRAVEL CHANGES AFTER PARKING CASH OUT

	Solo driver share			Vehicle trips per commuter per day				VMT per employee per year			
Location (case)	Before	After	Change	Before	After	Change	% Change	Before	After	Change	% Change
(1)	(2)	(3)	(4)=(2)-(3)	(5)	(6)	(7)=(5)-(6)	(8)=(7)/(6)	(9)	(10)	(11)=(9)-(10)	(12)=(11)/(9)
Downtown LA (5)	75%	53%	–22%	0.79	0.60	–0.19	–24%	5,297	4,013	–1,284	–24%
Downtown LA (8)	61%	45%	–16%	0.75	0.63	–0.12	–16%	5,281	4,418	–864	–16%
Century City (1)	71%	58%	–13%	0.81	0.74	–0.07	–9%	5,461	4,862	–599	–11%
Century City (4)	88%	76%	–12%	0.93	0.85	–0.08	–9%	6,578	6,006	–585	–9%
Century City (3)	79%	67%	–12%	0.85	0.78	–0.07	–9%	6,113	5,589	–524	–9%
Santa Monica (7)	83%	75%	–8%	0.83	0.79	–0.04	–5%	6,294	5,960	–334	–5%
Santa Monica (6)	85%	78%	–7%	0.90	0.82	–0.08	–9%	6,478	5,910	–568	–9%
West Hollywood (2)	72%	70%	–3%	0.76	0.72	–0.04	–5%	N/A	N/A	N/A	N/A
Weighted average	**76%**	**63%**	**–13%**	**0.82**	**0.73**	**–0.09**	**–11%**	**5,348**	**4,697**	**–652**	**–12%**

Source: Shoup 1997. The firms are listed in descending order of the change in solo driver share in Column 4.

3.8 -- Utilization Monitoring

Data collection and analysis is an essential aspect for transportation planning, and parking should be no different. In order to make sound and well-founded decisions, policy makers must have data to understand the current environment. In 2008 Seattle, under the Center City Program, began efforts to create a singular database detailing all of the off-street parking currently in downtown Seattle. Much of this information was already available through business licences for off-street parking with the City of Seattle[22]. With this data available, SDoT can make informed decisions on where on-street parking can be replaced with excess off-street parking and discover areas where parking can be completely removed. Utilization is also vital to know. Having a strong idea of how many spaces exist within a given area is useful, but knowing when those spaces are occupied is what matters most for creating shared parking facilities. This information would also be useful for building owners as well. If an owner has an accurate count of how many stalls are vacant throughout the day, they will have a better idea of what they might be able to lease to other outside customers. This information can also be used to demonstrate to residents that perceived parking shortages within an area may not be as drastic as believed to be. This data may also show them areas where parking is available. Without this needed data, parking will continue to be blindly built in excess. Cities will not know what the proper parking minimums should be within an area, and money will continue to be wasted on spaces that will remain unoccupied.

3.9 -- Plan for Future Uses

The necessity for parking continues to grow increasingly unclear. As more residents begin to use shared vehicles, cycling, or transit, private vehicles, and the areas for storing them, will become less necessary. Cities must start planning for these changing needs. Inevitably this will mean fewer parking spaces that are also more commonly shared. Technology will surely play a role in the reduction as well. Between apps that easily facilitate the buying and selling of parking stalls, and automated vehicles, which will require fewer stalls, current minimum parking requirements will certainly continue to produce wasteful excess. While it is difficult to assess how many stalls will be sufficient for technology that has not even arrived yet, the buildings housing these vehicles will be around for much longer durations of time and must be planned for future needs.

If parking construction is to continue at its current rate, buildings can also construct parking in ways that would allow for simple conversion at a later date. This sentiments are already worded in Transportation 2040 (M 2.5 "Design parking to be flexible and adaptable), but steps could be taken to encourage even more ambitious practices around this important strategy. In addition to converting parking stalls into room for bike storage, building tall ceilings and lining each floor with necessary water and electrical systems would make unnecessary floors of parking easily converted to livable spaces. Thoughtful alterations to the construction process could make areas that will soon become unnecessary or underutilized into additional housing units or work spaces. Without considering future uses in the building process, many current buildings will be left with floors of empty parking.

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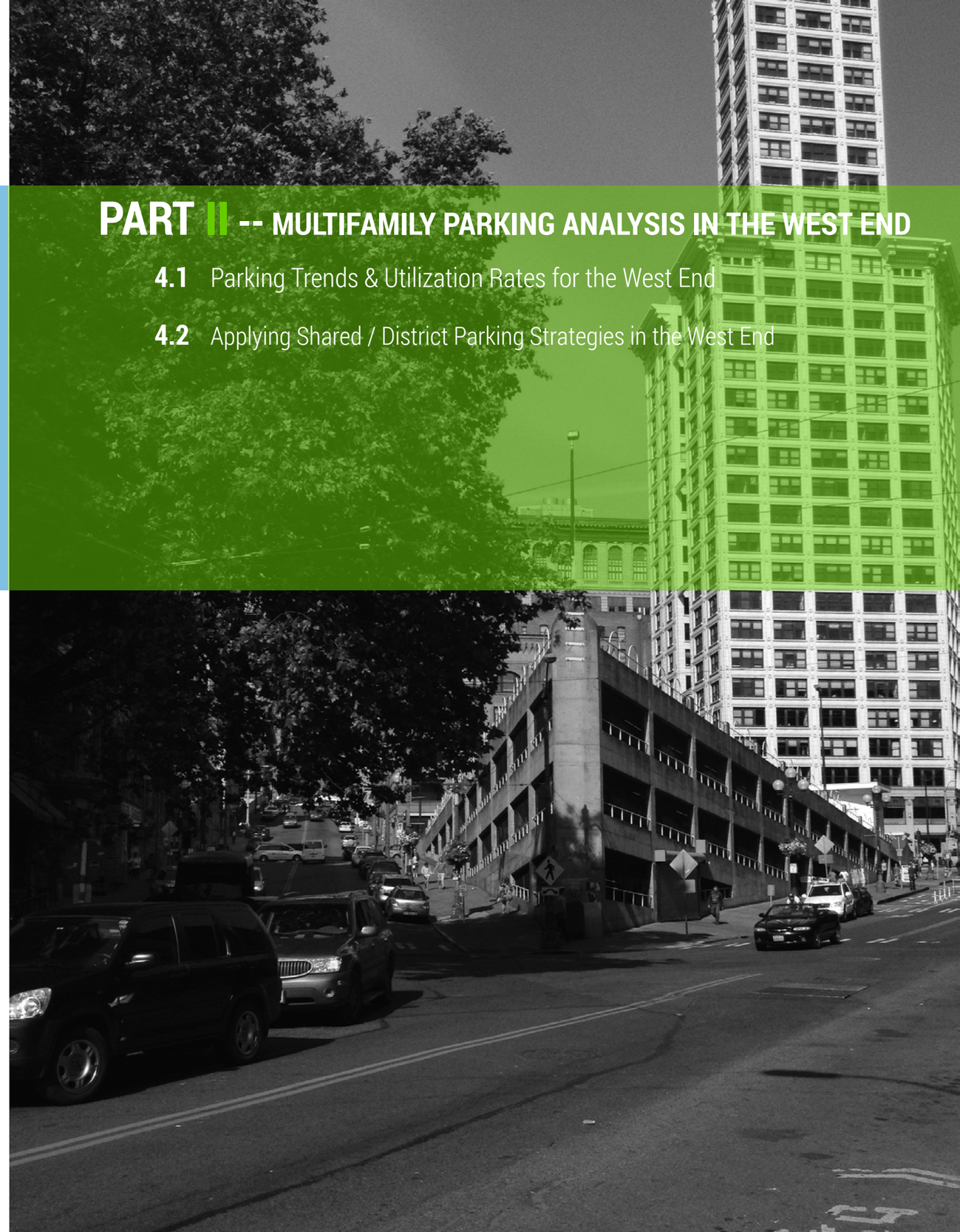
(21) Shoup, Donald. C (2005). Parking Cash Out. *American Planning Association*. Chicago, IL. pp. 64-65.

(22) Seattle Department of Transportation (2008). Center City Parking Program Work Plan. City of Seattle. p.10.



PART II -- MULTIFAMILY PARKING ANALYSIS IN THE WEST END

4.1 Parking Trends & Utilization Rates for the West End

4.2 Applying Shared / District Parking Strategies in the West End

West End Analysis Going Forward

The information discussed in the proceeding section is currently under review. Upon completion, the findings and recommendations will be featured here, as part of a related master's project.