ZONING ORDINANCE ADVISORY COMMITTEE **THURSDAY, September 3, 2020**

DALLAS DEVELOPMENT CODE AMENDMENT

FILE NO. DCA 190-002

Parking – Local and National Parking Studies, Part 1 **Planners: Andreea Udrea, PhD, AICP**
Lori Levy, AICP

Consideration of amending off-street parking and loading requirements including, but not limited to, hotel, restaurant, multifamily, alcoholic beverage establishment, and public and private schools uses in the Dallas Development Code.

BACKGROUND:

On September 5, 2019, City Plan Commission (CPC) authorized a public hearing to consider amending Chapters 51 and 51A of the Dallas Development Code, with consideration to be given to amending off-street parking and loading requirements including, but not limited to, hotel, restaurant, multifamily, and alcoholic beverage establishment uses, and transit-oriented development.

The intent of this code amendment is to review the current parking regulations and based on research, best practices, and other cities approach to parking requirements, determine the need to amend the City Code and make a recommendation and proposal.

Staff will provide reports on the following general research direction to build on information, culminating with recommendations and a proposal:

- Current Parking Regulations _ provided at the June 18, 2020 ZOAC meeting
- City of Dallas Planned Development Districts _ provided at the July 9, 2020 ZOAC meeting
- Index Cities and Other Cities Research _ provided at the August 6, 2020 ZOAC meeting
- **Local and National Parking Studies, Part 1**
- Local and National Parking Studies, Part 2 _ provided at the September 3, 2020 ZOAC meeting
- Board of Adjustment Parking Reductions_ provided at the September 3, 2020 ZOAC meeting
- Citywide Plans – Vision/Goals_ provided at the September 3, 2020 ZOAC meeting
- Feedback from Interested parties, Industry, Developers and Communities and Neighborhoods.

PROJECT WEBPAGE:

https://dallascityhall.com/departments/sustainabledevelopment/planning/Pages/parking-code-amendment.aspx

RESEARCH AND STAFF ANALYSIS:

Scope and methodology:

The scope of this report is to put together a collection of resources for parking-related topics that gives a general understanding of the major literature about parking, offering a wide image of parking issues and trends nationwide. Furthermore, the report intends to apply these gained lenses to better understand parking in Dallas; what is the current state, the patterns and behavior, how is parking and transportation being used. Another goal of this report is to gather data and create a collection of studies and resources at national and local level.

The report was conducted on two main levels, a general research of the global data and analysis that constitutes a major resource when studying parking and, a local research on studies, from regional level, to major parts of the city, up to very narrowly focused location and topics.

The report is a collection of excerpts from research and studies that are either free resource on the internet or submitted to the city and with author's permission. Each article or study is identified, the author is listed, and, where applicable, the client too, and includes the direct link to the entire document, where applicable. Each paragraph and illustration is annotated with the page number.

The criteria for selection of the studies is based on the material being from a trusted and primary source and containing verified information and data. The intent of this report is to highlight trends, tools, and data, and to assemble a general assessment of the current situation and trends nationwide. Given the length of this collection of excerpts, the report is split into two parts:

Part 1 – General research and high-level parking studies. Contains excerpts grouped by author, from more comprehensive views to research focused on certain uses or tools

Part 2 – Parking Studies for Dallas. Contains excerpts from studies from larger areas of the city, to larger multiuse locations, and to focused analysis on certain single uses.

Summary:

The following are samples of topics, information, and data that is referenced by the research and studies contained in this report:

Parking as a tool for Transportation Demand Management
Defining parking problems
Level of service for parking
Parking costs and costs of parking requirements
Parking management
Parking requirements comparisons and solutions
Parking reforms
Solution assessment
Parking impacts on housing affordability
Cruising for parking
Critique of parking minimums
Critique of free parking
Parking data about certain uses: multifamily, restaurants, office, high schools
Convertible parking garages

Environmental-friendly solutions – watershed urbanism.

For Dallas:

Autonomous transportation – solution for large scale, neighborhood-wide shared parking
Parking analysis for larger areas – Preston Center and Downtown with detailed parking assessments and data on parking utilization and accumulation
Parking analysis for shopping centers
Design guidelines
Environmental data
Housing data
Regional public transportation strategies
Parking data about certain uses: multifamily, restaurants with drive-through, grocery stores.

CONTENT:

Part 1 - General Research and High-Level Parking Studies

Focused Studies and Data___*(pp 54-75)*

The United States of Parking, by Seth Goodman, website

The Transformation of Parking. Multiple factors are converging to disrupt everything we know about parking, by/for: National Apartment Association, July 2018

Stalled Out. How Empty Parking Spaces Diminish Neighborhood Affordability, by: The Center for Neighborhood Technology, Searle Funds at the Chicago Community Trust, March 2016

Parking In Lieu Fees, *Parking Planning White Paper Series*, Kimley Horn and Associates Inc

Convertible Parking Garages

Adele Peters, "**These future-proof parking garages can easily morph into offices or housing**" *FastCompany*, World Changing Ideas, January 14, 2019

Charles LaCalle, Dreamit UrbanTech, *"**Real Estate Developers Begin to Future-Proof the Parking Garage**," Dreamit*, February 1, 2018

Alek Pochowski, Bryan Graveline, "**What's the Future of Parking Garages?**" *Kittelson and Associates*

Related domains___*(pp 76-78)*

Conway Urban Watershed Framework Plan. A Reconciliation Landscape for Little Creek-Palarm Creek Sub-watershed, by: University of Arkansas Community Design Center, an outreach center of the Fay Jones School of Architecture + Design; Fay Jones School of Architecture + Design; University of Arkansas Department of Biological and Agricultural Engineering, and Office for Sustainability; Arkansas Natural Resources Commission, January 2016

Part 2 - Parking studies for Dallas

Areas of the City

Dallas Midtown Autonomous Transportation System and Shared Parking Feasibility Study, ATS Study by Jacobs Engineering; LEA Elliott; Pacheco Kock; Toole Designs; KK Strategies; DeAngelo Rail Services, Parking Study: Walker Consultants; Coleman Associates, for: North Central Texas Council of Governments, September 2019

Northwest Highway and Preston Road Area Plan – Appendices, Parking Study Highlights, by Kimley-Horn, December 2016

Preston Center Parking Garage Study, by Walker Consultants, for: North Central Texas Council of Governments and City of Dallas, March 31, 2020

City Center TIF District Parking Strategy Study, by Kittelson & Associates, Inc, for: The City of Dallas, DRAFT, June 2001

Downtown Dallas 21st Century Strategic Parking Plan, by Kimley-Horn and Associates Inc, for: Downtown Dallas inc; Moore Iacofano Goltsman, January 2011

Downtown. Parking Accumulation Study, by DeShazo, Tang & Associates, Inc., for: The New Statler, December, 2016 and 2019

Dallas Area Rapid Transit Red & Blue Line Corridors Transit-Oriented Development Parking Study, Project Partners: North Central Texas Council of Governments; Dallas Area Rapid Transit; City of Dallas; City of Garland; City of Plano; City of Richardson, Consultant Team:

Nelson\Nygaard Consulting Associates; C.J. Hensch & Associates, Gateway Planning, **December 2019**

General guidelines and studies

Urban Design Guidelines for Projects Located in City of Dallas Tax Increment Financing Districts, City of Dallas, Office of Economic Development, Dallas CityDesign Studio, updated February 2015

Smart Growth for Dallas Decision Support Tool, by Trust for Public Land, bcWorkshop, Texas Trees Foundation, Dallas Parks and Recreation Department

Dallas Water Gardens Feasibility Analysis, by Sakura Robinson; Halff; Terradyne, for: North Central Council of Governments, June 30, 2019

2018 State of Dallas Housing Report. Regional Housing Production, Population Change, and Housing Accessibility, by: The buildingcommunityWORKSHOP, May 2018

Access North Texas. Regional Public Transportation Plan for North Central Texas, by North Central Texas Council of Governments, March 2018

Multiple Use

NorthPark Center Parking Analysis, by DeShazo, Tang & Associates, Inc., April 2008

NorthPark Center Parking Analysis, by DeShazo, Tang & Associates, Inc., February 2010

NorthPark Center Validation Study, by DeShazo Group, Inc., December 9, 2013

Preston Trail Village Parking Analysis, by: DeShazo, Tang & Associates, Inc., May 2006

Lakewood Village Shopping Center Parking Analysis, by Christy Lambeth, November 2019

Mockingbird / Abrams Shopping Center Parking Analysis excerpt, by DeShazo Group, June 2011

Village at Preston Hallow Parking Analysis, by DeShazo Group, February 2013

Village at Preston Hallow Technical Memorandum, by DeShazo Group, April 2017

The Hill Parking Analysis, by DeShazo Group, October 2015

Ross Avenue and McCoy Street Shopping Center, by Christy Lambeth, February 2020

Single Use

Multifamily

Comparative table, by Scot Johnson, Kimley-Horn and Associates, Inc., Excerpt from a Parking Analysis, data collected 2011, 2015 - 2020

Senior Living, Retirement Housing

Memorandum, by Scot Johnson, Kimley-Horn and Associates, Inc., April 2017

Restaurants with Drive-Through

1717 W Mockingbird Lane, (McDonald's), by: Christy Lambeth, April 2020

General merchandise or food store greater than 3,500 square feet.

Comparative table, by Scot Johnson, Kimley-Horn and Associates, Inc., Excerpt from a Parking Analysis, December 2012

Part 1 - General Research and High-Level Parking Studies

The following is a selection of specialized research on parking from credited sources that are usually used as source referenced in parking literature. This selection also includes views and opinions from different angles in addition to engineers and planners, like architects, environmentalists, as it is included to highlight the intersectionality of parking.

Comprehensive Overview and Solutions

Transportation Demand Management (TDM) Encyclopedia

Victoria Transport Policy Institute (https://www.vtpi.org/)
Updated April 2014
https://www.vtpi.org/tdm/tdm12.htm

This Encyclopedia is a starting point when it comes to exploring and understanding parking. It is a comprehensive resource. It is fully web-based and free-access, and it is continuously being updated. This is referenced source in parking literature.

The following are selected excerpts from various chapters. Active links to additional resources and data as embedded in the text or tables by the author were left in place.

What is the *Online TDM Encyclopedia*?
The *Online TDM Encyclopedia* is the world's most comprehensive information resource concerning innovative transportation management strategies. It describes dozens of Transportation Demand Management (TDM) strategies and contains information on TDM planning, evaluation and implementation. It has thousands of hyperlinks that provide instant access to more detailed information, including case studies and reference documents.

The Encyclopedia has an international perspective, with ideas and examples from all over the world, including both developed and developing countries. The Encyclopedia is created and maintained by the Victoria Transport Policy Institute (VTPI), an independent research organization located in Victoria, British Columbia.

What is Transportation Demand Management?
Transportation Demand Management or *TDM* (also called *Mobility Management*) refers to various strategies that change travel behavior (how, when and where people travel) in order to increase transport system efficiency and achieve specific planning objectives. TDM is increasingly used to address a variety of problems.

A typical person makes more than a dozen trips away from home each week – to work, shopping, errands, social and recreation activities. Many of these trips are flexible in terms of their timing, mode and destination. For example, many commuters can vary when and how they travel to work or school, at least some days. Similarly, errands can be organized in various ways, such as walking or bicycling to neighborhood shops, driving to a downtown or mall, or making several automobile trips to various destinations dispersed along major highways. Recreational activities can also have various travel options, ranging from a neighborhood stroll, driving across town to exercise at a gym, or cycling for errands and

commuting. Many factors affect people's transport decisions including the relative convenience and safety of travel modes (such as whether streets have sidewalks and bikepaths, and the quality of transit services available), prices (transit fares and the price of parking at destinations); and land use factors (such as whether or not schools, parks and shops are located close to residential neighborhoods). Even freight transport often has flexibility in how goods are shipped and deliveries organized.

Transportation Demand Management strategies influence these factors to encourage more efficient travel patterns, such as shifts from peak to off-peak periods, from automobile to alternative modes, and from dispersed to closer destinations.

There are numerous TDM strategies using various approaches to influence travel decisions. Some improve the transport options available; some provide incentives to change travel mode, time or destination; others improve land use accessibility; some involve transport policy reforms and new program that provide a foundation for TDM.

Table 1 **TDM Strategies Described In This Encyclopedia**

Improves Transport Options	Incentives	Land Use Management	Policies and Programs
Transit improvements Nonmotorized improvements Rideshare programs Flextime Car sharing Telework Taxi improvements Bike/transit integration Guaranteed ride home HOV Priority	Road pricing Distance-based fees Commuter financial incentives Parking pricing Pay-as-you-drive vehicle insurance Fuel tax increases Nonmotorized encouragement	Smart growth New urbanism Location-efficient development Parking management Transit oriented development Car free planning Traffic calming	TDM Programs Commute trip reduction Campus transport management Freight transport management Tourist transport management TDM marketing Least-Cost planning Market reforms Performance Evaluation

This table lists various mobility management strategies; (each word is an active link)

Parking Evaluation. *Evaluating Parking Problems, Solutions, Costs, and Benefits*

TDM Encyclopedia, Victoria Transport Policy Institute
Updated April 2017
https://www.vtpi.org/tdm/tdm72.htm

Defining Parking Problems and Solutions

Table 1 **Comparing Perspectives of Parking Problems**

Perspective	Problem Definition	Potential Solutions
Supply-oriented	Inadequate supply, excessive price.	Have governments, businesses and residents supply more parking. Increase minimum parking standards.
Information Oriented	Inadequate user information.	Create signs, brochures and other information resources indicating parking availability and price.
Choice- Oriented	Inadequate consumer options.	Increase the range of parking convenience and price levels available to consumers.
Pricing	Pricing is inconvenient.	Develop more convenient payment and time options.

Convenience		
Efficiency-oriented	Inefficient use of existing parking capacity.	Share parking facilities. Implement transport and parking demand management. Price parking. Provide shuttle services to parking facilities.
Demand-oriented	Excessive automobile use.	Improve access and transport choice. Transport and parking demand management programs.
Spillover Impacts	Inadequate parking causes problems in other locations.	Use management strategies to respond to spillover problems. Improve enforcement of parking regulations.
External Impacts	Parking facilities impose external costs.	Reduce parking minimums. Price parking. Improve parking facility design. Implement TDM programs.

This table summarizes different perspectives for viewing parking problems.

Parking facilities must be located within convenient walking distance of the destinations they serve. Table 3 indicates acceptable walking distances between parking facilities and destinations.

Table 3 **Level of Service By Walking - Distance in Feet** (Smith and Butcher, 1994)

Walking Environment	LOS A	LOS B	LOS C	LOS D
Climate Controlled	1,000	2,400	3,800	5,200
Outdoor/Covered	500	1,000	1,500	2,000
Outdoor/Uncovered	400	800	1,200	1,600
Through Surface Lot	350	700	1,050	1,400
Inside Parking Facility	300	600	900	1,200

This table indicates parking access Level of Service (LOS) rating under various conditions.

Acceptable walking distance is also affected by climate, line of site (longer distances are acceptable if people can see their destination), "friction" (barriers along the way, such as crossing busy traffic), and by the type of activity and user, as described in Table 4.

Table 4 **Walking Level of Service For Various Situations**

Adjacent	Minimal (LOS A or B)	Medium (LOS B or C)	Long (LOS C or D)
People with disabilities Deliveries and loading Emergency services Convenience store	Grocery stores Professional services Medical clinics Residents	General retail Restaurant Employees Entertainment center Religious institution	Airport parking Major sport or cultural event Overflow parking

This table indicates maximum acceptable walking distance from parking to destinations for various activities and users.

Parking Facility Costs are made up by costs for land, construction, operation and maintenance, transaction, and environmental.

Parking Costs, Pricing, and Revenue Calculator; By Todd Litman, VTPI; January 2012

Parking Solutions. A Comprehensive Menu of Solutions to Parking Problems

TDM Encyclopedia, Victoria Transport Policy Institute
Updated 17 April 2017
https://www.vtpi.org/tdm/tdm72.htm

Parking Management Paradigm Shift

Parking Management represents a *paradigm shift*, that is a change in the way parking problems are defined and potential solutions Evaluated.

> *Old paradigm*: motorists should nearly always be able to easily find, convenient, free parking at every destination. Parking planning consists primarily of generous minimum parking requirements, with costs borne indirectly, through taxes and building rents.
>
> *New paradigm*: parking facilities should be used efficiently, so parking lots at a particular destination may often fill (typically more than once a week), provided that alternative options are available nearby, and travelers have information on these options. This means, for example, that parking lots have a sign describing available , that motorists may often have a choice between paid parking nearby, or free parking a few blocks away. It also requires good walking conditions between parking facilities and the destinations they may serve. Parking planning can therefore include Shared Parking, Parking Pricing and regulations, parking User Information, and Walkability improvements.

This chapter describes various solutions that can be applied to parking problems. It can help expand the range of solutions considered and identify the best one to use in a particular situation. Table 1 lists the parking solutions described in this chapter. See Parking Evaluation for information on factors to consider when comparing and selecting these strategies.

Table 1 **Parking Solutions Described in This Chapter**

Increase Parking Supply	Use Existing Parking Capacity More Efficiently	Address Variable Demand	Reduce Parking Demand	Respond to Spillover Impacts	Management and Design
Minimum Parking Requirements Increase On-Street Parking Subsidize Off-Street Parking Remote Parking Redesign Existing Facilities Car Stackers	Improve User Information Encourage Use Of Remote Parking Regulate Parking Pedestrian Improvements Shared Parking Public Parking Access Management More Accurate Parking Requirements Control Parking Passes	Parking Brokerage Services Overflow Parking Plans Variable Pricing	Price Parking Tax Parking Commuter Parking Benefits Improve Transport Alternatives Transportation Demand Management Reduce Parking Supply Bicycle Parking	Regulate, Price And Enforce Compensate For Spillover Impacts	Improved Enforcement Universal Design Parking Location Safety And Security Aesthetics Charge Impervious Surface Fees Reduce Stormwater and Heat Gain Impacts

This table shows the parking solutions described in this chapter. Headings show general approaches, with specific strategies listed below.

Shared Parking

Description: Share parking facilities among users. This can occur at different scales, as described below.

Zoned Rather Than Assigned Spaces (Shared Parking #1)

Description: Share parking among a group of employees or residents, rather than assigning to individuals. For example, 50 employees or residents can usually share 30-40 parking spaces without problem, particularly if implemented in conjunction with other Commute Trip Reduction and Location Efficient Development strategies.

This can be a consumer option. For example, motorists could be offered an assigned space for $100 per month, or a shared space for $60 per month. This allows individuals to decide whether they are willing to pay extra for an assigned space, or capture the savings that result from shared parking.

Share Parking Between Sites (Shared Parking #2)

Description: Share the use of off-street parking facilities among different buildings in an area to take advantage of different peak periods (see Table 3). For example, an office complex can efficiently share parking facilities with a restaurant or theaters, since offices require maximum parking during weekdays, while restaurants and theaters require maximum parking during evenings and weekends. As a result, the total amount of parking can be reduced 40-60% compared with standard off-street parking requirements for each destination. Barton-Aschman Associates (1982) and ITE (1995) provide specific recommendations for shared parking implementation.

Table 3 **Peak Parking Demand**

Weekday Peaks	Evening Peaks	Weekend Peaks
Banks	Auditoriums	Religious institutions
Schools	Bars and dance halls	Parks
Distribution facilities	Meeting halls	Shops and malls
Factories	Restaurants	
Medical clinics	Theaters	
Offices		
Professional services		

This table indicates peak parking demand for different land use types. Parking can be shared efficiently by land uses with different peaks.

More Accurate and Flexible Parking Requirements

Description: This involves developing minimum parking requirements that more accurately reflect a site's parking demand, taking into account specific geographic, demographic and management conditions (ULI 2000; Millard-Ball 2002; Kodransky and Hermann 2011). For example, minimum parking requirements can be higher in more automobile-oriented locations and lower at locations that are more Accessible, have priced parking, or have TDM programs. Current parking standards tend to reflect parking demand in automobile dependent, suburban sites with unpriced parking, and so tend to be excessive in areas with better travel options, mixed land use, priced parking or other TDM strategies (Shoup 2002). The Land Use Impacts on Transportation chapter describes methods that can predict how land use and transportation management factors can reduce parking demand. The table below summarizes some of these effects.

Table 4 **Travel Impacts of Land Use Features** (Land Use Impacts)

Land Use Feature	Reduced Vehicle Travel
Residential development around transit centers.	10%
Commercial development around transit centers.	15%
Residential development along transit corridor.	5%
Commercial development along transit corridor.	7%
Residential mixed-use development around transit centers.	15%
Commercial mixed-use development around transit centers.	20%
Residential mixed-use development along transit corridors.	7%
Commercial mixed-use development along transit corridors.	10%
Residential mixed-use development.	5%
Commercial mixed-use development.	7%

Summary

The table below rates parking solutions according to their ability to achieve various transportation and land use objectives.

Table 4 **Comparing Solutions**

Solution	Parking Congestion	Costs	TDM & Land Use	Consumer Benefits	Equity	*Totals*
Increase Parking Supply						
Minimum Parking Requirements	3	-3	-3	2	-3	*-4*
On-Street Parking	3	-3	-3	2	-3	*-4*
Subsidize Off-street Parking	3	-3	-3	2	-3	*-4*
Redesign Existing Facilities	2	-1	0	1	0	*1*
Add Remote Parking	2	-2	-2	1	0	*-1*
Car Stackers	2	-2	-1	2	-1	*0*
Use Existing Parking Capacity More Efficiently						
Provide Parking Information	2	-1	0	3	0	*4*
Encourage Remote Parking Use	2	-1	-1	1	0	*1*
Regulate Parking	2	-1	1	1	0	*3*
Pedestrian Improvements	2	-1	3	3	3	*10*
Shared Parking	2	-1	2	-1	0	*2*
Public Parking	2	-2	2	-1	0	*1*
More Accurate Requirements	0	1	2	2	2	*7*
Address Variable Demand						
Parking Brokerage Services	2	-1	2	2	1	*6*
Overflow Parking Plans	2	-1	2	2	0	*5*
Reduce Parking Demand						
Price Parking	3	3	3	-3	2	*8*
Parking Taxes	2	3	3	-3	2	*7*
Commuter Benefits	3	-3	3	3	3	*9*
Improve Transport Alternatives	2	-3	3	3	2	*7*
TDM Programs	3	-2	3	2	2	*8*
Reduce Parking Supply	-3	3	3	-3	1	*1*
Bicycle Parking	1	-1	1	1	2	*4*
Respond to Spillover Impact						
Regulate, Price and Enforce	3	0	3	-3	1	*4*
Compensate Spillover Impacts	0	-2	0	0	3	*1*
Facility Design Improvements	0	-2	3	3	3	*7*

Rating from 3 (supports this objective, very beneficial) to –3 (contradicts this objective, very costly or harmful). A 0 indicates no impact or mixed impacts.

Parking Management: Strategies for More Efficient Use of Parking Resources

Victoria Transportation Policy Institute. *TDM Encyclopedia*
2015, updated in 2018
http://www.vtpi.org/tdm/tdm28.htm.

This chapter of the TDM Encyclopedia describes various management strategies that result in more efficient use of parking resources. Profiles several parking management districts, and has a section on parking benefit districts.

Summary of Parking Management Strategies

Table 1 **Parking Management Strategies**

Strategy	Description	Typical Reduction	Traffic Reduction
Shared Parking	Parking spaces serve multiple users and destinations.	10-30%	
Parking Regulations	Regulations favor higher-value uses such as service vehicles, deliveries, customers, quick errands, and people with special needs.	10-30%	
More Accurate and Flexible Standards	Adjust parking standards to more accurately reflect demand in a particular situation.	10-30%	
Parking Maximums	Establish maximum parking standards.	10-30%	
Remote Parking	Provide off-site or urban fringe parking facilities.	10-30%	
Smart Growth	Encourage more compact, mixed, multi-modal development to allow more parking sharing and use of alternative modes.	10-30%	X
Walking and Cycling Improvements	Improve walking and cycling conditions to expand the range of destinations serviced by a parking facility.	5-15%	X
Increase Capacity of Existing Facilities	Increase parking supply by using otherwise wasted space, smaller stalls, car stackers and valet parking.	5-15%	X
Mobility Management	Encourage more efficient travel patterns, including changes in mode, timing, destination and vehicle trip frequency.	10-30%	X
Parking Pricing	Charge motorists directly and efficiently for using parking facilities.	10-30%	X
Improve Pricing Methods	Use better charging techniques to make pricing more convenient and cost effective.	Varies	X
Financial Incentives	Provide financial incentives to shift mode, such as cash out.	10-30%	X
Unbundle Parking	Rent or sell parking facilities separately from building space.	10-30%	X
Parking Tax Reform	Change tax policies to support parking management objectives.	5-15%	X
Bicycle Facilities	Provide bicycle storage and changing facilities.	5-15%	X
Improve User Information and Marketing	Provide convenient and accurate information on parking availability and price, using maps, signs, brochures and electronic communication.	5-15%	X
Improve Enforcement	Insure that parking regulation enforcement is efficient, considerate and fair.	Varies	
Transportation Management Associations	Establish member-controlled organizations that provide transport and parking management services in a particular area.	Varies	X
Overflow Parking Plans	Establish plans to manage occasional peak parking demands.	Varies	
Address Spillover Problems	Use management, enforcement and pricing to address spillover problems.	Varies	
Parking Facility Design and Operation	Improve parking facility design and operations to help solve problems and support parking management.	Varies	

This table summarizes the parking management strategies described in this chapter. It indicates the typical reduction in the amount of parking required at a destination, and whether a strategy helps reduce vehicle traffic, and so also provides congestion, accident and pollution reduction benefits.

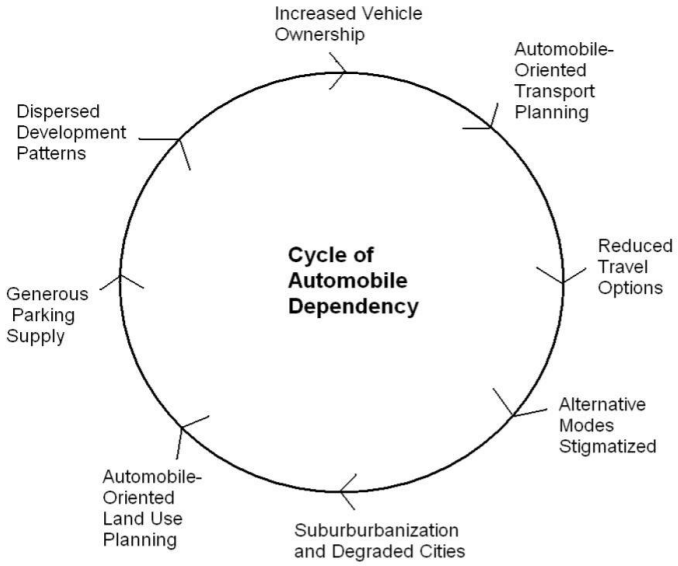
Parking Management Strategies, Evaluation and Planning

Victoria Transport Policy Institute, by Todd Litman
September 2016
(32 pages)
https://www.vtpi.org/park_man.pdf

Abstract

Parking management refers to various policies and programs that result in more efficient use of parking resources. This report summarizes the book, Parking Management Best Practices (Planners Press, 2006), which describes and evaluates more than two-dozen such strategies. It investigates problems with current parking planning, discusses the costs of parking facilities and potential savings from improved management, describes specific parking management strategies and how they can be implemented, discusses planning and evaluation issues, and describes how to develop optimal parking management in a particular situation. Cost-effective parking management programs can usually reduce parking requirements by 20-40% compared with conventional planning requirements, providing many economic, social and environmental benefits.(cover)

Figure 1 **Cycle of Automobile Dependency**



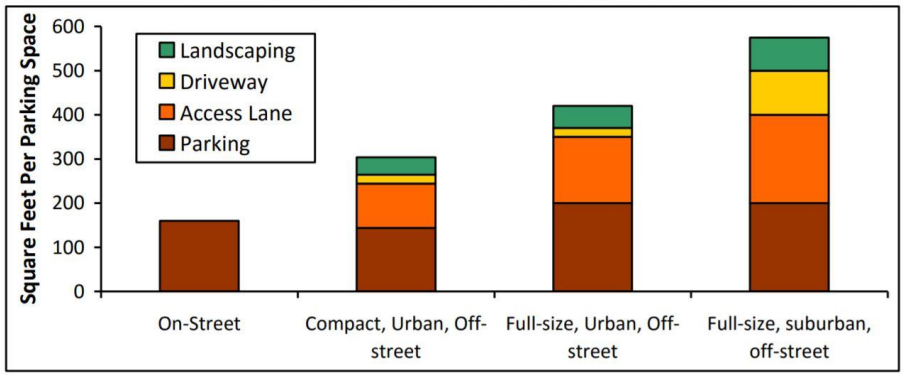
Generous parking supply is part of a cycle that leads to increased automobile dependency. Parking management can help break this cycle.

(pg 8)

Parking Facility Costs

A major benefit of parking management is its ability to reduce facility costs (Parking Costs," Litman, 2003). Parking facility costs are usually borne indirectly through rents, taxes and as a component of retail goods, so most people have little idea of parking facility costs and the potential savings from more efficient management. A typical parking space is 8-10 feet (2.4-3.0 meters) wide and 18-20 feet (5.5-6.0 meter) deep, totaling 144-200 square feet (13-19 sq. meters). Off-street parking requires driveways and access lanes, and so typically requires 300-400 square feet (28-37 square meters) per space, allowing 100-150 spaces per acre (250-370 per hectare). (pg 11)

Figure 2 **Typical Parking Facility Land Use** ("Parking Evaluation," VTPI, 2005)



Land requirements per parking space vary depending on type and size. Off-street spaces require driveways and access lanes. Landscaping typically adds 10-15% to parking lot area.

(pg 11)

Parking Requirement Impacts on Housing Affordability

Victoria Transport Policy Institute, By Todd Litman
June 2020
(39 pages)
https://www.vtpi.org/park-hou.pdf

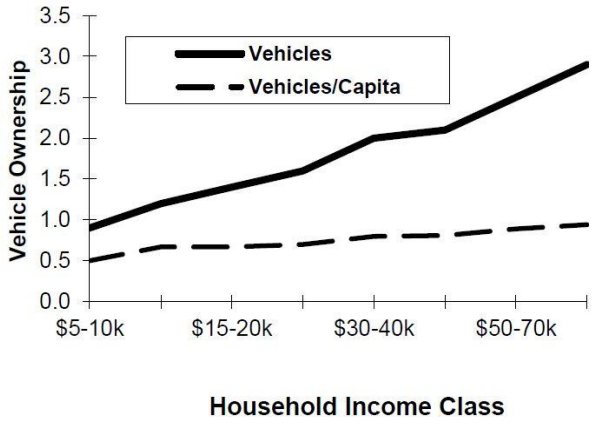
Abstract

Most zoning codes and development practices require generous parking supply, forcing people who purchase or rent housing to pay for parking regardless of their demands. Generous parking requirements reduce housing affordability and impose various economic and environmental costs. Based on typical affordable housing development costs, one parking space per unit increases costs approximately 12.5%, and two parking spaces can increase costs by up to 25%. Since parking costs increase as a percentage of rent for lower priced housing, and low-income households tend to own fewer vehicles, minimum parking requirements are regressive and unfair. Various parking management strategies can increase affordability, economic efficiency and equity. (cover)

Parking Demand by Households

Automobile ownership varies significantly, and is affected by demographic, geographic and management factors ("Parking Evaluation," VTPI, 2005; Hexagon Transportation Consultants 2008; San Diego 2011; Metro Vancouver 2012). Twelve percent of U.S. households do not own a motor vehicle, with higher rates of zero-vehicle households in larger cities and lower-income communities (BLS, 2003). Motor vehicle ownership rates tend to increase with income and household size, as indicated in figures 2 through 5 (also see Rice, 2004; CNU, 2008). (pg 4)

Figure 2 **Vehicle Ownership by Household Income** (BLS, 2003)



Lower income households own fewer automobiles than wealthier households.

(pg 4)

Parking Facility Costs

1. Land

Each off-street parking space requires about 300 square feet of surface area (including access lanes). One acre of land can hold about 125 spaces, fewer if major landscaping and screening are provided ("Parking Evaluation," VTPI, 2005). Land costs are about $4,200 per space, assuming 120 parking spaces and $500,000 per acre. Parking consumes a major portion of developed land, typically equal to or exceeding the land devoted to the buildings it serves. Expenses that occur early during project development, such as increased land acquisition and preparation costs, add construction financing costs, so parking facility expenses tend to incur higher financing costs than expenses incurred later in the development process.

Residential parking standards are calculated per unit, so parking land costs are a greater percentage of total costs for smaller units. For example, increasing parking from one to two spaces per unit increases land requirements for a small 1,000 square foot, two-story apartment or condominium from 800 to 1,100 square feet per unit, a 37% increase, resulting in more land devoted to parking than to housing. The same doubling of parking requirements only increases the land requirement for a 2,400 square foot one story house by 12.5%. (pg 9)

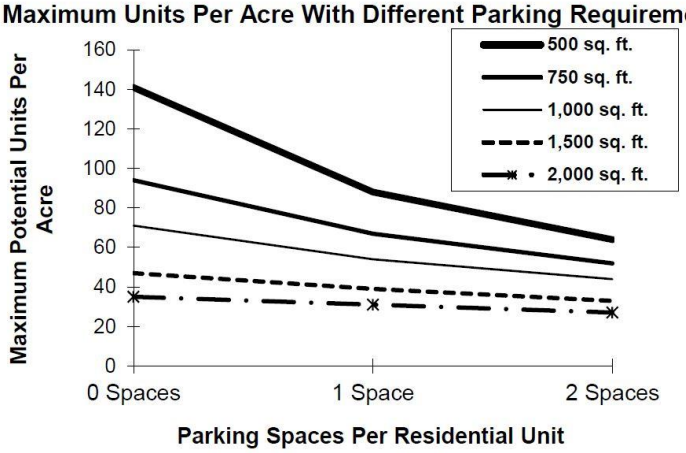
3. Construction and Maintenance

Paving costs average about $1,600 per parking space in 1994 dollars, excluding land costs. Parking structure costs average approximately $10,000 per space, and underground parking $15,000 to $20,000 per space, which makes these options uneconomic except where land prices are very high. Annual maintenance costs range from about $20 to $100 per year. (pg 9)

4. Reduced Development Density

By increasing the land needed per residential unit, increased surface parking reduces the maximum potential development density (units per acre). In other words, parking squeezes out housing. This impact is proportionally greatest for smaller units. For example, increasing parking requirements from one to two spaces per unit reduces the maximum potential density for two story, 500 square foot bachelor apartments from 88 to 64 units per acre, representing a 37% decline, but only causes a 13% reduction in maximum density for 2,000 square foot townhouses. Figure 10 illustrates this impact. (pg 10)

Figure 10 **Maximum Units Per Acre With Different Parking Requirements**



Maximum potential density declines as the number of surface parking spaces increases. This impact is proportionally largest for smaller units. (Assumes 300 sq. ft. per parking space, 90% land coverage, 10% common areas, 2 story buildings.)

(pg 10)

5. Higher Retail Price Targets
6. Environmental and Aesthetic Costs
7. Urban Sprawl and Increased Automobile Dependency
8. Increased Curb Cuts

Development Cost Example

Requiring one off-street parking space adds about 6% to the unit cost, two spaces add about 16%, and 3 spaces adds about 34% compared with no parking. These percentages vary depending on construction and land costs. (pg 12)

This indicates that conventional parking minimums significantly increase housing costs, especially when land prices are high and housing construction costs are relatively low, such as affordable, urban infill housing. Based on typical affordable urban housing development costs, one parking space per unit increases total development costs by about 12.5%, and two parking spaces increase costs by about 25%. (pg 13)

According to a study by Shoup, these generous parking requirements are the largest of all regulatory burdens placed on developers, about four times greater than all other development fees combined, such as levies for schools, parks and roads (Shoup 1999).

Developers' most common response to the high incremental costs of increased parking is to build less affordable urban housing (Lehe 2018). One case study from the early 1960's found that requiring one off-street parking space per unit reduced dwelling units per acre in new multi-family developments by 30%, and increased construction costs by 18% (Smith 1964). This significantly reduced the amount of urban land available for infill housing and gave developers an incentive to develop fewer, larger and lower quality units. The resulting reduction in affordable housing construction increased local rents (Shoup, 2005 contains more examples of parking requirement cost impacts). (pg 13)

Empirical research indicates that excessive parking requirements really do affect housing supply and affordability. Manville (2010) found that when parking requirements were removed in downtown Los Angeles, developers provide more housing and less parking, and a greater variety of housing types: housing in older buildings, in previously disinvested areas, and lower-priced housing with unbundled parking that is marketed toward non-drivers. The research also indicates that allowing developers to provide parking off-site can allow more affordable infill housing.

Analysis of 23 recently completed Seattle-area multifamily housing developments reveals that parking subsidies increase monthly rents approximately 15% or $246 per month for each occupied unit; that approximately 20% of occupants own no motor vehicles, and during peak periods 37% of parking spaces are unoccupied (London and Williams-Derry 2013). The authors conclude that "the practice of providing abundant "cheap" parking actually makes rental housing more expensive."

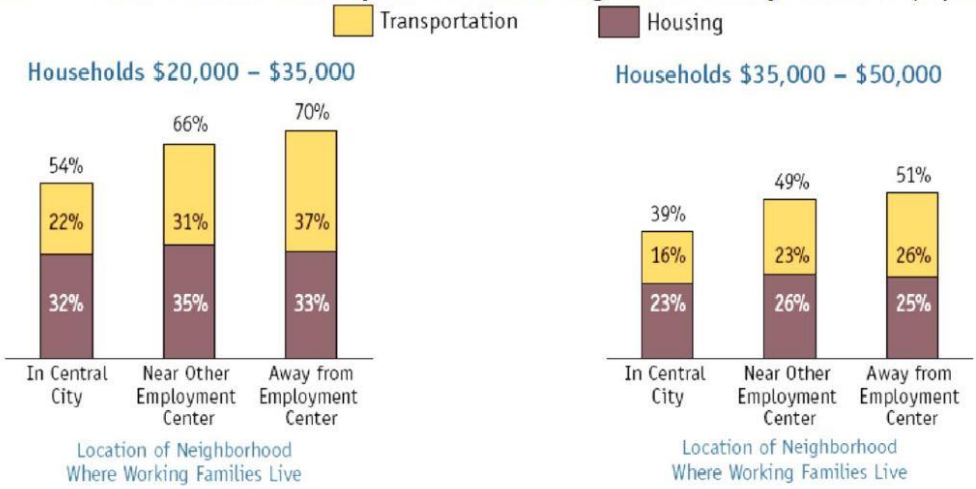
A study found that San Francisco housing prices increased significantly (an average of $39,000 or 13% for condominiums, and $46,000, or 12% for single-family units) if they include off-street parking (Jia and Wachs 1998). Only unit size and number of bathrooms have a greater effect on sales price. Based on standard mortgage requirements, a typical household would need to earn $76,000 annually to purchase a single-family home with off-street parking, compared with $67,000 for the same housing without parking.

Similarly, Jung (2009) used hedonic pricing to estimate the marginal effect of an additional parkade-style parking space on condominium prices. His results indicate that the value of a parking space is statistically significant but substantially less than the typical cost of supplying that space. The results suggest that if the retail price is increased to include the costs of additional parking spaces, the higher price does not fully reflect the cost to the developer of providing those parking spaces. This adversely affects housing affordability because developers must charge more per unit, and to the degree that the additional parking costs cannot be recovered by higher prices, are likely to provide less housing, leading to a higher market-clearing price, particularly in lower price ranges. (pg 14)

Impacts on Lower Income Households

Current housing markets harm lower-income households by forcing them to choose between urban residential locations, which tend to be either in undesirable neighborhoods or have high prices, and suburban or exurban residential locations, which have lower housing costs but much higher transportation costs (CTOD and CNT, 2006; Lipman, 2006). Many lower income households would be financially better off if affordable housing were available in more accessible, multi-modal urban locations where their combined housing and transportation costs were lower. More flexible parking requirements can help provide such housing by reducing housing development costs in areas with higher land prices. (pg 16)

Figure 14 **Share Of Income Spent On Housing And Transportation** (Lipman, 2006)



Urban fringe housing is often cheaper, but these savings are offset by higher transport costs.
(pg 16)

Solutions

There is much that can be done to manage parking to increase housing affordability. For more information see Arigoni, 2001; Russo, 2001; SPUR, 2002; VTPI, 2005; CTOD, 2008.

Rather than establishing generous parking requirements to satisfy the maximum potential demand that may occur during a facility's lifetime, parking management allows contingency-based planning, which means that various solutions are identified and deployed if needed. For example, rather than providing 150 parking spaces at a 100 unit apartment building, as required by conventional standards, the developer might initially supply 80 spaces, along with various parking management strategies, and perhaps some land banked for constructing additional parking if needed. This approach saves costs and is more responsive to community needs. (pg 18)

Reduce, Eliminate or Adjust Parking Minimums (…)
Shared Parking (…)
Unbundling (…)
Location Efficient Development (…)
Carsharing (…)
Car-free Planning (…)
Overflow Parking (…)
Transportation Management Associations (…)
(pg 18-20)

Affordable Housing Opportunities

Table 6 **Land Area Per Unit**

Housing Type	Without Surface Parking		With Surface Parking	
	Sq. Feet	Units Per Acre	Sq. Feet	Units Per Acre
1/2 Acre Single-family	21,780	2	21,780	2
1/4 Acre Single-family	10,890	4	10,890	4
Small-lot Single-family	5,445	8	5,445	8
Two-Story Duplex	3,630	12	3,630	12
Three-Story Townhouse	1,000	44	1,333	33
Four-story Condominium	450	97	783	56
Medium-Rise Condominium	225	194	558	78
High-Rise Condominium	113	387	446	98

Increased density and reduced parking requirements significantly reduce unit land requirements. This assumes that one-third of parcel is devoted to setback, and 333 square feet per surface parking space.

(pg 22)

Affordable Residential Development (SPUR 1998)

Table 10 illustrates how tradeoffs between housing and parking affect the costs of medium-rise (four stories maximum) housing on a 3-acre parcel in an urban neighborhood. As the number of surface parking spaces increases, the number of housing units declines, and costs rise. Using underground parking reduces land requirements but significantly increases construction costs. As a result, it is impossible to provide affordable rents while meeting conventional parking requirements. (pg 26)

Table 10 **Residential Development Options**

	Option 1	Option 2	Option 3	Option 4
Housing Units	50	40	30	50
Parking	25 (surface)	40 (surface)	40 (surface)	50 (underground)
Cost Per Unit	$50,000	$60,000	$75,000	$80,000
Monthly Rent	$312	$375	$468	$500

(pg 26)

Renter Parking Costs

Gabbe and Pierce (2016), used national American Housing Survey data to investigate parking costs imposed on renter households. They estimate that renter households garage parking costs average approximately $1,700 annually, or an additional 17% of a housing unit's rent, imposing $440 million direct deadweight loss for carless renters. They suggest that cities reduce or eliminate minimum parking requirements and allow and encourage landlords to unbundle parking costs from housing costs. (pg 28)

Conclusions

This report indicates that excessive, inflexible parking requirements are inefficient and inequitable, since they fail to provide an expensive resource (parking) in proportion to need (vehicle ownership). Parking demand varies between households, between neighborhoods, and over time for individual households. Smaller, lower income households located in accessible areas tend to own fewer cars. A typical house or apartment unit may at various times house residents with zero, one, two or three vehicles.

Parking is a costly resource. Parking typically represents 10-20% of the cost of housing. This may be acceptable to most middle- and upper-income households, which tend to own multiple vehicles and can afford the extra expense, but for lower income families generous parking requirements impose significant financial burdens. (pg 30)

For typical affordable housing in urban locations, where parking represents 20% of residential build costs and parking demand is less than 50% of conventional parking standards, applying more accurate and flexible parking requirements can reduce housing costs by 10%, and even more if additional parking management strategies are implemented. For households that do not own an automobile, more accurate parking requirements and unbundling parking costs can reduce rents by 10-20%. (pg 30)

Donald Shoup
https://www.shoupdogg.com/

> *The following are selected excerpts from various articles available for free from the website hosted by the UCLS Institute for Transportation Studies, in an effort to capture the main ideas and parking solutions advocated by Donald Shoup.*

Donald Shoup is Distinguished Research Professor in the Department of Urban Planning at UCLA. His research has focused on parking, transportation, public finance, and land economics.

In his 2005 book, *The High Cost of Free Parking,* Shoup recommended that cities should (1) charge fair market prices for on-street parking, (2) spend the revenue to benefit the metered areas, and (3) remove off-street parking requirements. In his 2018 edited book, *Parking and the City,* Shoup and 45 other academic and practicing planners examined the results in cities that have adopted these three policies. The successful outcomes show that parking reforms can improve cities, the economy, and the environment.

2019
Donald Shoup, "**Parking Reform Will Save the City. Cities that require builders to provide off-street parking trigger more traffic, sprawl, and housing unaffordability. But we can break the vicious cycle**.," *Bloomberg-CityLab*, September 20, 2019
https://www.bloomberg.com/news/articles/2019-09-20/how-to-reform-your-city-s-bad-parking-requirements#:~:text=Cities%20that%20require%20builders%20to,%2C%20sprawl%2C%20and%20housing%20unaffordability.

The most emotional topic in transportation
Few people are interested in parking itself, but parking strongly affects issues people do care strongly about, such as affordable housing, climate change, economic development, public transportation, traffic congestion, and urban design. Parking requirements reduce the supply and increase the price of housing. Parking subsidies lure people into cars from public transportation, bicycles, or their own two feet. Cruising for curb parking congests roads, pollutes the air, and adds greenhouse gases. Do people really want a

drive-in dystopia more than they want affordable housing, clean air, walkable neighborhoods, good urban design, and a sustainable planet? But most people consider parking a personal issue, not a policy problem.

Planners typically assume that every new resident will come with a car, so they require developers to provide enough off-street parking to house all the cars. Ample free parking then ensures that most residents do want a car. Parking requirements thus result from a self-fulfilling prophecy.

The three essential parking reforms

The upside of parking requirements is that removing them can trigger a cascade of benefits: shorter commutes, less traffic, a healthier economy, a cleaner environment, and more affordable housing. Vast parking lots can evolve into real communities. There's an accidental land reserve available for job-adjacent housing. If cities remove their parking requirements, we can reclaim land on a scale that will rival the Netherlands. Economic objectives often conflict with environmental objectives, but parking reforms can serve both. To distill the 800 pages of my 2005 book *The High Cost of Free Parking* into three bullet points, I recommended three parking reforms that can improve cities, the economy, and the environment:

1. Remove off-street parking requirements. Developers and businesses can then decide how many parking spaces to provide for their customers.
2. Charge the right prices for on-street parking. The right prices are the lowest prices that will leave one or two open spaces on each block, so there will be no parking shortages. Prices will balance the demand and supply for on-street spaces.
3. Spend the parking revenue to improve public services on the metered streets. If everybody sees their meter money at work, the new public services can make demand-based prices for on-street parking politically popular.

Each of these three policies supports the other two. Spending the meter revenue to improve neighborhood public services can create the necessary political support to charge the right prices for curb parking. If cities charge the right prices for curb parking to produce one or two open spaces on every block, no one can say there is a shortage of on-street parking. If there is no shortage of on-street parking, cities can then remove their off-street parking requirements.

Finally, removing off-street parking requirements will increase the demand for on-street parking, increasing the revenue to pay for public services.

2016

Donald Shoup, "**Cutting the Cost of Parking Requirements**," Access, Number 48, Spring 2016, pp. 26-33
http://www.shoupdogg.com/wp-content/uploads/sites/10/2016/05/Cutting-the-Cost-of-Parking-Requirements.pdf

American cities have unwisely embraced each of these car-friendly policies, luring people into cars for 87 percent of their daily trips. Zoning ordinances that segregate land uses, limit density, and require lots of parking create drivable cities but prevent walkable neighborhoods. Urban historians often say that cars have changed cities, but planning policies have also changed cities to favor cars over other forms of transportation. (pg 26)

Without knowing how much the required parking spaces cost to build, planners cannot know how much parking requirements increase the cost of housing. Small, spartan apartments cost much less to build than

large, luxury apartments, but their parking spaces cost the same. Many cities require the same number of spaces for all apartments regardless of their size; the cost of the required parking thus greatly increases the price of low-income housing.

Parking requirements reduce the cost of owning a car but raise the cost of everything else. Recently, I estimated that the parking spaces required for shopping centers in Los Angeles increase the cost of building a shopping center by 67 percent if the parking is in an aboveground structure and by 93 percent if the parking is underground.

Developers would provide some parking even if cities did not require it, but parking requirements would be superfluous if they did not increase the parking supply. This increased cost is then passed on to all shoppers. For example, parking requirements raise the price of food at a grocery store for everyone, regardless of how they travel. People who are too poor to own a car pay more for their groceries to ensure

A single parking space, however, can cost far more to build than the net worth of many American households. In recent research, I estimated that the average construction cost (excluding land cost) for parking structures in 12 American cities in 2012 was $24,000 per space for aboveground parking, and $34,000 per space for underground parking (Table 1). By comparison, in 2011 the median net worth (the value of assets minus debts) was only $7,700 for Hispanic households and $6,300 for Black households in the United States (Figure 1). One space in a parking structure therefore costs at least three times the net worth of more than half of all Hispanic and Black households in the country. (pg 28)

Many families have a negative net worth because their debts exceed their assets: 18 percent of all households, 29 percent of Hispanic households, and 34 percent of Black households had zero or negative net worth in 2011 (Figure 2). The only way these indebted people can use the required parking spaces is to buy a car, which they often must finance at a high, subprime interest rate. In a misguided attempt to provide free parking for everyone, cities have created a serious economic injustice by forcing developers to build parking spaces that many people can ill afford. (pg 28)

TABLE 1

The Construction Cost of a Parking Space

CITY	CONSTRUCTION COST PER SQUARE FOOT		CONSTRUCTION COST PER PARKING SPACE	
	UNDERGROUND $/SQ FT (1)	ABOVEGROUND $/SQ FT (2)	UNDERGROUND $/SPACE (3) = (1) x 330	ABOVEGROUND $/SPACE (4) = (2) x 330
Boston	$95	$75	$31,000	$25,000
Chicago	$110	$88	$36,000	$29,000
Denver	$78	$55	$26,000	$18,000
Honolulu	$145	$75	$48,000	$25,000
Las Vegas	$105	$68	$35,000	$22,000
Los Angeles	$108	$83	$35,000	$27,000
New York	$105	$85	$35,000	$28,000
Phoenix	$80	$53	$26,000	$17,000
Portland	$105	$78	$35,000	$26,000
San Francisco	$115	$88	$38,000	$29,000
Seattle	$105	$75	$35,000	$25,000
Washington, DC	$88	$68	$29,000	$22,000
Average	**$103**	**$74**	**$34,000**	**$24,000**

(pg 28)

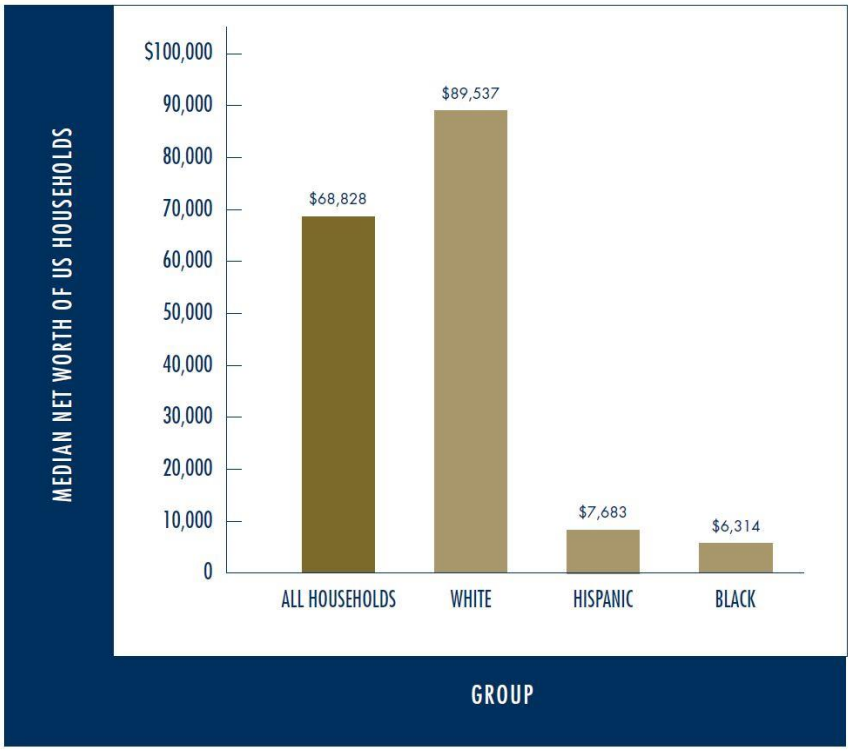


FIGURE 1

Median Net Worth of US Households, 2011

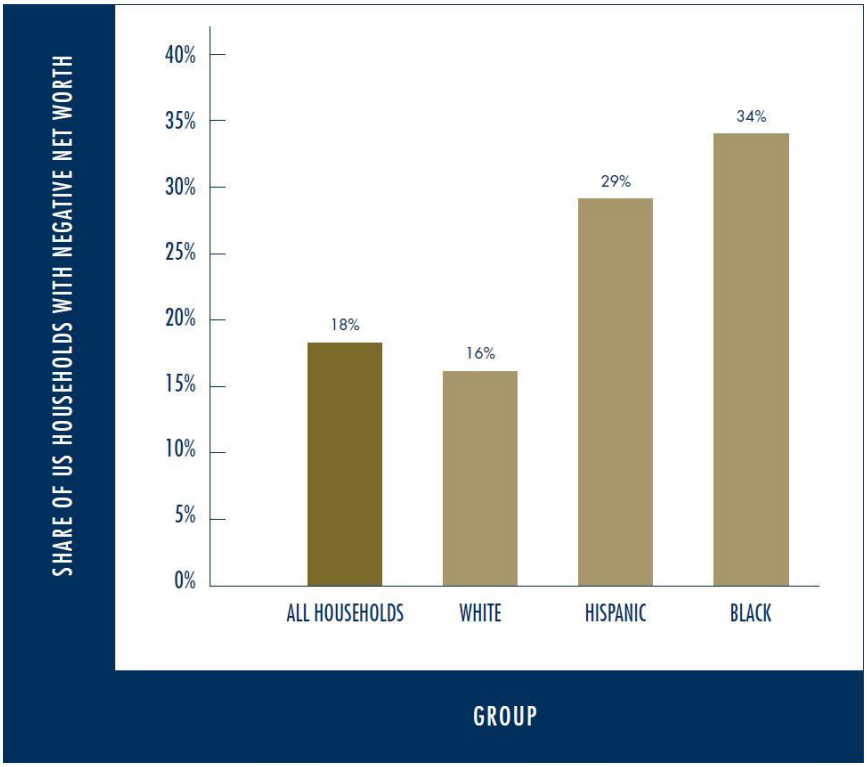


FIGURE 2

Share of US Households with Zero or Negative Net Worth, 2011

(pg 29)

According to recent newspaper articles, some of the reasons cities have reduced or removed their parking requirements include “to promote the creation of downtown apartments” (Greenfield, Massachusetts), “to see more affordable housing” (Miami), “to meet the needs of smaller businesses” (Muskegon, Michigan), “to give business owners more flexibility while creating a vibrant downtown” (Sandpoint, Idaho), and “to prevent ugly, auto-oriented townhouses” (Seattle). (pg 30)

How will reducing off-street parking requirements affect development? Zhan Guo and Shuai Ren at New York University studied the results when London shifted from minimum parking requirements with no maximum, to maximum parking limits with no minimum. Comparing developments completed before and after the reform in 2004, they found that the parking supplied after the reform was only 52 percent of the previous minimum required and only 68 percent of the new maximum allowed. This result implies that the previous minimum was almost *double* the number of parking spaces that developers would have voluntarily provided. Guo and Ren concluded that removing the parking minimum caused 98 percent of the reduction in parking spaces, while imposing the maximum caused only 2 percent of the resulting reduction. Removing the minimum had a far greater effect than imposing a maximum. (pg 31)

2014
Donald Shoup, "**The High Cost of free Parking Requirements**," *Parking and the City*, Donald Shoup Ed, Routledge, 2018, pp. 81-96

The cost of required parking spaces

Because the construction costs vary by location, there is no single measure of how much a parking space costs, but we can estimate the price tag in different locations by using published estimates of local construction costs. Rider Levett Bucknall (RLB***), an international consulting firm that specializes in estimating real estate construction costs, publishes quarterly cost estimates for several real estate categories in cities around the world, including 12 cities in the United States. Table 3-1 presents RBL's estimates of the average cost of parking spaces in the 12 American cities in 2012. (pg 81)

Table 3-1 The Construction Cost of a Parking Space

City	Construction Cost per Square Foot		Construction Cost per Space	
	Underground	Aboveground	Underground	Aboveground
	$/sq ft (1)	$/sq ft (2)	$/space (3)=(1)x330	$/space (4)=(2)x330
Boston	$95	$75	$31,000	$25,000
Chicago	$110	$88	$36,000	$29,000
Denver	$78	$55	$26,000	$18,000
Honolulu	$145	$75	$48,000	$25,000
Las Vegas	$105	$68	$35,000	$22,000
Los Angeles	$108	$83	$35,000	$27,000
New York	$105	$85	$35,000	$28,000
Phoenix	$80	$53	$26,000	$17,000
Portland	$105	$78	$35,000	$26,000
San Francisco	$115	$88	$38,000	$29,000
Seattle	$105	$75	$35,000	$25,000
Washington, DC	$88	$68	$29,000	$22,000
Average	$101	$71	$33,000	$24,000

(pg 82)

We can use the RBL data on the cost of parking spaces to show how parking requirements increase construction costs. Eight of the 12 cities in table 3-1 require parking in direct proportion to the size of the building.

Table 3-2 The cost of parking requirements for office buildings—underground parking structure

City	Parking Requirement	Building Area	Parking Area	Construction Cost		Building Cost	Parking Cost	Cost Increase
				Building	Parking			
	Spaces/1,000 sq ft (1)	Sq ft (2)	Sq ft (3)=(1)×(2)×0.33	$/sq ft (4)	$/sq ft (5)	$ (6)=(2)×(4)	$ (7)=(3)×(5)	% (8)=(7)/(6)
Las Vegas	3.3	1,000	1,100	$148	$105	$148,000	$116,000	78%
Phoenix	3.3	1,000	1,100	$128	$80	$128,000	$88,000	69%
Honolulu	2.5	1,000	825	$233	$145	$233,000	$120,000	52%
Portland	2.0	1,000	660	$138	$105	$138,000	$69,000	50%
Los Angeles	2.0	1,000	660	$158	$108	$158,000	$71,000	45%
Denver	2.0	1,000	660	$125	$78	$125,000	$51,000	41%
Seattle	1.0	1,000	330	$138	$105	$138,000	$35,000	25%
New York	1.0	1,000	330	$225	$105	$225,000	$35,000	16%
Average	2.1	1,000	708	$161	$104	$161,625	$73,125	47%

(pg 84)

Table 3-3 The cost of parking requirements for office buildings—aboveground parking structure

City	Parking Requirement	Building Area	Parking Area	Construction Cost		Building Cost	Parking Cost	Cost Increase
				Building	Parking			
	Spaces/1,000 sq ft (1)	Sq ft (2)	Sq ft (3)=(1)×(2)×0.33	$/sq ft (4)	$/sq ft (5)	$ (6)=(2)×(4)	$ (7)=(3)×(5)	% (8)=(7)/(6)
Las Vegas	3.3	1,000	1,100	$148	$68	$148,000	$74,000	50%
Phoenix	3.3	1,000	1,100	$128	$53	$128,000	$58,000	45%
Portland	2.0	1,000	660	$138	$75	$138,000	$50,000	36%
Los Angeles	2.0	1,000	660	$158	$78	$158,000	$51,000	32%
Honolulu	2.5	1,000	825	$233	$83	$233,000	$68,000	29%
Denver	2.0	1,000	660	$125	$55	$125,000	$36,000	29%
Seattle	1.0	1,000	330	$138	$75	$138,000	$25,000	18%
New York	1.0	1,000	330	$225	$85	$225,000	$28,000	12%
Average	2.1	1,000	708	$161	$71	$161,625	$48,750	30%

(pg 86)

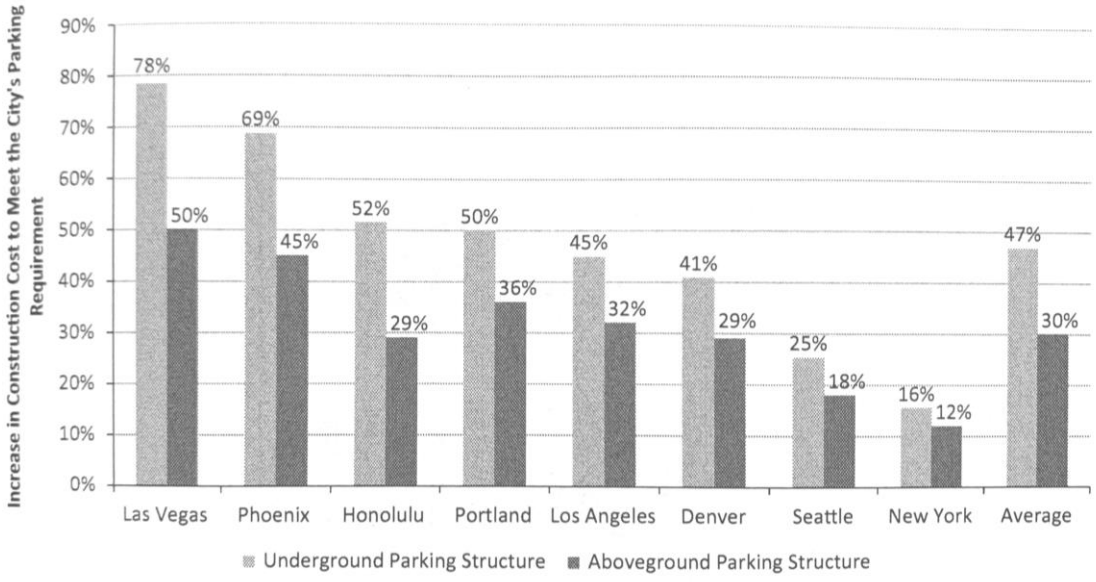


Figure 3-1 How parking requirements increase the cost of constructing office buildings

(pg 87)

Table 3-4 The cost of parking requirements for shopping centers–underground parking structure

City	Parking Requirement	Building Area	Parking Area	Construction Cost		Building Cost	Parking Cost	Cost Increase
				Building	Parking			
	Spaces/1,000 sq ft	Sq ft	Sq ft	$/sq ft	$/sq ft	$	$	%
	(1)	(2)	(3)=(1)x(330)	(4)	(5)	(6)=(2)x(4)	(7)=(3)x(5)	(8)=(7)/(6)
Los Angeles	4.0	1,000	1,320	$153	$108	$153,000	$142,000	93%
Phoenix	3.3	1,000	1,100	$135	$80	$135,000	$88,000	65%
Honolulu	3.3	1,000	1,100	$255	$145	$255,000	$160,000	63%
Denver	2.5	1,000	825	$105	$78	$105,000	$64,000	61%
Las Vegas	4.0	1,000	1,320	$298	$105	$298,000	$139,000	47%
Portland	2.0	1,000	660	$153	$105	$153,000	$69,000	45%
Seattle	2.0	1,000	660	$158	$105	$158,000	$69,000	44%
New York	1.0	1,000	330	$195	$105	$195,000	$35,000	18%
Average	2.8	1,000	914	$181	$104	$181,500	$95,750	53%

(pg 88)

Table 3-5 The cost of parking required for shopping centers—aboveground parking structure

City	Parking Requirement	Building Area	Parking Area	Construction Cost		Building Cost	Parking Cost	Cost Increase
				Building	Parking			
	Spaces/1,000 sq ft	Sq ft	Sq ft	$/sq ft	$/sq ft	$	$	%
	(1)	(2)	(3)=(1)×(2)×0.33	(4)	(5)	(6)=(2)×(4)	(7)=(3)×(5)	(8)=(7)/(6)
Los Angeles	4.0	1,000	1,320	$153	$78	$153,000	$102,000	67%
Phoenix	3.3	1,000	1,100	$135	$53	$135,000	$58,000	43%
Denver	2.5	1,000	825	$105	$55	$105,000	$45,000	43%
Honolulu	3.3	1,000	1,100	$255	$83	$255,000	$91,000	36%
Portland	2.0	1,000	660	$153	$75	$153,000	$50,000	33%
Seattle	2.0	1,000	660	$158	$75	$158,000	$50,000	32%
Las Vegas	4.0	1,000	1,320	$298	$68	$298,000	$89,000	30%
New York	1.0	1,000	330	$195	$85	$195,000	$28,000	14%
Average	2.8	1,000	914	$181	$71	$181,500	$64,125	37%

Source: Rider Levett Bucknall, Quarterly Construction Cost Report, Fourth Quarter 2012

(pg 89)

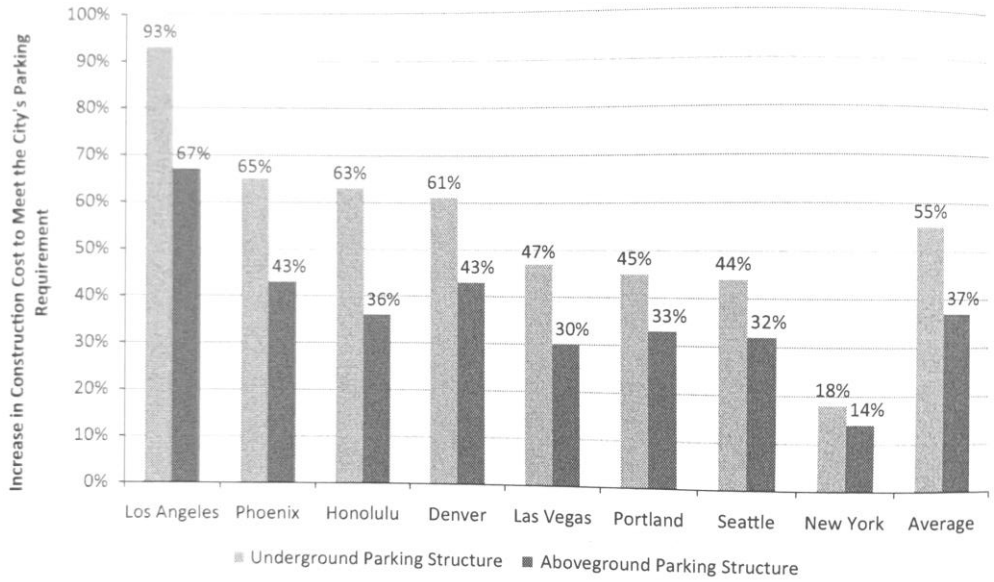


Figure 3-2 How parking requirements increase the cost of shopping centers

(pg 90)

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Rider Levett Bucknall "**Quarterly Construction Cost Report**", Second Quarter 2020 is available on the website:
https://s28259.pcdn.co/wp-content/uploads/2020/07/Q2-2020-QCR.pdf

For comparison purposes, the construction cost for 2020 is on page 4 and 5 of the report.

	PARKING			
	GROUND		BASEMENT	
LOCATION	LOW	HIGH	LOW	HIGH
USA				
Boston	85	140	100	160
Chicago	80	125	125	170
Denver	75	100	135	175
Honolulu	105	150	145	270
Las Vegas	50	85	60	150
Los Angeles	105	125	135	195
New York	95	175	125	200
Phoenix	45	70	70	110
Portland	115	150	130	215
San Francisco	140	160	260	300
Seattle	100	120	140	200
Washington	90	130	110	140

(pg 5)

2006
Vinit Mukhija and Donald Shoup, **"Quantity versus Quality in Off-Street Parking Requirements,"** *Journal of the American Planning Association*, Vol. 72, No.3, Summer 2006, pp. 296-308
http://www.shoupdogg.com/wp-content/uploads/sites/10/2016/11/QuantityVersusQualityInOff-StreetParkingRequirements.pdf

Most local off-street parking requirements emphasize quantity over quality. Local governments often have minimum parking requirements that overwhelm the physical landscape with an excessive supply of unattractive parking,1 but relatively few impose design requirements on parking lots and parking structures. Off-street parking requirements focus on the ratio of parking spaces to floor area, usually neglecting the consequences for urban design. As a result, most parking lots are asphalt breaks in the urban fabric, and most parking structures present blank walls to the street. Parking lots and garages tend to interrupt the streetscape, expand the distances between destinations, and undermine walkability (see Figures 1 and 2). We argue that planners should worry less about the quantity of parking provided and should pay more attention to its quality. (pg 296)

The market gives developers a strong incentive to provide adequate parking because lenders are unwilling to finance projects with inadequate parking and tenants are unwilling to rent space in them. But the market provides less incentive
to improve parking design because many of the benefits of better parking design accrue to the community rather than to the property owner. Developers are more likely to spend money on a marble-veneered lobby (which will increase the value of the building) than on landscaping the parking lot (which will increase the value of the whole neighborhood).
In this article we show how planners can use the following five strategies to improve urban design.

1. Deregulate or limit the number of parking spaces.
2. Improve the location of parking.
3. Improve the design of surface parking.
4. Improve the design of parking structures.
5. Improve the design of residential garages. (pg 296)

Eliminating Minimum Off-Street Parking Requirements

To preserve and enhance walkability, Alexander and his coauthors suggested that only 9% of a city's land should be devoted to parking, though there is little empirical basis for this number. (pg 297)

Removing off-street parking requirements can also ease adaptive reuse and historic preservation. Older buildings rarely meet current minimum parking requirements, and as a consequence many stunning buildings are demolished and replaced by ordinary structures that do meet the requirements. Apart from the irreplaceable loss of heritage, such demolition limits the possibility of a rich and varied collage of buildings from different time periods.2 To encourage the conversion of older, economically distressed office buildings to apartments and lofts, some cities exempt these buildings from parking requirements if they are converted to residential uses. (pg 298)

The cities then use the revenue to provide shared public parking spaces to replace those the developers would have provided. Public parking spaces built with the in-lieu revenue allow drivers to park once and visit multiple sites on foot, reducing vehicle traffic and increasing foot traffic. The in-lieu option makes it easier to restore historic buildings and rehabilitate historic areas for the reasons noted earlier. And because developers can meet their parking requirements without on-site parking, storefronts can be continuous, without the gaps that parking lots create. Developers can also undertake infill projects without assembling large parcels for on-site parking, and architects have greater design freedom. The public parking structures consume less land than if each development provided its own parking lot, and cities can place the structures where they interfere least with vehicle and pedestrian circulation. To improve the streetscape, some cities dedicate the first floor of public parking structures to retail uses. The in-lieu policy thus contributes to a better looking, safer, and more walkable city. (pg 299)

Letting markets determine the number of off-site parking spaces changes, but does not eliminate, planning for parking. Local governments should still regulate parking landscaping, layout, location, pedestrian access, provisions for the handicapped, security, setback, signage, storm water runoff, and urban design. The following section discusses ways to improve urban design by regulating the location and appearance of parking spaces. (pg 299)

2006
Donald Shoup, "**Cruising for parking**," *Transport Policy* 13, 2006, pp. 479–486
http://shoup.bol.ucla.edu/Cruising.pdf

Nevertheless, a few researchers have attempted to estimate the volume of cruising and the time it takes to find a curb space. They have analyzed videotapes of traffic flows, interviewed drivers who park at the curb, and have themselves cruised. Table 1 shows the results of every study of cruising I have been able to find. Between 8 and 74 percent of the traffic was cruising for parking, and the average time to find a curb space ranged between 3.5 and 14 min. The wide variance in the estimates of cruising surely reflects reality. On most streets most of the time, none of the traffic is cruising, but on some streets some of the time, most of the traffic may be cruising. (pg 479)

Table 1
Twentieth century cruising

Year	City	Share of traffic cruising (percent)	Average search time (min)
1927	Detroit (1)	19%	
1927	Detroit (2)	34%	
1933	Washington		8.0
1960	New Haven	17%	
1965	London (1)		6.1
1965	London (2)		3.5
1965	London (3)		3.6
1977	Freiburg	74%	6.0
1984	Jerusalem		9.0
1985	Cambridge	30%	11.5
1993	Cape Town		12.2
1993	New York (1)	8%	7.9
1993	New York (2)		10.2
1993	New York (3)		13.9
1997	San Francisco		6.5
2001	Sydney		6.5
Average		30	8.1

Note: The numbers after Detroit, London, and New York refer to different locations within the same city.
Sources: Simpson (1927), Hogentogler et al. (1934), Huber (1962), Inwood (1966), Bus+Bahn (1977), Salomon (1984), O'Malley (1985), Clark (1993a, b), Falcocchio et al. (1995), Saltzman (1994), and Hensher (2001).

(pg 480)

2005

Michael Manville and Donald Shoup, "**People, Parking, and Cities**," *Journal of Urban Planning and Development*, Vol. 131, No. 4, December 2005, pp. 233-245

http://shoup.bol.ucla.edu/People,Parking,CitiesJUPD.pdf

Abstract: In this study of how off-street parking requirements affect urban form, we begin by analyzing the relationship between population density and streets in cities. We find that denser cities devote a greater share of their land to streets, but also have less street space per person. This relationship results in part from the difficulty of constructing new streets in built-out areas. The amount of street space does not increase as fast as population density, and this in turn helps explain why dense areas have less vehicle travel per person but higher levels of congestion. In contrast to streets, new off-street parking is supplied continually, owing largely to minimum parking requirements that make new development contingent on the provision of parking spaces. But the ample supply of off-street parking makes traffic congestion worse and inhibits street life. We recommend either removing off-street parking requirements, or converting them from minimums to maximums. (pg 223)

Problems with Minimum Parking Requirements

Although all cities have elaborate sets of parking requirements in their zoning ordinances, no city we are aware of keeps careful track of its total number of parking spaces. The absence of such data makes a direct comparison of parking and streets difficult. However, many cities do collect data on the parking supplies of the central business districts, and we can use the CBD data to illustrate the powerful effects that parking requirements have on the city. In their classic text *The Urban Transportation Problem*, John Meyer, John Kain, and Martin Wohl, 1965, calculated that in a downtown with 40-ft-wide streets and 12 blocks to the mile, streets would account for 18% of total land area. Parking, however, could take up much more land. Meyer, Kain, and Wohl calculated that if all commuters traveled downtown by car, and that if all parking was in four-level garages, parking spaces would consume about 38% of the total land area, more than twice the area taken up by streets. Why would so much more land be needed for parking, even if it was stacked in four-level garages? We tend to think of the land needed by cars as being exclusively a matter of space, but in truth it is a function of space and time. Eric Bruun and Vukan Vuchic, 1995, explain that the land used by a vehicle is the product of the land area it occupies and the time it occupies it (space used=land area x time of occupation), and this equation helps explain the enormous demands made by parking on the built environment. (pg 240-241)

Table 5. Parking in the CBD

City	(1)	Land area (hectares) (2)	Parking spaces (3)	Parking spaces per hectare (4)=(3)/(2)	Parking area[a] (hectares) (5)=(3)/325	Parking coverage (6)=(5)/(2)	Employment (jobs) (7)	Jobs per hectare (8)=(7)/(2)	Parking spaces per job (9)=(3)/(7)
1	Los Angeles	408	107,441	263	331	81%	206,474	506	0.52
2	Melbourne, Australia	172	42,601	248	131	76%	126,286	734	0.34
3	Adelaide, Australia	181	42,857	237	132	73%	73,868	408	0.58
4	Houston	392	72,797	186	224	57%	118,889	303	0.61
5	Detroit	362	65,639	181	202	56%	93,012	257	0.71
6	Washington, D.C.	460	80,100	174	246	54%	316,723	689	0.25
7	Brisbane	117	19,895	170	61	52%	61,844	529	0.32
8	Calgary, Atl., Canada	298	45,260	152	139	47%	86,700	291	0.52
9	Portland, Ore.	280	41,861	150	129	46%	103,872	371	0.40
10	Brussels, Belgium	308	45,512	148	140	45%	144,906	470	0.31
11	Vancouver, B.C., Canada	337	46,053	137	142	42%	104,000	309	0.44
12	Edmonton, Alt., Canada	297	37,512	126	115	39%	63,200	213	0.59
13	Frankufurt, Germany	240	29,487	123	91	38%	119,735	499	0.25
14	Canberra, Australia	329	39,558	120	122	37%	22,521	68	1.76
15	Chicago	395	46,653	118	144	36%	363,794	921	0.13
16	Denver	636	37,757	107	208	33%	93,012	146	0.73
17	San Francisco	391	39,756	102	122	31%	291,036	744	0.14
18	Toronto	188	18,436	98	57	30%	174,267	927	0.11
19	Sydney, Australia	416	39,031	94	120	29%	175,620	422	0.22
20	San Diego	570	50,234	88	155	27%	72,964	128	0.69
21	Winnipeg, Canada	440	37,419	85	115	26%	68,593	156	0.55
22	Boston	868	73,604	85	226	26%	119,189	137	0.62
23	Ottawa	305	25,565	84	79	26%	111,031	364	0.23
24	Perth, Wash.	759	63,000	83	194	26%	99,819	132	0.63
25	Phoenix	393	31,937	81	98	25%	35,267	90	0.91
26	Montreal	1,224	94,745	77	292	24%	273,203	223	0.35
27	Paris	2,333	172,000	74	529	23%	862,180	370	0.20
28	Munich, Germany	795	58,430	73	180	23%	219,518	276	0.27
29	Vienna, Austria	298	21,036	71	65	22%	112,770	378	0.19
30	Singapore	725	45,870	63	141	19%	280,000	386	0.16
31	Copenhagen, Denmark	455	27,400	60	84	19%	122,770	270	0.22
32	Sacramento, Calif.	462	27,677	60	85	18%	54,121	117	0.51
33	New York	2,331	138,148	59	425	18%	2,305,545	989	0.06
34	Hamburg, Germany	460	27,056	59	83	18%	152,590	332	0.18
35	Zurich, Switzerland	152	8,668	57	27	18%	63,410	417	0.14
36	Hong Kong	113	6,376	56	20	17%	193,520	1,713	0.03
37	Kuala Lampur	1,625	86,030	53	265	16%	290,000	178	0.30
38	London	2,697	138,843	51	427	16%	1,142,781	424	0.12
39	Amsterdam	824	28,600	35	88	11%	80,722	98	0.35
40	Stockholm	424	13,050	31	40	9%	111,233	262	0.12
41	Seoul, Korea	2,117	59,758	28	184	9%	1,226,830	580	0.05
42	Bangkok	2,056	50,848	25	156	8%	271,944	132	0.19
43	Tokyo	4,208	98,755	23	304	7%	2,300,728	547	0.04
44	Manila	3,600	22,000	6	68	2%	815,400	227	0.03
	Average	**828**	**53,074**	**100**	**163**	**31%**	**321,043**	**403**	**0.36**

Note: Source for CBD area and parking spaces: Kenworthy and Laube (1999, Chapter 3).

[a]Total parking area is the surface parking area (hectares) that all parking spaces (column 3) would occupy. Each hectare of surface parking accommodates about 325 parked cars.

(pg 243)

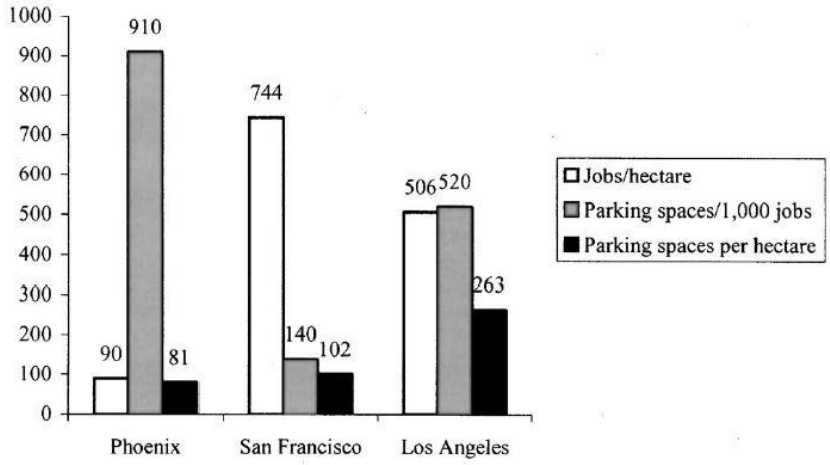


Fig. 2. Land, jobs, and parking in Phoenix, San Francisco, and Los Angeles

(pg 244)

Perhaps the simplest and most productive reform of American zoning would be to declare that all existing off-street parking requirements are maximums rather than minimums. The examples of New York and San Francisco suggest that limits on off-street parking can foster many of density's benefits, and urbanists who admire these cities might urge other places to adopt their approaches to parking. From a different perspective, however, more regulation may not be the best first step. The market can mediate the supply of parking in most urban areas, and despite the planner's frequent desire to replace a floor with a ceiling, it may be better to simply deregulate parking—to force it on no one and let those who want it pay for it. A market-oriented approach to parking would eliminate cumbersome regulations, remove incentives to drive, and let city planners concentrate on matters that seriously demand their attention. (pg 245)

2003

Donald Shoup, "**Truth in Transportation Planning**," *Journal of Transportation and Statistics*, Vol 6, No. 1, 2003, pp. 1-16

http://www.shoupdogg.com/wp-content/uploads/sites/10/2017/01/TruthInTransportationPlanning.pdf

ABSTRACT

Transportation engineers and urban planners often report uncertain estimates as precise numbers, and unwarranted trust in the accuracy of these precise numbers can lead to bad transportation and land use policies. This paper presents data on parking and trip generation rates to illustrate the misuse of precise numbers to report statistically insignificant estimates. Beyond the problem of statistical insignificance, parking and trip generation rates typically report the parking demand and vehicle trips observed at suburban sites with ample free parking and no public transit. When decisionmakers use these parking and trip generation rates for city planning, they create a city where everyone drives to their destinations and parks free when they get there. (pg 1)

PLANNING FOR FREE PARKING

ITE's parking and trip generation rates can create serious problems when they are used for urban planning. Most ITE samples are too small to draw statistically significant conclusions, and ITE's method of collecting data skews observations toward sites with high parking and trip generation rates. Larger samples might solve the problem of statistical insignificance, but a basic problem with parking and trip generation rates would remain: they measure the peak parking demand and the number of vehicle trips *at suburban sites with ample free parking.* This situation is troubling, because ITE rates greatly influence the outcome of transportation and land-use planning, ultimately contributing to decisions that result in more traffic, lower density, and more urban sprawl.

To explain how ITE's parking and trip generation rates influence transportation and land-use planning, consider what appears in practice to be the six-step process of planning for free parking in the United States.

Step 1. Transportation engineers survey the peak parking demand at a few suburban sites with ample free parking but no transit service, and ITE publishes the results in *Parking Generation* with misleading precision.

Step 2. Urban planners consult *Parking Generation* to set minimum parking requirements. The maximum observed parking demand thus becomes the minimum required parking supply.

Step 3. Developers provide all the parking that planners require, and the ample supply of parking drives the price of most parking to zero, which increases vehicle travel.

Step 4. Transportation engineers survey vehicle trips to and from suburban sites with ample free parking but no transit service, and ITE publishes the results in *Trip Generation* with misleading precision.

Step 5. Transportation planners consult *Trip Generation* as a guide to design the transportation system with adequate capacity to bring cars to the free parking.

Step 6. Urban planners limit density so that development with ample free parking will not generate more vehicle trips than nearby roads can carry. This lower density spreads activities farther apart, further increasing both vehicle travel and parking demand.

We come full circle when transportation engineers again survey peak parking demand at suburban sites that offer free parking but no transit service and find that more parking spaces are "needed." Misusing precise numbers to report uncertain data gives a veneer of rigor to this elaborate but unscientific practice, and the circular logic explains why planning for transportation and land use has contributed to increased traffic and sprawl. (pg 9-10)

CONCLUSION: LESS PRECISION AND MORE TRUTH

Estimates of parking and trip generation respond to a real demand for essential information. Citizens want to know how development will affect parking demand and traffic congestion in their neighborhood. Developers want to know how many parking spaces they should provide for employees and customers. Planners want to regulate development to prevent problems with parking and traffic. Politicians want to avoid complaints from unhappy parkers. These are all valid concerns but reporting parking and trip generation rates with needless precision creates false confidence in the data. To unsophisticated users, these precise rates appear to carry the rigor of scientific constants.

When planners set parking requirements and design the transportation system, they treat parking and trip generation like established laws and ITE estimates like scientific observations. But parking and trip

generation are poorly understood phenomena, and they both depend on the price of parking, an element not addressed by ITE in the two reports discussed. Demand is a function of price, not a fixed number, and this does not cease to be true merely because transportation engineers and urban planners ignore it. Most cities are planned on the unstated assumption that parking should be free—no matter how high the cost or how small the benefit.

American motor vehicles consume one-eighth of the world's total oil production, and ubiquitous free parking contributes to our automobile dependency. What can be done to improve this situation? Here are four recommendations:

1. ITE should state in the report for each parking and trip generation rate that this rate refers only to suburban sites with ample free parking but no public transit, pedestrian amenities, or TDM programs.
2. ITE should show the regression equation and the *R*2 for each parking and trip generation report and state whether the coefficient of floor area (or other independent variable) in the equation is significantly different from zero.
3. ITE should report the parking and trip generation rates as ranges, not as precise point estimates.
4. Urban planners should recognize that even if the ITE data were accurate, using them to set parking requirements would dictate an automobile-dependent urban form with free parking everywhere. (pg 11-12)

1999

Donald Shoup, "The trouble with minimum parking requirements," *Transportation Research*, Part A 33, 1999, pp. 549-574

http://shoup.bol.ucla.edu/Trouble.pdf

Motorists pay for their vehicles (worth US$1.1 trillion in 1995) but they park free for 99% of automobile trips.10 Motorists pay so little for parking because parking requirements bundle the cost of parking into the cost of development. Parking is free for most automobile trips only because its cost has been shifted into higher prices for everything else. Everyone pays for parking whether they use it or not. (pg 557)

5. An alternative: let prices do the planning

Minimum parking requirements are a mistake, but they do respond to a real problem, spillover parking. If a land use does not provide enough off-street parking, some motorists drawn to the site will park on nearby streets, competing for the scarce curb parking supply. Urban planners know that this spillover parking creates enormous political problems. If spillover parking from a new development congests the adjacent curb parking, everyone nearby will angrily ask planners and politicians, "How could you let this happen"? To prevent parking spillover where adjacent curb parking is free, new land uses must provide enough off-street spaces to satisfy the demand for free parking. Free curb parking explains why planners consciously or unconsciously base off-street parking requirements on the demand for free parking. (pg 560)

7.1. Efficiency

Even if market prices can efficiently allocate a fixed stock of parking spaces, can market forces alone supply enough spaces to meet the demand for parking? If minimum parking requirements are eliminated, the ratio of parking spaces to cars will decline, and the price of parking will rise. This price rise will have two effects on demand and supply.

First, motorists will economize on parking by changing their travel behavior. Shifting to higher occupancy vehicles to spread the cost of parking among more people will reduce the demand for parking. Shifting to walking, cycling, or public transit will also reduce the demand for parking. Shifting vehicle trips to off-peak will reduce the demand for parking at peak hours. Finally, citizens can choose to own fewer cars, and this will reduce the demand for parking.

Second, freed from minimum parking requirements, developers will supply parking spaces in response to parking prices. The higher price of parking will encourage developers to voluntarily supply more parking in places where the resulting revenue will cover the cost of providing the parking. Parking will tend to become unbundled from other transactions, and forms that specialize in providing parking will manage more of the parking supply. Off-street parking prices will tend to cover the cost of providing parking spaces, including the cost of land, and these o€-street prices will put a ceiling on the price of adjacent curb parking.

Flexible market prices can equate demand with the fixed supply of parking in the short run, and these prices will signal where the supply can probably be increased in the long run. The proper role for the government is to price curb parking to maintain a minimum vacancy rate so that parking will always be available if motorists are willing to pay for it. (pg 568)

8. Conclusion: time for a paradigm shift
Planning for parking deserves a new paradigm.
Minimum parking requirements are based on two highly unreasonable assumptions: (1) the demand for parking does not depend on its price, and (2) the supply of parking should not depend on its cost. This neglect of price and cost stems from a belief that planners can assess community needs and can regulate the land market to meet these needs. Regulation is justified in many cases where market prices fail to communicate social costs. But market failure does not justify minimum parking requirements.

Letting prices determine the number of parking spaces will transfer to the market an important function that urban planners now perform. But this does not mean an end to planning for parking because planners should regulate many other features of parking that affect the community, such as aesthetics, landscaping, layout, location, pedestrian access, provisions for the handicapped, setback, signage, and stormwater runoff.

Pricing curb parking rather than requiring o€-street parking will improve urban design, reduce traffic congestion, restrain urban sprawl, conserve natural resources, and produce neighborhood public revenue. Eliminating parking requirements will also reduce the cost of housing and of many other goods and services. In conclusion, deregulating the quantity and increasing the quality of parking will improve transportation, land use, and the environment. (pg 570)

1999

Donald Shoup, "Instead of Free Parking," Access, Number 15, Fall 1999, pp. 8-13
http://shoup.bol.ucla.edu/InsteadOfFreeParking.pdf

Because the required parking spaces raise the cost of development, the cost of parking is then translated into higher prices for everything else, and everyone pays for parking indirectly. Residents pay through higher prices for housing, consumers pay through higher prices for goods and services, employers pay through higher office rents. Only in our role as motorists do we *not* pay for parking. (pg 8)

A SURVEY OF IN-LIEU PARKING FEE PROGRAMS
I surveyed the in-lieu parking programs in forty-six cities—twenty-four in the United States, seven in Canada, six in the
United Kingdom, six in Germany, two in South Africa, and one in Iceland. I examined the ordinances and supporting documents for the programs and interviewed the officials who administer them. (pg 9)

The average parking impact fee for the US cities is $31 per square foot of office space, which dwarfs the impact fees levied for all other public purposes. A 1991 survey of one hundred US cities found that the total impact fees for all purposes (roads, schools, parks, water, sewers, flood control, and the like) averaged $6.97 per square foot of office space. The average parking impact fee for office buildings is thus 4.4 times the average impact fee for all other public purposes combined. If impact fees reveal a city's preferences for public services, then it seems that many cities' highest priority is free parking. Officials in most cities reported that they set the in-lieu fee below the cost of providing a public parking space because the fee would be "too high" if the city charged the full cost. When the cost of required parking is hidden in the cost of development, cost does not seem to matter. But when the cost of required parking is made explicit in cash, everyone can see that it is "too high." (pg 11)

TABLE 1

Parking requirements for office buildings in city centers interpreted as impact fees, 1996 (US dollars)

CITY	IN-LIEU PARKING FEE ($/space)	PARKING REQUIREMENT (spaces /1,000 sq ft)	PARKING IMPACT FEE ($/sq ft)
Palo Alto, CA	$17,848	4.0	$71
Beverly Hills, CA	20,180	2.9	59
Walnut Creek, CA	16,373	3.3	55
Kingston upon Thames, UK	20,800	2.3	48
Carmel, CA	27,520	1.7	46
Mountain View, CA	13,000	3.0	39
Sutton, UK	13,360	2.7	36
Harrow, UK	14,352	2.3	33
Hamburg, Germany	20,705	1.5	32
Lake Forest, IL	9,000	3.5	32
Mill Valley, CA	6,751	4.4	30
Palm Springs, CA	9,250	3.1	28
Reykjavik, Iceland	13,000	2.2	28
Claremont, CA	9,000	2.9	26
Concord, CA	8,500	2.9	24
Davis, CA	8,000	2.5	20
Orlando, FL	9,883	2.0	20
Kitchener, Ontario	14,599	1.3	19
Chapel Hill, NC	7,200	2.5	18
Kirkland, WA	6,000	2.9	17
Hermosa Beach, CA	6,000	2.6	16
Berkeley, CA	10,000	1.5	15
Burnaby, British Colombia	7,299	2.0	15
Vancouver, British Colombia	9,708	1.0	10
State College, PA	5,850	1.3	8
Ottawa, Ontario	10,043	0.7	7
Calgary, Alberta	9,781	0.7	7
Port Elizabeth, South Africa	1,846	2.3	4
Waltham Forest, UK	2,000	0.9	2
MEAN	**$11,305**	**2.3**	**$26**
MEDIAN	**$ 9,781**	**2.3**	**$24**

(pg 11)

Parking Code Guidance: Case Studies and Model Provisions. MTC Smart Growth Technical Assistance: Parking Reform Campaign
Prepared for Valerie Knepper, MTC Regional Parking Initiative
Prepared by: Dyett & Bhatia; Nelson Nygaard
June 2012
(72 pages)
Available at: http://resources.cleanenergyroadmap.com/Parking_Code_Guidance_June_2012.pdf

A tool chest for parking. An overview of solutions for revising parking requirements based on research on a selection of cities; explains each tool and approach, includes models for ordinance language, summarizes and proposes solutions matrixes. This is can be uses as a menu manual. The following are selected excerpts:

Executive Summary
This paper identifies key issues and provides guidance for local jurisdictions as they consider refining their parking codes to reflect "best practices" for parking standards and parking management. It builds on MTC's *Toolbox/Handbook: Parking Best Practices and Strategies for Supporting Transit Oriented Development in the San Francisco Bay Area* and includes the following components:

- An overview of issues related to parking minimums, shared parking and pricing;
- A 10-point program for parking reform for discussion purposes;
- An overview of key parking policies and model code provisions that can be adapted for local use and implemented hand in hand with reducing parking requirements; and
- In the appendices, a review of regulatory provisions that have reduced or eliminated parking requirements, including issues addressed and sample code language and web links to exemplary codes.

The best practices reflect and support transit-oriented and pedestrian friendly areas; they also will help make infill development viable and create more walkable, livable communities. They are based on the principle that parking should be managed as a resource that has critical impacts on visitor and commuter access, retail health, traffic safety, economic development, and streetscape quality, and that parking should be managed to achieve both transportation objectives and other community goals. These ideas also respond to trends showing growing interest in living in transit-served areas, with less dependence on the automobile. (pg ES-1)

Parking Minimum Overview
The Problem with Parking Minimums

It is important to note that parking minimum requirements are just that—minimum requirements. Reducing or eliminating the minimum requirement does not eliminate parking—a developer will build parking where demand exists for it, even without minimums, in order to make their products attractive to buyers and renters, and obtain financing. (pg 2)

Addressing Local Concerns
A range of local concerns may arise in relation to reducing or eliminating parking requirements, and details will need to be worked out with local decision-makers. A few of the key issues are listed below (…):

- Understanding the role of parking minimums, when and where they can be reduced and how this can best be done;
- Equity—who is eligible and why would distinctions be made;
- Concerns related to spill-over parking into adjacent neighborhoods;
- Impacts to the developer and financing implications;
- Impacts on businesses and employers ability to attract customers/employees; and
- Consideration of the needs of handicapped residents, commuters and shoppers. (pg 2)

The Big Ideas – A Ten Point Program for Parking Reform

1. Reduce or Eliminate Unnecessary Parking Requirements

Requirements for additional parking for new nonresidential development in Downtowns and town centers should be eliminated, wherever feasible, based on local conditions and community plans. The elimination or reduction in city parking minimums will allow developments to proceed with lower levels of parking in the specific situations where developers think these are viable and will not prevent the construction of new parking where warranted by the market. Experience has demonstrated that such flexibility results in more creativity in addressing access through transit passes, car share, bike parking and shared parking, among other approaches. For example, for residential development in free-standing buildings, some on-site parking may be warranted, but in mixed use buildings, opportunities for shared spaces can reduce the total amount of parking built. In transit corridors with frequent service and around rail transit stations, reductions on the order of 25 percent or more are justified based on "best practices". The Appendix has details on these in the Bay Area and elsewhere, and model code provisions that follow show how this could be done. (pg 3)

2. Share Parking

Ideally, all new non-residential parking in Downtowns and town centers, and around rail transit stations, should be shared parking—spaces that are available for public use, rather than reserved for the tenants and visitors associated with any particular property or set of properties. Shared spaces make economic sense, as the experience in Bay Area cities and elsewhere demonstrate. This can reduce the total parking demand by up to 25 percent or more. (pg 3-4)

3. Promote Alternative Modes

Incorporate requirements or incentives for free/discounted transit passes in exchange for parking spaces, carshare incentives, and bicycle parking requirements to promote the use of alternative modes and reduce the need for car ownership. Cities can establish commuter benefit ordinances that require employers above a stated size to provide multi-modal options to employees, as enacted in San Francisco1, Richmond and Berkeley – these policies can save both the employers and employees money. Specific code provisions to accomplish this are presented in this paper. (pg 3-4)

4. Establish Parking Maximums in Very Transit-Rich and Walkable Areas

A combination of on-street parking and off-street parking is typically used at approximately 1 to 2 spaces per 1,000 square feet of gross floor area for non-residential uses and 1 space per unit for market-rate residential land uses in downtowns, town centers, transit corridors, and mixed-use districts in small cities. Parking usage may be even lower close to excellent transit and in walkable, bikeable communities. Parking maximums can be established in these particular locations, and can help to reduce automobile congestion. Parking occupancy surveys should be performed to establish utilization. Parking utilization responds to pricing, so pricing policies should be assessed when conducting utilization studies. Maximums can prevent over-building of parking, but use of this strategy should be informed by careful local market analysis to

avoid overly dampening the development market, and should be developed in consultation with stakeholders and decision-makers. Parking codes can cap the allowable amount of parking, and require additional permits if a developer or the review authority believes more are required. (pg 4)

5. Adopt Additional Strategies for Parking Management
Some best-practice management strategies that could be included in Parking Code updates are:

- Require developers to unbundle parking costs in residential projects
- Implement/support parking cashout programs
- Provide/facilitate discounted transit pass programs
- Provide parking credits for on-site carsharing service
- Require/facilitate more bike parking (pg 4)

6. Price on-street and off-street parking (…)
7. Adopt an on-street parking availability target (…)
8. Manage parking to achieve the availability target using pricing or time limits (…)
9. Prevent spillover parking impacts in surrounding neighborhoods with residential permit parking zones (…)
10. Establish Parking Benefit Districts (…)

Model Provisions and Zoning Strategies
Reduce or Eliminate Unnecessary Parking Space Requirements
Zoning Strategy
Typical parking standards establish fixed ratios based on land use types (e.g. residential single family, vs. multi-family, retail or office) without regard to urban density and the character of a place, alternate modes, pricing or the parking demand generated by individual uses. They establish requirements for private development that may not serve the public realm and other civic priorities, given the growing interest in creating vibrant urban areas, supporting affordable
housing and infill in our town and city centers and reducing greenhouse gases. The model policies shown above suggest a range of approaches. Some flexibility should be provided in local zoning ordinances, and public parking strategies and pricing for on-street spaces can support an overall access and parking management program meeting broader community objectives. For example, exemptions could be granted for any new development within a Downtown or town center and for small retail shops, and businesses with parking demand below an established threshold. Reductions should be offered for senior housing and Transit-Oriented Development (TOD) without any discretionary review because auto ownership is lower in this population (although special consideration should be given for disabled users). It also might be appropriate to reduce excessive space requirements for certain uses, reflecting transit availability and the evolving urban character of development, and for populations with lower parking utilization, such as smaller households, younger households, lower income households, seniors and those who consciously choose not to own a car. This may have economic development benefits if parking spaces can be used more efficiently. (pg 8)

Cities should establish specific policies for where and when parking minimums may be reduced or eliminated based on their General Plans and transit availability. (pg 9)

Some cities have gone further than just eliminating parking requirements; they have set limits on the maximum amount of parking that can be provided, either in terms of a base standard applicable citywide or

in terms of a “cap” that is applied to a specific geographic area. The basic idea is that limiting the number of spaces allowed promotes efficient use of land, enhances urban form, and supports use of alternate modes of transportation. It helps make Downtowns and town centers more livable spaces, because parking facilities do not dominate the streetscape. While maximums can be used to prevent over-building of parking in highly urban areas, and may reduce excess local automobile traffic, use of this strategy should be informed by careful analysis of parking utilization rates and local market conditions to avoid overly constraining the local market for development. Where parking structures are provided, they can be subject to design requirements to reduce negative impacts on the quality of the area, e.g., requirements for “wrapping” with habitable space – offices or residences, and requirements that parking garage entries cannot be on major pedestrian streets. Air quality benefits also accrue with this policy, as it would lower auto use and also reduce “cruising” for spaces. (pg 9-10)

Another option is to adopt a “Parking Exempt Overlay Zone” that identifies a specific geographic area within the community where no parking is required. The intent would be to support a pedestrian-oriented environment where it exists or is planned and implement a marketbased approach to setting parking requirements. Using an overlay allows the boundaries to fit with urban form and character, and not face problems that may arise if base zoning had to be changed to implement a specific parking exemption. (pg 10)

Table 1: Options for "Rightsizing" Parking for Specific Land Use Type

Use Types	*Typical Parking Requirements*	*A "Rightsize" Parking Requirement*
Residential Use Types		
Single-Family Detached	2 covered parking spaces/unit	Eliminate "covered", reduce standard to one for small lots.
Two-family or Multi-family dwellings:		Allow 25 percent reduction for senior housing; allow reductions or eliminate transit-served corridors; allow reductions for "car-share" spaces; allow reductions or eliminate small-lot development and for small units; do not require additional parking for housing in mixed-use development if shared parking is provided; eliminate parking requirements in car-free zones and allow for guest parking credits with new on-street spaces.
Studio Units	1/unit	
One (1) bedroom	1/unit	
Two (2) or more bedroom units	1.5/unit	
Five (5) or more dwelling units	0.25 guest parking spaces/unit plus parking spaces stated above 60 percent may be of compact car size, individually marked.	
Civic Use Types		
Community Education		
Elementary and Junior High Schools	1/classroom and 1/35 sq. ft. of non-fixed seating area in the auditorium.	
High Schools	5/classroom and 1/25 sq. ft. non-fixed seating in the auditorium, plus the standard public assembly areas and dormitories.	Reduce to 1/classroom plus 1/10 students; allow City to tailor requirements through CUP process for projects with transit access
Trade schools, business colleges, and commercial schools	1/ 35 sq. ft. in instruction area, plus 1/ 250 sq. ft. in office area.	Reduce to 1/25 sq. ft. or less with transit access
Community Assembly	1/3 fixed seats, or per 50 sq. ft. where there are no fixed seats	Reduce to 1/100 sq. ft. and 1/6 seats with transit access.
Commercial Use Types		
Offices	1/ 333 sq. ft.	Reduce to 2/1000 sq. ft. or even eliminate in areas with good transit access and 1/1000 or less in Downtowns
Financial Services	1/250 sq. ft.	
Retail Sales	1/333 sq. ft. of local-serving retail serving primarily local customers. 1/250 sq. ft. for regional retail uses.	Exempt small shops, less than 5,000 sq. ft., with larger cutoffs in downtowns and along transit corridors
Multi-tenant Commercial	1/250 sq. ft. of gross leasable	Eliminate if need less than 20

(pg 14)

Table 1: Options for "Rightsizing" Parking for Specific Land Use Type

Use Types	*Typical Parking Requirements*	*A "Rightsize" Parking Requirement*
	area.	spaces and transit service is available or tier, based on location and project size and transit service available
Hotels and Motels	1/guest unit plus 2 for a manager's unit and 0.5/employee	Reduce employee parking and reduce hotel to 0.75/unit plus spaces for conference/meeting rooms, or to .50/unit if parking is priced and managed.
Eating/Drinking Establishments:		
Full service	1/125 sq. ft.	Reduce to 1/250 or less, or allow Director approval based on case-by-case review and specifically allow for very low or no minimums where circumstances warrant
Convenience. Drive-in and drive-through in restaurants	1/125 sq. ft.	Reduce to 1/250 or less; exempt small uses, less than 2,000 sq. ft.; prohibit drive-in and drive-through in pedestrian-oriented areas

(pg 15)

Discussion Issues for Local Jurisdictions Considering Reducing or Eliminating Parking Requirements

- Whether to eliminate or provide reductions in certain areas, such as transit corridors or Downtown, or for specified uses, such as restaurants, or where parking is priced and actively managed;
- Whether to maintain minimums for residential uses in residential neighborhoods;
- Whether to maintain minimums for auto-oriented uses, particularly where on-street parking alternatives are limited;
- Whether to provide credits for on-street spaces as well as provide reductions;
- Whether to link minimums where in lieu fees may be required to fund multi-modal access improvements or public parking facilities;
- Whether to establish a maximum amount of parking that can be provided in a transit-served area or in Downtown or a town center, subject to careful analysis;
- How to take the needs of disabled people into account; and
- Whether to make reductions discretionary or as of right. (pg 15)

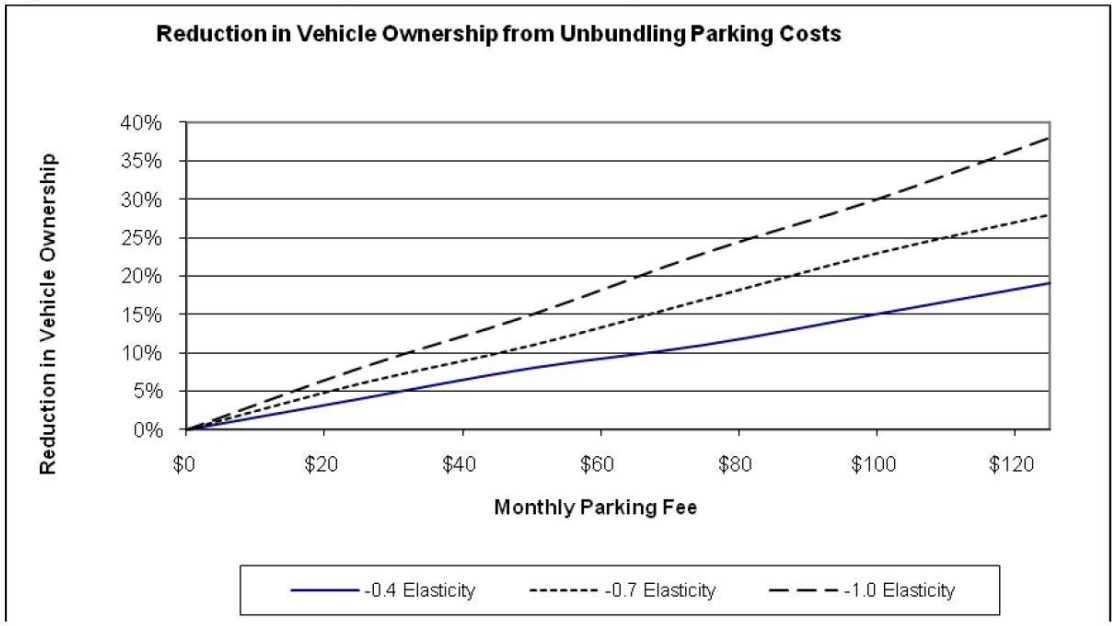
"Unbundling" Parking

Parking costs are generally subsumed into the sale or rental price of housing and commercial space. Although the cost of parking is often hidden in this way, parking is never free; instead the cost to construct and maintain the "free" parking is included in the cost of the goods and services. For all commercial and residential development in a community, or only for projects in a Priority Development Area, local parking

regulations could require the cost to lease or purchase parking to be unbundled from the cost to lease or purchase space. Such a policy would provide a financial incentive to residents and employers to lease only the amount of parking they need. For residential development, unbundled parking may prompt some residents to dispense with one of their cars and to make more of their trips by other modes. Among households with below-average vehicle ownership rates (e.g., low-income people, singles and single parents, seniors on fixed incomes, and college students), unbundled parking can also provide a substantial financial benefit that increases housing affordability. Unbundled parking can allow employers to provide employees with an equitable transportation benefit that can reduce vehicle commuting. This also is known as a "parking cash-out" and may be part of a broader program for Transportation Demand Management (TDM), as discussed more fully in a subsequent section.

By requiring unbundled parking local jurisdictions could see significant reductions in residential vehicle ownership and an associated decrease in vehicle trips from residents of new residential development. Figure 1 indicates the reduction in vehicle ownership that can be expected from unbundling. It is important to note that if on-street parking adjacent to the development is not priced and no time limits are in place, some residents may choose to park in these spaces. (pg 16)

Figure 1: Unbundled Parking and Vehicle Ownership



Source: Litman, Todd. "Parking Requirement Impacts on Housing Affordability." Victoria Transport Policy Institute, 2004.

(pg 17)

A local zoning ordinance then would:

- Require developers to sell or rent the parking space separately from the residential unit to tenants/residents in the project; and
- Not require a prospective residential unit owner to purchase or rent a parking space along with the purchase or rent of a unit.

Specific Code Requirements for Unbundling Parking

- Set a floor on the price of the parking space in order to prevent the sale of a parking space essentially for free. For example, the floor could be set at a certain minimum value (for example, $5,000 or less) and higher where TOD is being encouraged (e.g. around Major Transit Hubs).
- Require the homeowners' association or building management to sell spaces only to building residents until all units are bought/leased, at which time spaces may be offered to other users on a monthly rental, but not for sale, to preserve the option of a new owner/tenant being able to buy a space. (pg 18)

Discussion Issues for Local Jurisdictions Considering Unbundling Provisions

- Whether to require unbundling of all residential parking spaces, or to set a minimum requirement of one space per unit and only require "unbundling" for the additional spaces;
- Whether to differentiate between rental and purchased housing;
- Whether to apply the unbundling requirement only to projects within a half mile of a rail transit station or projects within a downtown area;
- Whether to apply the policy to all newly built properties or only those above a certain size; and
- Whether to test unbundling and related enforcement issues (e.g. on-street parking problems and renting/selling spaces) through a pilot project, only codifying the requirement if the project is successful. This option may not fully consistent with the jurisdiction's General Plan policy on "unbundling", but would allow for additional information to be gleaned, which might facilitate implementation. However, it may suffice to evaluate the success of such programs in other jurisdictions. (pg 19)

Parking Cash-Out

Discussion Issues for Jurisdictions Considering Parking Cash-outs

- Whether major employers are supportive of the program as a local initiative;
- Whether a penalty program should be created as an enforcement mechanism; and
- Whether a pilot effort should be initiated on a voluntary basis before establishing a citywide mandatory program. (pg 21)

Payment In-Lieu of Providing Parking and Related Parking Pricing

Discussion Issues for Jurisdictions Considering In-Lieu Fees and Related Parking Prices

- Whether to create a parking meter fee program to fund a variety of transportation or streetscape related improvements or programs;
- Whether to have the meter pricing be variable, based on real-time information on parking demand;
- Whether to create a parking assessment district with "by right" in lieu fees for uses subject to required parking, that is any use within a defined public parking district can pay an in-lieu fee and no have an on-site parking obligation; or
- Whether under a discretionary program, the City only has to accept fees for up to, say, 20 spaces, and may negotiate with applicants whether a portion of the on-site parking still would have to be provided, such as for short-term use. (pg 28)

Parking for Car-Sharing Vehicles

Discussion Issues for Local Jurisdictions Considering Parking Spaces for Car-Sharing Vehicles

- Whether to require car-sharing spaces in addition to or in lieu of any amount of required parking;

- Whether the number of required car-sharing spaces should be indexed to building size, type, and/or number of standard parking spaces required, and whether the requirement shall apply to new and converted uses in all districts or in selected ones; and
- Whether to require guarantees that the car-sharing spaces will remain in place for a specified term, and whether additional administrative procedures are needed to monitor the use of the spaces post-occupancy.
- Whether to designate some public spaces for the exclusive use of vehicles in the same way that taxis often are given preferential rights at designated parking stands. (pg 30)

Transportation Demand Management (TDM)
Zoning Strategy

To implement the proposed plan policy, a zoning ordinance could allow developers to provide less than the required number of parking spaces in exchange for enhancing alternative mode travel at the development. This option would be integrated with an intensity/density bonus program or a community benefits program or just be a requirement of major new non-residential development. When compared to the cost of providing parking, enhancements to other modes of travel or incentives for drivers to share rides can be more cost-effective. As a general rule, programs that reduce the number of drive-alone trips will in turn reduce the demand for parking.

TDM programs are made up of a number of different initiatives that are meant to increase the attractiveness of modes other than the car. These include but are not limited to:

- Carpool/vanpool preferential parking and gas cards
- Ride-share matching services
- Bicycle parking/lockers
- Shower facilities
- Free or deeply discounted employee transit passes, and/or Commuter Checks
- Dedicated spaces for car-sharing vehicles
- Flexible work schedules and telecommuting options
- "Guaranteed Ride Home" programs

A zoning ordinance then would:

- Allow reductions in the amount of parking provided, in exchange for participation in an approved TDM program under the bonus program; (pg 35)
- Optionally, require certain amenities, such as a minimum number of bicycle spaces or bicycle lockers and bicycle showers, or a certain number of spaces dedicated to carsharing, carpooling or vanpooling, regardless of whether a bonus is requested; and
- Optionally, allow other adjustments to parking requirements in exchange for participation in a TDM program. For example, allow the developer to provide a certain number of carshare spaces instead of standard spaces in exchange for TDM program participation. (pg 36)

Specific Code Requirements for Transportation Demand Management (TDM)

Participation in the TDM program must be assured for at least 5-10 years; a zoning ordinance should require that participation is maintained, or else the building owner must make up any parking deficiency and/or contribute to a transportation fund established by the City. Specific enforcement provisions and penalties for violations should be established.

- Require building owners to have property managers establish a point person who is in charge of administering the program for employees;

 Allow substitution of the employer's own set of TDM initiatives, especially where Cityrun programs are not available. In this case, the ordinance would establish minimum criteria for these programs, with bonding or other financial guarantees; and
 Establish standards for the provision of required amenities, such as bicycle parking. If the requirements state that bicycle lockers and showers, carsharing spaces or other amenities must be provided, these must be provided for the life of the building in order to qualify. (For example, bicycle showers must be fully functional, and priority spaces devoted for carpooling must be monitored to prevent abuse by non-carpool drivers.) (pg 36)

Discussion Issues for Local Jurisdictions Considering TDM Programs

 Whether the TDM program is optional or mandatory for specified uses or projects above a certain size;
 Whether penalties should be imposed for non-compliance, as authorized, for example, for cash-out programs and whether periodic monitoring is required; and
 Whether applicants can re-program activities or have substitute measures as long as performance criteria are met. (pg 38)

American Planning Association (APA) resources

PAS Reports
https://planning.org/pas/reports/
Parking Standards, PAS Report 510-511, 2002
Planning For Shared Mobility, PAS Report 583, 2016
AVs PAS Report 592, 2018

PAS Memo
https://planning.org/pas/memo/
Equity, PAS Memo, 2017
Smart Transportation Metrics, PAS Memo, 2016

PAS Quick Notes
https://planning.org/pas/quicknotes/
Parking Management, PAS Quick Notes, 2014
Shared-Use Micromobility, PAS Quick Notes, 2020

Historical resources:
Municipal Provisions of Parking Facilities, PAS Report 43, 1952
Site Design, Parking and Zoning for Shopping Centers, PAS Report 59, 1954
Urbanizing Influence on the Expressway, PAS Report 71, 1955
Highway-Oriented, PAS Report 177, 1963
Parking Lor Esthetics, PAS Report 190, 1964
Residential Parking, PAS Report 214, 1966

Planning for Shared Mobility

APA, Planning Advisory Service, PAS Report 583
By Adam Cohen and Susan Shaheen
July 2016
(110 pages)

EXECUTIVE SUMMARY

In recent years, economic, environmental, and social forces have quickly given rise to the "sharing economy," a collective of entrepreneurs and consumers leveraging technology to share resources, save money, and generate capital. Homesharing services, such as Airbnb, and peer-to-peer carsharing services, such as Getaround, have become part of a sociodemographic trend that has pushed the sharing economy from the fringe and more to the mainstream. The role of shared mobility in the broader landscape of urban mobility has become a frequent topic of discussion. Major shared transportation modes—such as bikesharing, carsharing, ridesourcing, and alternative transit services—are changing how people travel and are having a transformative effect on mobility and local planning.

WHAT IS SHARED MOBILITY?

Shared mobility—the shared use of a vehicle, bicycle, or other low-speed travel mode—is an innovative transportation strategy that enables users to have short-term access to a mode of transportation on an as-needed basis. Shared mobility includes various service models and transportation modes that meet the diverse needs of travelers. Shared mobility can include roundtrip services (vehicle, bicycle, or other low-speed mode is returned to its origin); one-way station-based services (vehicle, bicycle, or low-speed mode is returned to a different designated station location); and one-way free-floating services (vehicle, bicycle, or low-speed mode can be returned anywhere within a geographic area).

Shared mobility directly influences and is influenced by most facets of urban planning, including the following:

Transportation and circulation: Shared mobility can influence travel patterns, such as modal choice, vehicle occupancy, and vehicle miles traveled.

Zoning, land use, and growth management: Shared mobility can affect land use–related planning factors, including zoning requirements (e.g., parking minimums), parking demand, and the use of public rights-of-way.

Urban design: Shared mobility can support sustainability principles by promoting walking and cycling, providing first-and-last-mile connections to public transportation, and potentially reducing the need to own personal vehicles.

Housing: Shared mobility can support affordable housing strategies by potentially reducing parking demand and allowing for reduced minimum parking requirements at new developments.

Economic development: Shared mobility can create new opportunities for employment and generate revenue from underused resources.

Environmental policy, conservation, and climate action: Shared mobility has the potential to reduce negative impacts commonly associated with surface transportation, such as greenhouse gas emissions.

Because of the wide range of impacts, this report examines the interdependencies, synergies, opportunities, and challenges associated with shared mobility. (pg 4)

Parking Policies

Numerous other parking policies can be implemented alongside the inclusion of shared mobility in the public rights-of-way for a synergistic effect. The following are examples of different parking policies:

Variable market-rate on-street parking: Allow parking rates to fluctuate with demand to help manage the supply-demand balance and optimize parking availability.

Unbundled parking costs: Enable parking spaces to be sold or leased separately from the sale or rental of properties. Unbundling parking costs can incentivize individuals to drive less, own fewer vehicles, and use shared mobility and public transportation.

Parking taxes and surcharges: Assess taxes and surcharges to discourage certain parking behaviors. For example, a city may implement a meter surcharge on parking over four hours to encourage parking turnover and commuter use of alternative transportation.

Parking cash-outs: Allow employers to charge employees for parking while providing pay increases or bonuses to employees who use alternative transportation.

Broadly, these policies let supply and demand price parking, encourage transparency of the true cost of parking (and often pass these costs onto users), and use incentives and disincentives in an attempt to shift drivers to more efficient, lower-impact alternative modes. (pg 42-43)

INCENTIVE ZONING

Finding and leasing parking spaces in urban areas can be difficult and time consuming for carsharing operators. For developers, each parking space can cost upwards of tens of thousands of dollars to construct. Surplus parking can be costly for developers, urban homeowners, and renters alike. Providing designated, on-street parking spaces is one example of how city managers, planners, and public works departments can support shared mobility. Cities can also implement a wide array of policies aimed at easing zoning regulations and parking minimums to promote the inclusion of shared mobility in new developments. Commonly referred to as incentive zoning for shared mobility, these policies can be categorized as (1) policies that enable reduced parking and (2) policies that allow increased density. Policies that allow reduced parking include parking reductions (downgrading the required number of spaces in a new development) and parking substitution (substituting general-use parking for shared modes, such as carsharing parking and bikesharing kiosks).

Parking reduction policies are ideal in urban areas with particularly high housing or parking construction costs. This strategy can help make housing more affordable by reducing per-unit costs and can encourage neighborhood redevelopment and revitalization by making it easier for developers to have positive cash flows and higher capitalization rates on real estate projects. Similarly, parking substitution can be employed in both new and existing developments. Carsharing parking stations can contribute to an overall network effect: the more cars an operator has in a city, the more members it can attract, which in turn can lead to both more vehicle miles traveled and vehicle reductions. To encourage modal shift, parking reduction and substitution strategies should be employed in high-density areas with more robust public transit services.

Policies that allow increased density include greater floor-to-area ratios, more dwelling units permitted per acre, and greater height allowances. Similar to parking reduction, policies that allow for increased density aim at making development more lucrative for developers and real estate investors. Rather than reducing per-unit or overall project costs, these policies increase the overall cash flow of development projects. Allowing increased density is most appropriate for cities seeking to increase overall urban density, residential density, or both. These strategies can be particularly effective at encouraging brownfield

redevelopment because these parcels are often more expensive to repurpose due to the costs commonly associated with environmental remediation.

While the majority of these provisions are codified into municipal codes, parking reductions and policies allowing for increased density can also be granted on case-by-case bases through mechanisms like variances. A variance is a process where applicants can request a departure from standard municipal codes, such as zoning and building codes. Some cities may need to grant special-use permits to allow shared mobility to legally operate. For example, in Massachusetts, the City of Cambridge prohibits carsharing parking on residential driveways. A special-use permit is another method that could allow specific exceptions to the zoning regulations for a particular parcel, neighborhood, or zoning district. (pg 44-45)

Focused Studies and Data

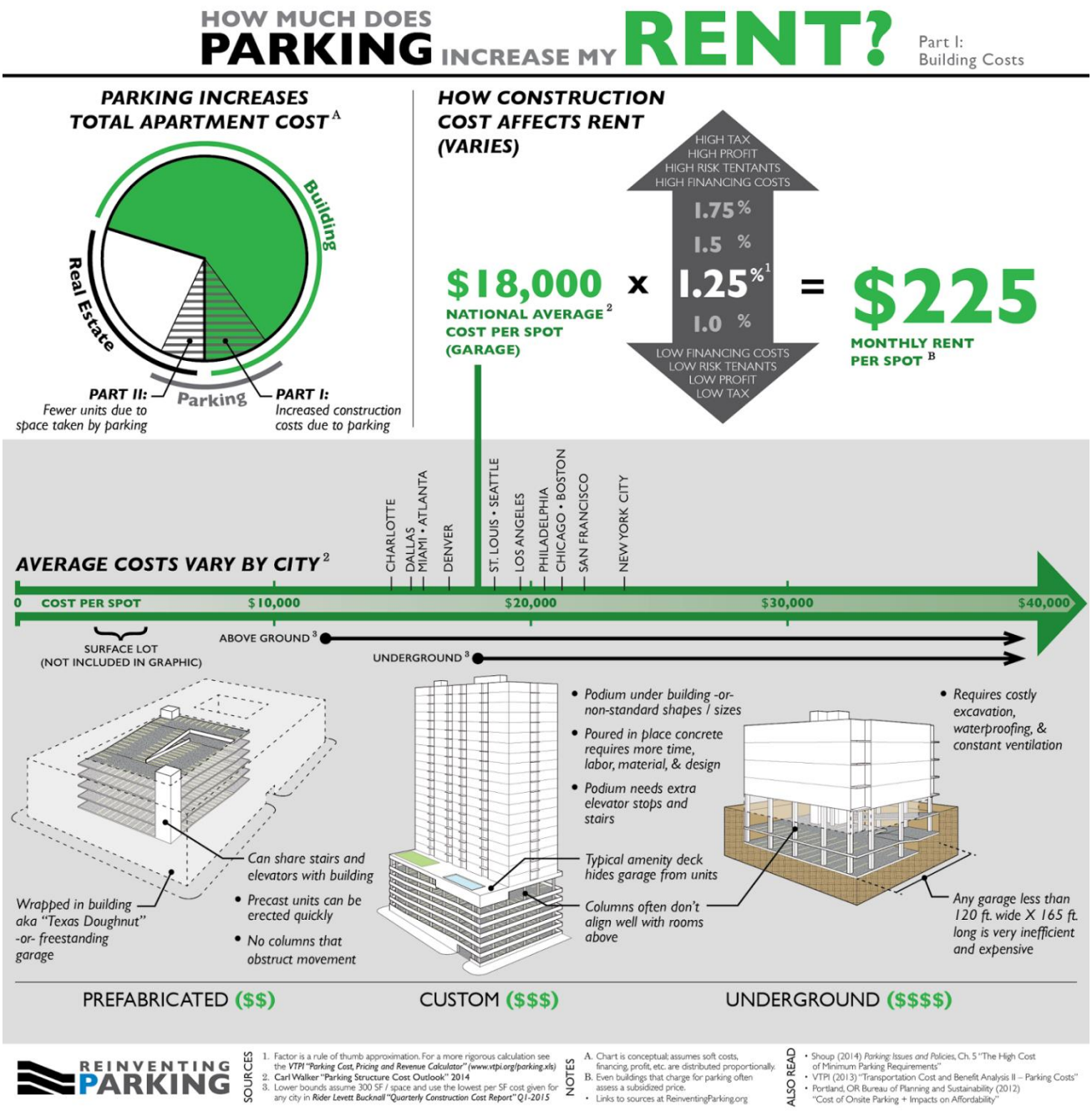
The United States of Parking

By Seth Goodman
All information and data is freely available on his website:
https://graphingparking.com/author/sethbgoodman/
https://graphingparking.com/
Also in In Parking and the City, Donald Shoup, 2018, Routledge; Chapter 6; pg 109-125

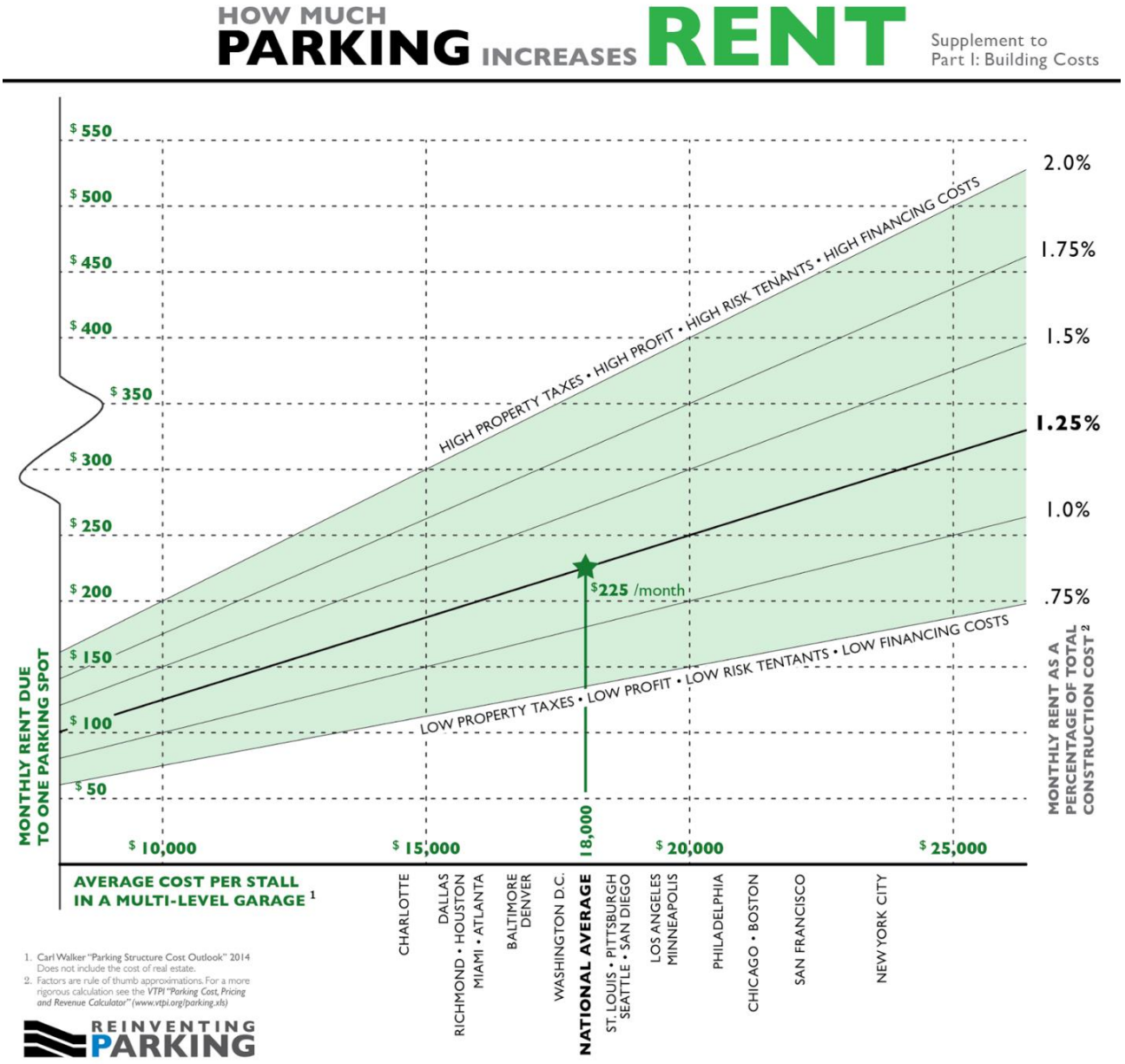
The following is a selection from series of posts on different topics:
How much does one parking spot add to rent?
June, 2015
(https://www.reinventingparking.org/2015/06/how-much-does-one-parking-spot-add-to.html)

Parking is expensive. It costs thousands of dollars per stall to build. It occupies valuable real estate. It is ubiquitous, accompanying nearly every building built across the United States. Yet at nearly every destination, drivers don't directly pay for the parking they use. Instead the cost is hidden, bundled into the grocery bill, benefits package, and rent of every shopper, employee, and tenant. Everyone pays the same amount for parking whether she or he walked, rode transit, carpooled, or drove alone, but rarely does anyone see that price itemized on a receipt. As a result, most people are unaware of the heavy financial burden they bear for the sake of parking. The above graphic takes a look at one area where parking adds significantly to a household's expenses: Rent.

So how much does one parking spot add to an apartment's rent? There is no single answer to that question. Construction costs are affected by local soil conditions, zoning requirements, site constraints, regional differences in construction costs, and the type of parking to be built. On the other hand, the rent needed to justify an initial capital investment varies according to local property taxes, financing costs, resident turnover and delinquency rates, et cetera. The graphic attempts to present the range covered by these variables while providing numbers that might be considered typical for structured parking in the United States.



(https://www.reinventingparking.org/2015/06/how-much-does-one-parking-spot-add-to.html)



(https://www.reinventingparking.org/2015/06/how-much-does-one-parking-spot-add-to.html)

The effect of each parking spot on affordability is significantly higher in urban communities than suburban ones both because the land occupied by parking is more expensive in urban areas and because building structured parking is many times more costly than paving surface lots. This reality affects the ability of lower income households to live in urban areas since parking costs roughly the same to build whether an apartment is luxury grade or modest. An $18,000 spot might not have a noticeable impact on the rent of a $300,000 unit, but it would definitely be noticed by someone renting a $75,000 unit.

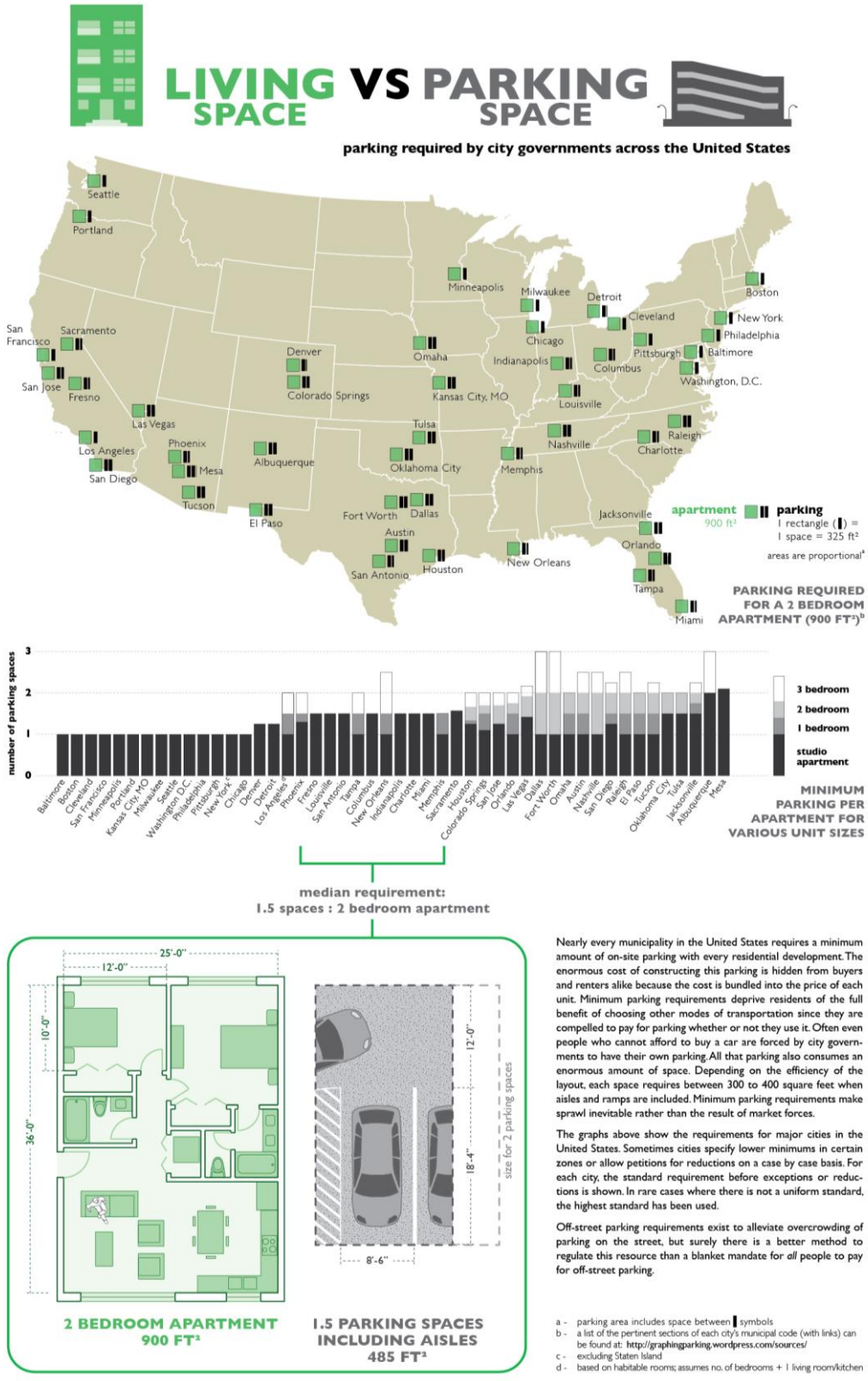
The following is a series on parking analysis by use and parking ratios per use, that is comparing 37 major cities, including Dallas, Fort Worth, Austin, Houston.

Residential Parking Requirements
January 2013
https://graphingparking.com/2013/01/25/residential-parking-requirements/

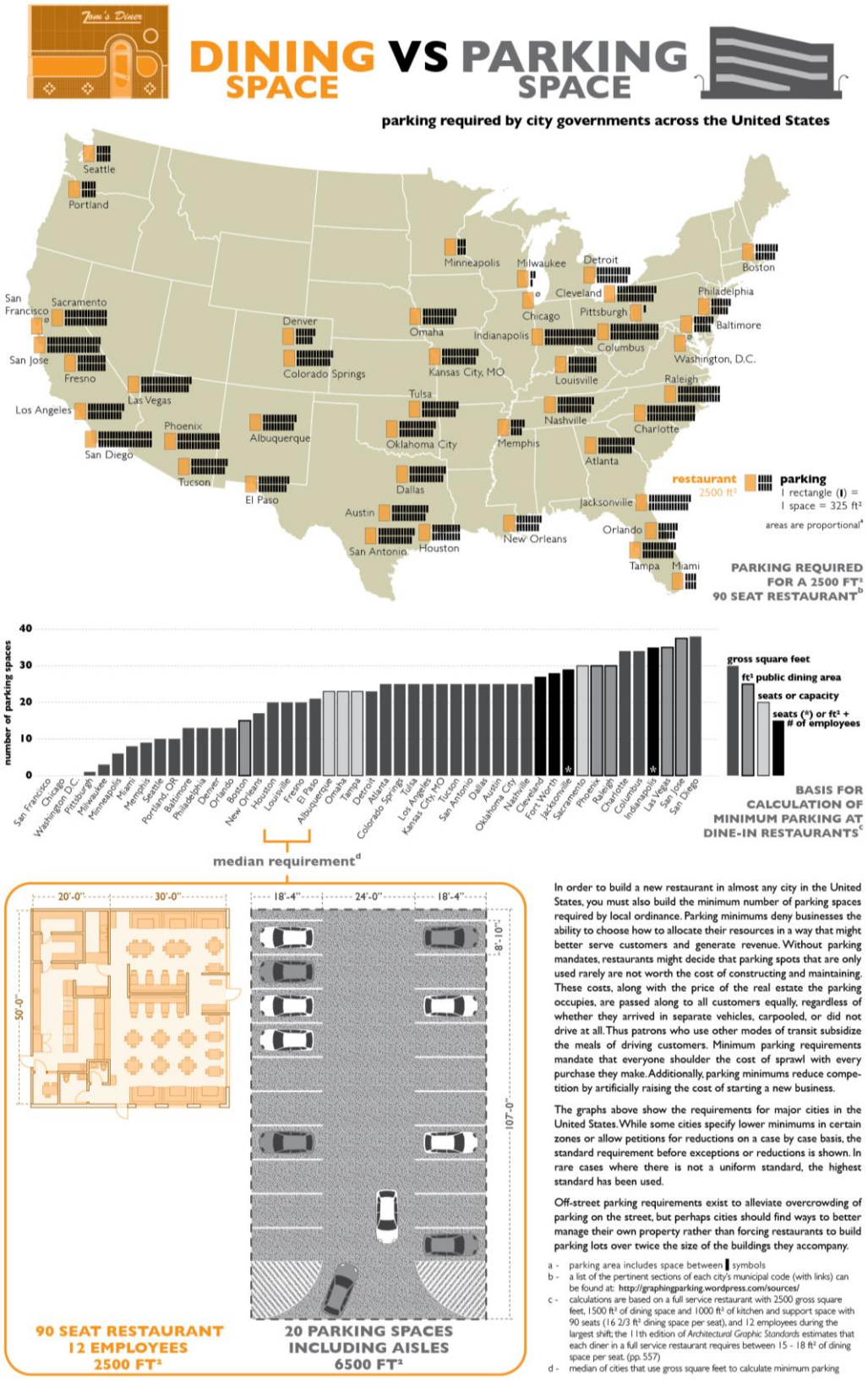
Parking Requirements for Restaurants
February 2013
https://graphingparking.com/2013/02/06/parking-requirements-for-restaurants/

Parking Requirements for Office Buildings
May 2013
https://graphingparking.com/2013/05/17/parking-requirements-for-office-buildings/

Parking for High Schools
September 2013
https://graphingparking.com/2013/09/22/parking-for-high-schools/



(https://graphingparking.files.wordpress.com/2013/01/apartments.png)



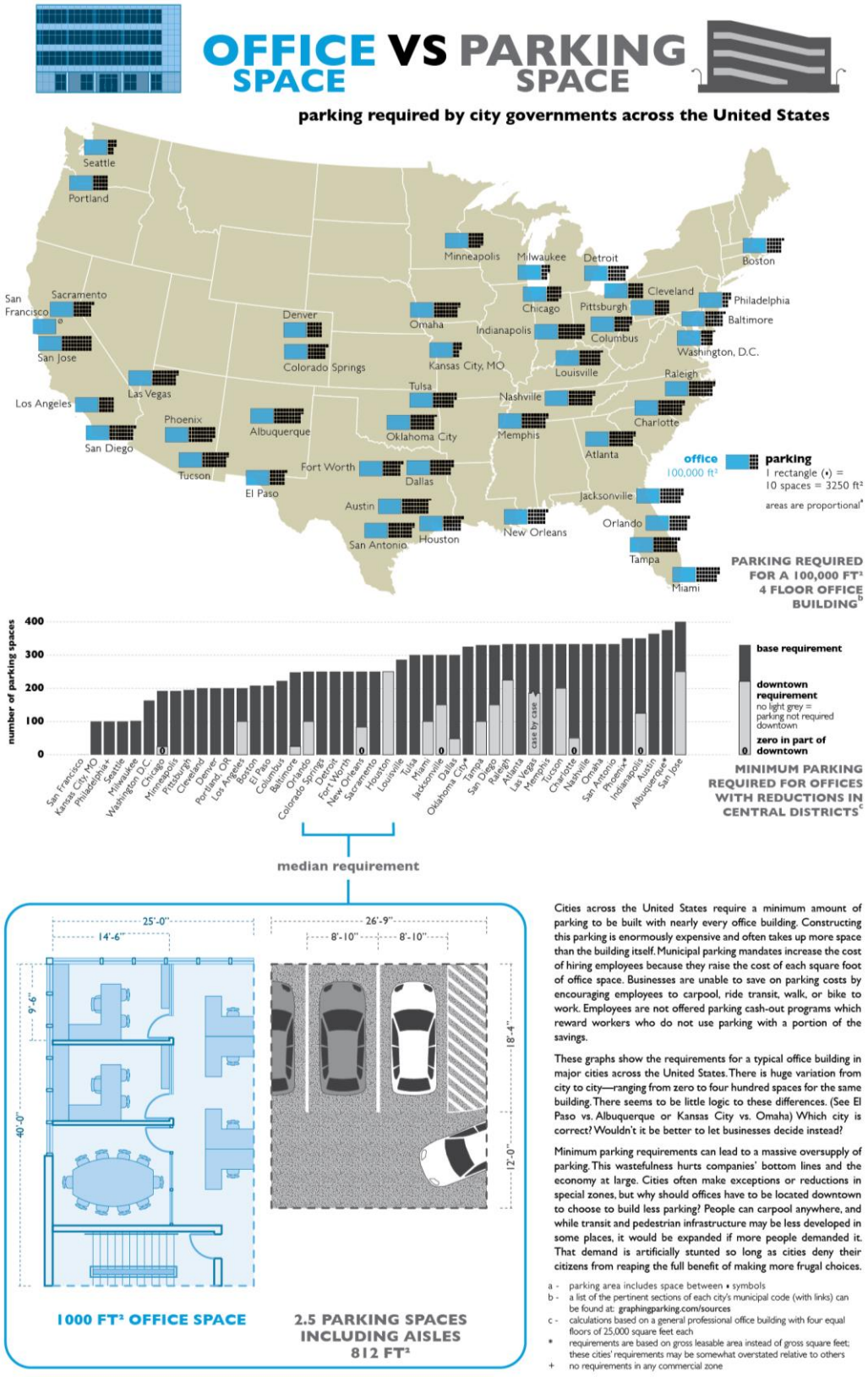
In order to build a new restaurant in almost any city in the United States, you must also build the minimum number of parking spaces required by local ordinance. Parking minimums deny businesses the ability to choose how to allocate their resources in a way that might better serve customers and generate revenue. Without parking mandates, restaurants might decide that parking spots that are only used rarely are not worth the cost of constructing and maintaining. These costs, along with the price of the real estate the parking occupies, are passed along to all customers equally, regardless of whether they arrived in separate vehicles, carpooled, or did not drive at all. Thus patrons who use other modes of transit subsidize the meals of driving customers. Minimum parking requirements mandate that everyone shoulder the cost of sprawl with every purchase they make. Additionally, parking minimums reduce competition by artificially raising the cost of starting a new business.

The graphs above show the requirements for major cities in the United States. While some cities specify lower minimums in certain zones or allow petitions for reductions on a case by case basis, the standard requirement before exceptions or reductions is shown. In rare cases where there is not a uniform standard, the highest standard has been used.

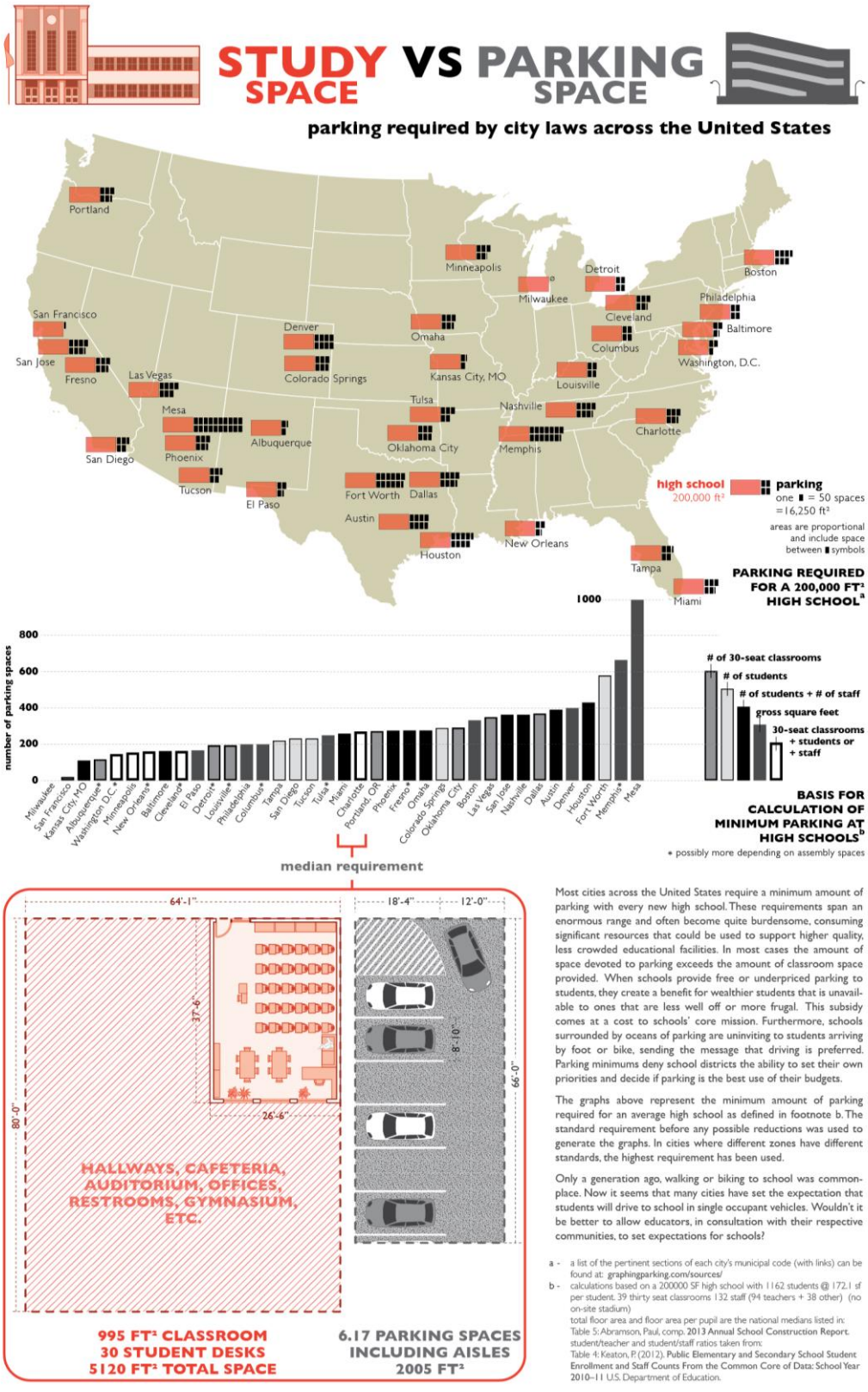
Off-street parking requirements exist to alleviate overcrowding of parking on the street, but perhaps cities should find ways to better manage their own property rather than forcing restaurants to build parking lots over twice the size of the buildings they accompany.

a - parking area includes space between ▮ symbols
b - a list of the pertinent sections of each city's municipal code (with links) can be found at: **http://graphingparking.wordpress.com/sources/**
c - calculations are based on a full service restaurant with 2500 gross square feet, 1500 ft² of dining space and 1000 ft² of kitchen and support space with 90 seats (16 2/3 ft² dining space per seat), and 12 employees during the largest shift; the 11th edition of *Architectural Graphic Standards* estimates that each diner in a full service restaurant requires between 15 - 18 ft² of dining space per seat. (pp. 557)
d - median of cities that use gross square feet to calculate minimum parking

https://graphingparking.files.wordpress.com/2013/02/restaurant-2500sf1.png



https://graphingparking.files.wordpress.com/2013/05/office3.png



https://graphingparking.files.wordpress.com/2013/09/high-school.png

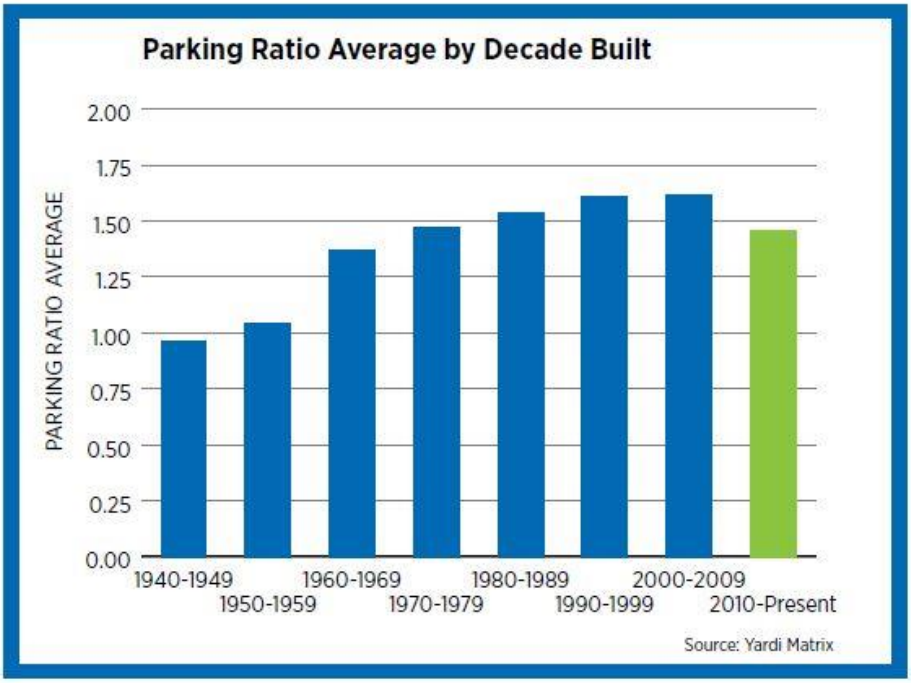
The Transformation of Parking. Multiple factors are converging to disrupt everything we know about parking

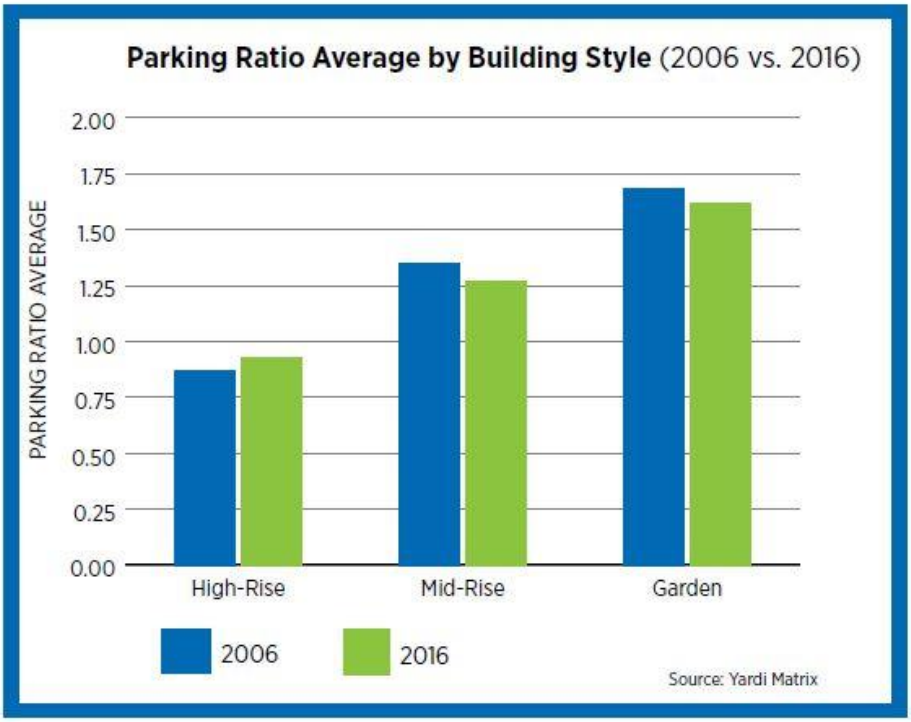
Prepared by/for: National Apartment Association
July 20, 2018
(13 pages)
Available at:
https://www.naahq.org/news-publications/transformation-parking
https://www.naahq.org/sites/default/files/naa-images/Research/naa_parking_final_revised_sep_2018.pdf

Multiple factors are converging to disrupt everything we know about parking: Its physical structure, format, design, cost and, perhaps most important, demand. The urban revival leading to a reduction in the need for parking, electronic vehicles, autonomous vehicles and the sharing economy as it relates to auto use will all have major impacts on parking. Apartment community developers, owners and operators who are not yet addressing this in their business plans will find themselves missing opportunities for operational efficiencies and maximizing revenue sources. (slide 1)

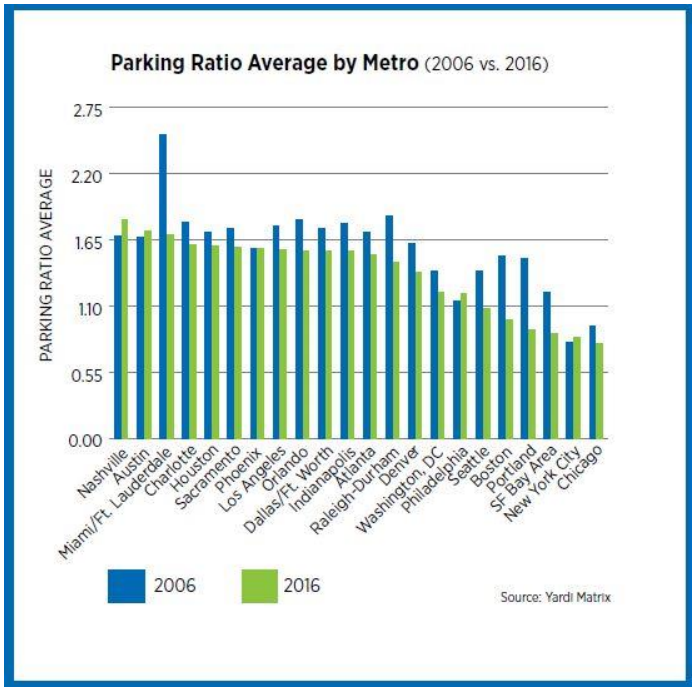
Parking Ratios
After rising consistently through the decades, the 2010s witnessed a decrease in parking ratios in newly constructed
buildings across the United States. Average parking ratios for apartment properties with 50 or more units peaked at 1.62 in the 2000s before declining to 1.46 in the current decade, its lowest rate since the 1960s. This major shift coincides with the ongoing apartment boom of the current business cycle and reflects the increasing urban nature of residential development versus the overwhelming suburban character of residential developments in decades past.

More recent changes reveal that the parking ratio average for garden apartments has declined slightly from 1.68 in 2006 to 1.62 in 2016. Similarly, the ratio for mid-rise buildings also declined from 1.35 to 1.27 during the same period. However, the ratio for high-rise buildings has risen slightly from 0.87 to 0.93, illustrating the fact that while changes are clearly underway, the societal car-centric nature remains strong and major shifts in attitude might take decades to play out in the data. (pg 1)


Parking Ratio Average by Decade Built
PARKING RATIO AVERAGE
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
1940-1949
1950-1959
1960-1969
1970-1979
1980-1989
1990-1999
2000-2009
2010-Present
Source: Yardi Matrix


Parking Ratio Average by Building Style (2006 vs. 2016)
PARKING RATIO AVERAGE
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
High-Rise
Mid-Rise
Garden
2006
2016
Source: Yardi Matrix

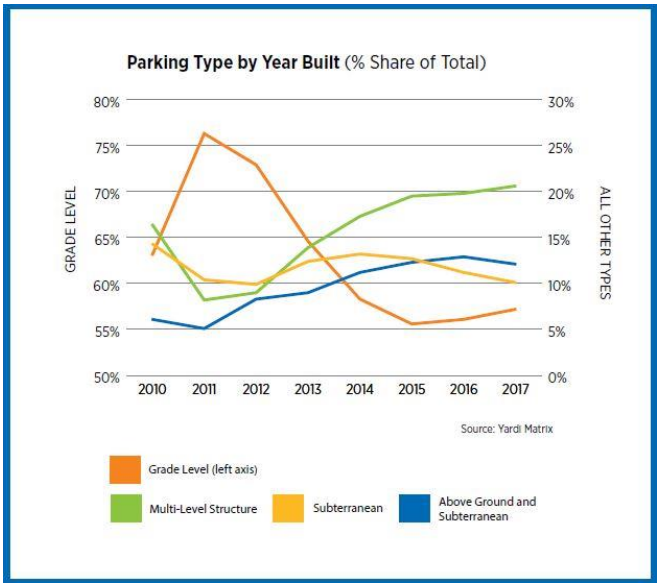
(pg 1)



(pg 2)

Parking Structures

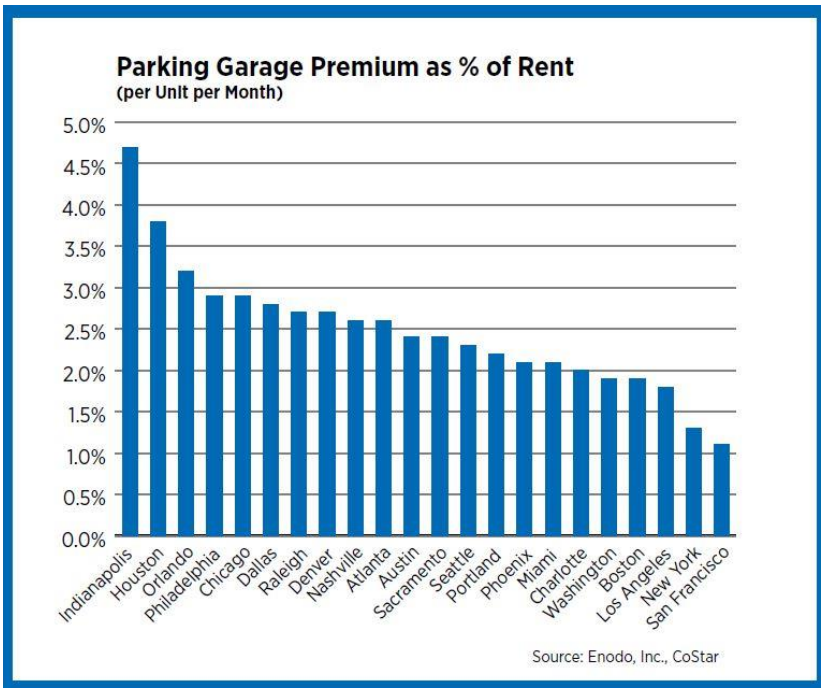
The types of parking available at apartment properties have become substantially more diverse in recent decades. While the vast majority of properties (over 90 percent) constructed from the 1940s to the 1990s offered grade-level parking, in line with the dominance of the automobile-oriented lifestyle and suburban development patterns, the percentage of new properties with grade-level parking has decreased significantly to 61.5 percent in the present decade. Not surprising, other parking types have become more common given the surge in urban developments and inherent lack of available land. (pg 3)



(pg 3)

Rent Premiums

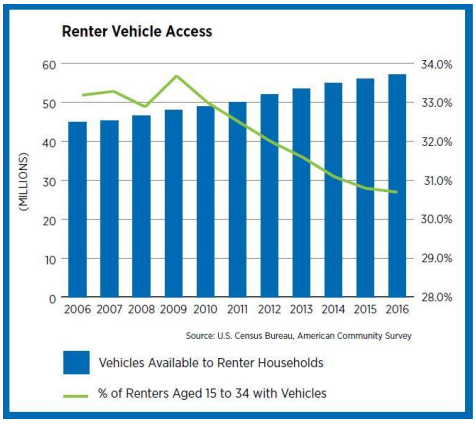
Apartment residents are willing to pay more for parking, a testament to the fact that Americans still love their automobiles. Data provided by Enodo, Inc., a real estate predictive analytics company, for selected cities across the U.S. reveal premiums ranging from just over 1 percent of average monthly rent to nearly 5 percent. (pg 5)

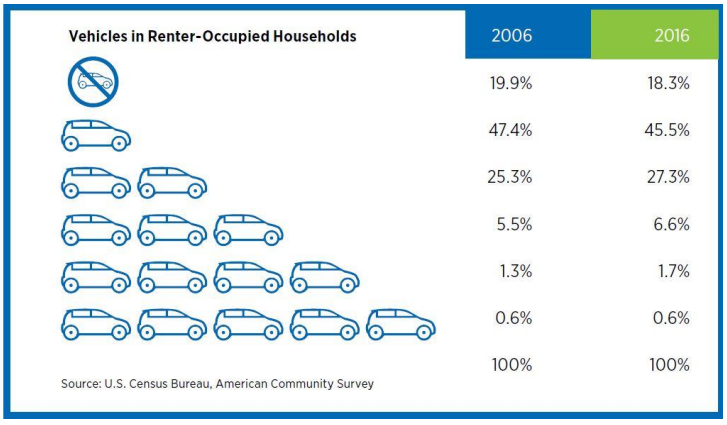


(pg 5)

Vehicle Access

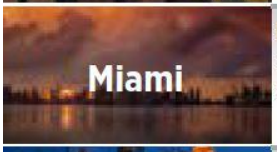
The number of vehicles available to renters saw an uptick from 2006-2016, according to the U.S. Census Bureau. Nevertheless, the portion of renters ages 15 to 34 with vehicles has decreased from a peak of 33.7 percent in 2009 to 30.7 percent in 2016. (pg 6)





(pg 6)

The Affordability Factor

 Seattle	Minimum parking requirements reduced for affordable housing developments to one space per six units, and bicycle parking requirements expanded. Definition of "frequent transit" revised to include more districts. Parking agreements required to be separate from rental agreements.[3]	Enacted in April 2018
 Arlington, VA	Minimum parking requirements in Metro corridors can be reduced to 0.2 to 0.6 spaces per unit by special exception. Developers required to provide mitigations if they offer more than 1.65 spaces per unit.[4]	Enacted in November 2017
 Baltimore	Downtown district minimum parking requirements eliminated.[5]	Enacted in June 2017
 Oakland	Additional parking requirements eliminated for one-family residential properties containing secondary unit.[6]	Enacted in May 2017
 Denver	After allowing parking exemptions for smaller lots in certain zoning districts beginning in 2010, the City Council rolled back exemptions, requiring more parking.[7]	Revisions enacted in May 2017
 Portland	Minimum parking requirements eliminated for developments located near frequent transit if project contains affordable units.[8]	Enacted in February 2017
 Buffalo	All minimum parking requirements eliminated.[9]	Enacted January 2017
 New York	Minimum parking requirements eliminated for subsidized and senior housing projects located in transit zone.[10]	Enacted in May 2016
 Miami	Minimum parking requirements were initially waived for developments in downtown district; eventually expanded to include developments outside downtown under 10,000 square feet.[11]	Downtown waivers began in 2010; expansion to other districts enacted in October 2015
 Minneapolis	Initially targeting the downtown district, minimum parking requirements were eliminated for developments with 50 or fewer units and cut in half for projects with more than 50 units located near frequent transit.[12]	Downtown changes enacted in 2013; expanded in July 2015
 San Francisco	No off-street parking spaces required except for permit simple exceptions in all zoning districts except RH (residential, house).[13]	Enacted in May 2015

(pg 8)

Looking Forward

Studies on myriad aspects of parking by a variety of stakeholders are abundant, and there is no shortage of predictions on its future. According to Green Street Advisors, parking needs will be cut in half over the next 30 years, to the tune of 75 billion square feet.14 RethinkX, an independent think tank, forecasts a decline in vehicle ownership from 247 million currently to 44 million by 2030, but makes a major assumption that autonomous vehicles will receive regulatory
approval by 2020.15 Recent setbacks in autonomous vehicles' progress, including accidents, make this assumption seem highly unlikely. The architecture firm, Gensler, calculates a reduction in parking's footprint from 25 percent for above and below-grade parking to up to 100 percent for surface parking16, that is, the potential to be completely eliminated; and also believes car ownership will peak in 2020 and decline thereafter.

Gensler is already advising its clients to build parking that can easily be converted in the future. It comes at a cost, however, which is typically 15-20 percent higher. Design alterations include flat floor plates and higher floor-to-floor-heights, both of which lend themselves to conversions to several other use types.

For the vast majority of apartment communities, removing parking altogether is clearly not an option at this point in time, as many residents own vehicles and lack of parking is a deal-breaker. Taking steps to move away from dependence on parking, however, makes sense given the trends already evident and likely to continue in the future. Perhaps more important in the near term is the ability of property owners and managers to provide their residents with access and support for multiple modes of transportation. In the public and private sectors, more and more emphasis is being placed on managing demand rather than managing supply. The U.S. Department of Transportation defines demand management as "providing travelers with effective choices to improve travel reliability."19 Products like TransitScreen®, which provide real-time arrival and departure times for subways, buses and commuter trains, are becoming more common in lobbies. Offering discounted transit passes and providing shuttles to transit stops also encourage public transit use. Communities that are already offering incentives for ride hailing may need to strengthen their marketing material, given that one in five survey respondents was unaware of whether this was available. Dedicated drop-off and pick-up locations are becoming more commonplace and make it easier for residents to use these services. While walking topped biking among our survey respondents, offering bike storage and bike sharing have the added benefit of promoting wellness. Using Redfin's WalkScore ® is an easy way to get a quick snapshot of walkability at the property specific level.

Like any operations decision in the apartment industry, planning for parking's future will be asset-driven and highly dependent on location. There is no "one size fits all," but organizations that consider the complete transportation picture in all of its varied and emerging forms, as well as understand the value of flexibility, will have a clearer vision of one of many disruptors in the industry. (pg 9)

Stalled Out. How Empty Parking Spaces Diminish Neighborhood Affordability
Prepared by: The Center for Neighborhood Technology
Funded by Searle Funds at the Chicago Community Trust
March 2016
(28 pages)
https://www.cnt.org/publications/stalled-out-how-empty-parking-spaces-diminish-neighborhood-affordability

Stalled Out: How Empty Parking Spaces Diminish Neighborhood Affordability explores the relationship between unused parking and neighborhood affordability. Many cities, including Chicago, mandate the minimum number of parking spaces new developments need to build. As the report points out, however, these minimum requirements don't always reflect real demand.

For this study, we interviewed multifamily developers in Chicago and went to the parking lots and garages of 40 apartment buildings, both market-rate and subsidized, to see how much parking was being used. Researchers went at 4:00 a.m., when most tenants have parked their cars and are asleep in bed. Consistent with our findings in the San Francisco Bay Area; Washington, D.C.; and King County, Washington, the study found that:

- **The supply of parking exceeds demand.** Buildings offered two spots for every three units. According to our analysis, they only used one for every three.
- **As parking supply goes up, much of it sits empty.** Apartments with fewer spaces saw a greater percentage of their parking used.
- **Apartment buildings near frequent transit need less parking.** Buildings within ten minutes of a Chicago Transit Authority (CTA) train stop provided one spot for every two units. Even then, one-third of the spots sat empty.

Parking In Lieu Fees. Parking Planning White Paper Series
Kimley Horn and Associates Inc
December 2012
(12 pages)
https://www.kimley-horn.com/wp-content/uploads/2017/02/TOD-and-Parking-Policies-White-Paper.pdf

Introduction
Some cities allow developers to pay a fee in lieu of providing parking spaces required by zoning ordinances, and use this revenue to finance public parking spaces to replace the private parking spaces the developers would have been required to provide. These in-lieu programs can reduce the cost of development, encourage shared parking, improve urban design, support historic preservation and allow development of sites that cannot physically accommodate the required parking. Establishment of in-lieu fees also reveals that the cost of complying with minimum parking requirements is more than four times the cost of the impact fees that cities levy for all other public purposes combined. The high cost of meeting parking requirements suggests other promising in-lieu policy options that allow developers to reduce parking demand rather than increase the parking supply and provide a mechanism to support alternative transportation modes that help accomplish that goal. Reducing parking demand can cost far less than increasing the parking supply. (pg 3)

Advantages of In-Lieu Fees

In-lieu fees have five major advantages for both cities and developers.

1. *A new option.* In-lieu fees give developers an alternative to meeting the parking requirements on sites where providing all the required parking spaces would be difficult or extremely expensive.
2. *Shared parking.* Public parking spaces allow shared use among different sites where the peak parking demands occur at different times. Shared public parking is more efficient and cost effective than single-use private parking because fewer spaces are needed to meet the total peak parking demand. Shared parking also allows visitors to leave their cars parked while making multiple trips on foot, and is one of the easiest ways to make better use of scarce urban land.
3. *Better urban design.* Cities can put public parking lots and structures where they have the lowest impact on vehicle and pedestrian circulation. Less on-site parking allows continuous storefronts without "dead" gaps for adjacent surface parking lots. To improve the streetscape, some cities dedicate the first floor of the public parking structures to retail uses. Developers can undertake infill projects without assembling large sites to accommodate on-site parking, and architects have a greater range of design options that can translate into more attractive buildings.
4. *Fewer variances.* Developers often request parking variances when providing the required parking would be difficult. These variances create unearned economic windfalls, granted to some but denied to others. If developers can pay cash rather than provide the required parking, cities do not have to grant parking variances and can therefore treat all developers consistently.
5. *Historic preservation.* In-lieu fees allow adaptive reuse of historic buildings where the new use requires additional parking that is difficult to provide. The in-lieu policy therefore makes it easier to preserve historic buildings and rehabilitate historic areas.

Disadvantages of In-Lieu Fees

Officials in many cities recommended in-lieu fees, but some report that developers were initially skeptical. The following four points summarize the potential disadvantages mentioned by developers.

1. *Lack of on-site parking.* Parking is a valuable asset for any development. A lack of on-site, owner-controlled parking can reduce a development's attractiveness to tenants and customers. While a lack of on-site parking is a real disadvantage, developers who are concerned about this problem can normally provide the parking rather than pay the fee.
2. *High fees.* Cities may not construct and operate parking facilities as efficiently as the private sector. For example, cities may pay extra to improve the architectural design of parking lots and structures. The resulting in-lieu fees may be high. Although some cities charge high in-lieu fees, most set their in-lieu fees lower than the cost of providing a public parking space. Because the fixed cost for ramps, elevators, stairwells, and curb cuts can be spread among more spaces in large public parking structures, economies of scale in building these structures can further reduce the in-lieu fees.
3. *No guarantees.* Cities may intend to use the in-lieu fee revenue to finance public parking, but they do not guarantee when or where the parking spaces will be provided. To address this concern, some cities build public parking structures before receiving the in-lieu fees. The in-lieu fees are then used to retire the debt incurred to finance the structures. Other cities return the in-lieu fees if they do not provide the parking within a certain time. A city can also delay collecting the in-lieu fees until the revenue is needed to construct the public parking.
4. *Fewer parking spaces.* In-lieu fees will reduce the parking supply if cities provide fewer than one public parking space for each in-lieu fee paid. A smaller parking supply can put an area at a competitive disadvantage. Cities may not provide one public parking space for each in-lieu fee paid, but if a city uses in-lieu fees to build public parking spaces rather than grant variances to reduce parking requirements, the in-lieu policy will increase rather than decrease the parking supply. Even if an in-lieu policy does reduce the

parking supply, shared public parking reduces the parking supply needed to meet the sum of all individual peak parking demands. While the developers' concerns cannot be ignored, officials in most of the surveyed cities said that the fees had become a form of administrative relief for developers who do not want to provide the required parking spaces. In practice, the in-lieu fees have benefited developers by offering them an alternative to building expensive parking spaces. (pg 3-5)

CITY	IN-LIEU PARKING FEE	LAND USE	PARKING REQUIREMENT	PARKING IMPACT FEE
	($/SPACE)		(SPACES PER 1,000 SQUARE FEET)	($/SQUARE FOOT)
(1)	(2)	(3)	(4)	(5)=(2)X(4)/1,000
Palo Alto, Calif.	$17,848	OFFICES	4.0	$71
Beverly Hills, Calif.	$20,180	OFFICES	2.9	$59
Walnut Creek, Calif.	$16,373	OFFICES	3.3	$55
Kingston upon Thames, UK	$20,800	OFFICES	2.3	$48
Carmel, Calif.	$27,520	OFFICES	1.7	$46
Mountain View, Calif.	$13,000	OFFICES	3.0	$39
Sutton, UK	$13,360	OFFICES	2.7	$36
Harrow, UK	$14,352	OFFICES	2.3	$33
Hamburg, Germany	$20,705	OFFICES	1.5	$32
Lake Forest, Ill.	$9,000	OFFICES	3.5	$32
Mill Valley, Calif.	$6,751	OFFICES	4.4	$30
Palm Springs, Calif.	$9,250	OFFICES	3.1	$28
Reykjavik, Iceland	$13,000	OFFICES	2.2	$28
Claremont, Calif.	$9,000	OFFICES	2.9	$26
Concord, Calif.	$8,500	OFFICES	2.9	$24
Davis, Calif.	$8,000	OFFICES	2.5	$20
Orlando, Fla.	$9,883	OFFICES	2.0	$20
Kitchener, Ontario	$14,599	OFFICES	1.3	$19
Chapel Hill, N.C.	$7,200	OFFICES	2.5	$18
Kirkland, Wash.	$6,000	OFFICES	2.9	$17
Hermosa Beach, Calif.	$6,000	OFFICES	2.6	$16
Berkeley, Calif.	$10,000	OFFICES	1.5	$15
Burnaby, British Columbia	$7,299	OFFICES	2.0	$15
Vancouver, British Columbia	$9,708	OFFICES	1.0	$10
State College, Penn.	$5,850	OFFICES	1.3	$8
Ottawa, Ontario	$10,043	OFFICES	0.7	$7
Calgary, Alberta	$9,781	OFFICES	0.7	$7
Port Elizabeth, South Africa	$1,846	OFFICES	2.3	$4
Waltham Forest, U.K.	$2,000	OFFICES	0.9	$2
MEAN	$11,305		2.3	$26
MEDIAN	$9,781		2.3	$24

In-lieu fees and parking requirements are for the city center in 1996. In-lieu fees and impact fees are expressed in US$. To obtain the parking requirement in spaces per 100 square meters, multiply the required spaces in Column 4 by 1 .076. To obtain the parking impact fee in dollars per square meter, multiply the impact fee in Column 5 by 10.76.

(pg 10)

(for office buildings)

CITY	IN-LIEU PARKING FEE ($/SPACE)	LAND USE	PARKING REQUIREMENT (SPACES PER 1,000 SQUARE FEET)	PARKING IMPACT FEE ($/SQUARE FOOT)
(1)	(2)	(3)	(4)	(5)=(2)X(4)/1,000
Beverly Hills, Calif.	$20,180	RESTAURANT	22.2	$448
Palm Springs, Calif.	$9,250	CABARET	28.6	$264
Mountain View, Calif.	$13,000	ASSEMBLY HALL	18.0	$234
Kingston upon Thames, UK	$20,800	FOOD SUPERSTORE	7.7	$160
Davis, Calif.	$8,000	FUNERAL HOME	20.0	$160
Sutton, UK	$13,360	FOOD SUPERSTORE	8.5	$114
Kitchener, Ontario	$14,599	MANUFACTURING	7.7	$112
Calgary, Alberta	$9,781	BILLIARD PARLOR	10.3	$101
Ottawa, Ontario	$10,043	CHURCH	9.8	$98
Claremont, Calif.	$9,000	THEATER	10.0	$90
Hermosa Beach, Calif.	$6,000	THEATER	13.0	$78
Burnaby, British Columbia	$7,299	ART GALLERY	10.3	$75
Palo Alto, Calif.	$17,848	ALL USES	4.0	$71
Mill Valley, Calif.	$6,751	ASSEMBLY HALL	10.0	$68
Harrow, UK	$14,352	GARDEN CENTER	4.6	$67
Hamburg, Germany	$20,705	GARDEN CENTER	3.1	$64
Walnut Creek, Calif.	$16,373	NONRESIDENTIAL	3.3	$55
Kirkland, Wash.	$6,000	RESTAURANT	8.0	$48
Carmel, Calif.	$27,520	COMMERCIAL	1.7	$47
Concord, Calif.	$8,500	RESTAURANT	4.0	$34
Port Elizabeth, South Africa	$1,846	RECREATION HALL	18.6	$34
Reykjavik, Iceland	$13,000	NONRESIDENTIAL	2.2	$28
Lake Forest, Ill.	$9,000	RESTAURANT	2.5	$23
Orlando, Fla.	$9,883	NONRESIDENTIAL	2.0	$20
Chapel Hill, N.C.	$7,200	OFFICES	2.5	$18
Berkeley, Calif.	$10,000	NONRESIDENTIAL	1.5	$15
Vancouver, British Columbia	$9,708	NONRESIDENTIAL	1.0	$10
Waltham Forest, U.K.	$2,000	SHOPS	4.5	$9
State College, Penn.	$5,850	ALL USES	1.3	$8
MEAN	$11,305		8.3	$88
MEDIAN	$9,781		7.7	$67

In-lieu fees and parking requirements are for the city center in 1996. In-lieu fees and impact fees are expressed in US$. To obtain the parking requirement in spaces per 100 square meters, multiply the required spaces in Column 4 by 1.076. To obtain the parking impact fee in dollars per square meter, multiply the numbers in Column 5 by 10.76.
The land uses are those with the highest minimum parking requirements in each city.

(pg 11)

Minimum Parking Requirements Considered as Impact Fees
(for land uses with the highest parking requirements)

The average parking impact fee for the U.S. cities in the Table above is $31 per square foot, which dwarfs the impact fees levied for all other public purposes. A 1991 survey of 100 U.S. cities found that the impact fees for all purposes (roads, schools, parks, water, sewers, flood control, and the like) averaged $6.97 per square foot of office buildings (see Altshuler and José Gómez-Ibáñez 1993, 40). The average parking impact fee for office buildings is thus 4.4 times the average impact fee for all other public purposes

combined. If impact fees reveal a city's priorities for public services, many cities' highest priority is free parking. (pg 11)

Convertible Parking Garages

January 2019

Adele Peters, "**These future-proof parking garages can easily morph into offices or housing**" *FastCompany*, World Changing Ideas, January 14, 2019
https://www.fastcompany.com/90291136/these-futureproof-parking-garages-can-be-easily-turned-into-offices-or-housing

Even today, parking garages are typically underused. In the not-too-distant future, car shares, self-driving cars, increased investment in transit, or simple behavioral change could all shift the amount of parking people think they need. And the U.S. also has far more parking than necessary–in Seattle, for example, there are five parking spaces for every resident. Architects and city planners are increasingly realizing that valuable city space could be put to better use than storing cars.

"There are 500 million parking spaces in the United States and [325 million] people," says Andy Cohen, co-CEO of Gensler, the architecture firm that designed the Hollywood office tower. "Think about all that real estate, all that attention to parking, that could be revitalized and reused for the future of our cities."
….
Retrofitting existing parking garages can be more difficult–they're not designed for human habitation, and typically have low ceilings, sloped floors, and, in areas like California, aren't built to the same seismic standards as an office or apartment building. They also can't handle the same loads. "Being able to say I'm just going to convert this parking garage into apartments is often not really the way to go because it's structurally not really possible," says Marcus Martinez, a founder of the Houston-based design firm UltraBarrio, who started studying the potential future of parking garages when he was an urbanism student at MIT and collaborating with others looking at the impact of autonomous cars. "We have to really rethink the DNA of the garage altogether."

Underground garages pose greater challenges, since they typically don't have windows, but also have the potential for reuse. "I actually think that's interesting, what are all the other things that you can do in these leftover spaces that are less ideal for people?" says Hall. The spaces could potentially be used for urban agriculture, or storage, or data centers.

As parking shrinks (in lots, garages, and on streets) neighborhoods will change. Some of the space could go to housing. Cities often build about 1.6 parking spaces per new unit of housing; in a parking garage or lot, a single space can use 450 square feet, if you consider the space also needed for cars to move. "Four hundred and 50 square feet is the size of a one bedroom," says Hall. "In a place like the Bay Area, where we have a housing crisis and every square foot is so valuable and we are literally fighting for every square foot for housing, to require that developers be building parking at these ratios is really limiting the housing supply, especially in areas that are really well served by transit." (Though San Francisco recently eliminated its parking requirements, many other Bay Area communities still have them.)

Street parking could become a combination of drop-off and pickup zones and green space, or could transform into protected bike lanes. That could change cities further; the majority of less frequent bike riders say that they'd be more likely to commute by bike if they felt safer. Sidewalks could also widen

February 2018

Charles LaCalle, Dreamit UrbanTech, "**Real Estate Developers Begin to Future-Proof the Parking Garage**," *Dreamit*, February 1, 2018
https://www.dreamit.com/journal/2018/1/31/developers-rethink-the-parking-garage-with-rise-of-autonomous-vehicles

The Brief:

- According to the WSJ, Developers are starting to future-proof parking garages that may be obsolete in the coming years. With autonomous vehicles becoming an inevitability, garages must be designed to be used for cars now and repurposed for other things later.
- Developers are building master-planned projects in cities like Toronto, Los Angeles, Oslo, San Francisco and Boston with features like curbside drop-off areas for passengers and e-commerce deliveries. These will replace traditional parking lanes.
- Developers in high-density areas are looking to existing parking infrastructure for conversion projects, with an added benefit of being able to label these "sustainable" projects because they conserve materials.

The first multi-level parking garage was built in 1918 in Chicago, and as of 2012, there are nearly 13,000 parking garages across the United States. About 500 million parking spaces exist in the United States (the US population is around 326 million people). Parking infrastructure (garages and parking lots) covers an estimated 3,590 square miles, an area larger than Delaware and Rhode Island combined.

Converting existing garages can come with a unique set of problems. These structures are often not ideal for residential conversions because they are deep structures with much of the building lacking access to natural light. They are also expensive to convert because the high ceilings required for a parking garage mean less space in the building envelope for offices or residential units. Also, many parking garages were built on an incline, so that drains could carry water easily from the building, and large ramps throughout the building make those areas uninhabitable.

Future proofing a garage is also a tricky process. Developers have to think about reinforcing the floors to accommodate the load of cars, and they have to think about separating columns and building narrow columns that will one day be acceptable to a residential tenant or office worker. Instead of ramps, some developers are solving the problem of moving cars with elevators or with removable steel ramps.

These solutions are not always economical from a developer's perspective, but cities are stepping in to provide incentives for builders to consider the future. According to Wired:

> Cities are finding ways to incentivize smart construction. There's toying with parking minimums (an excellent addition to any suite of pro-affordable housing policies). There's the hammer of regulation—some cities already require those building new parking garages to create a ground floor that can be used for a non-parking use. There's also the tax code. To incentivize a retrofit, a city might create a "future use" tax credit, or give credits to developments in neighborhoods where it plans to build more transit down the line.

How Architects Are Building Garages of the Future

- AvalonBay Communities in Los Angeles is developing a parking garage and imagining portions of the two levels of underground parking being converted to a gym, a theater and perhaps other recreational uses. They are also **placing elevators and stairs in the middle of the structure**, the way they are in offices. Finally, they are putting knock-out panels on the ceiling and floors to create future light wells.
- Rick Caruso, the owner of the Grove and other upscale shopping centers, is working with Google's Intersection to prepare for the arrival of self-driving cars. Intersection is developing **technology that integrates beams, sensors, license-plate recognition and phone apps that can potentially improve the shopping experience**. Caruso predicts he will start converting his parking garages into mixed-use developments by 2025.
- For the immediate years ahead during which people will be transitioning to autonomous cars, Gensler is looking at ways to free up green space in housing developments by **replacing driveways with common storage areas** for vehicles.
- Reebok and Gensler have been studying how to **repurpose gasoline stations** in the future when driverless vehicles will visit remote charging stations instead. One idea they have come up with is fitness centers that include playgrounds, workout areas and fresh food stores. Stations would be more about "recharging human beings" than about recharging cars.
- Kohn Pedersen is designing a complex in Shenzhen in China with an **elevated loop that could be dedicated to autonomous vehicles** and underground parking areas that could be converted into retail space or other uses.
- San Francisco Giants baseball team is looking down the driverless road with architecture firm Perkins + Will in their planning for Mission Rock, a 27-acre project south of AT&T Park. Planners are **designing streets and buildings that can adapt to declining parking demand and the growing need for better curbside pickups and drop-offs of passengers and packages**. Apartment buildings are being designed with more space—including cold storage—for package deliveries from Amazon.com and other e-commerce businesses.

Alek Pochowski, Bryan Graveline, "**What's the Future of Parking Garages?**" *Kittelson and Associates*
https://www.kittelson.com/ideas/whats-the-future-of-parking-garages/

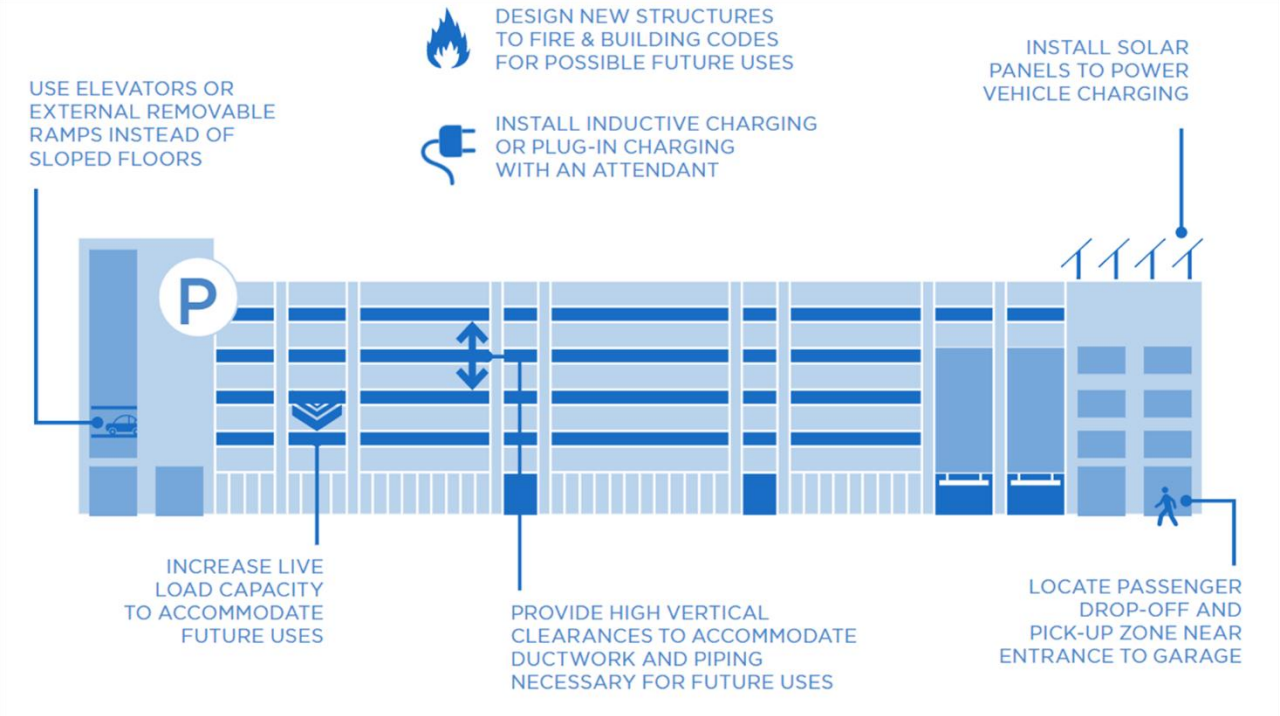


Image: "Effects of Emerging Vehicle Technologies on Land Use & Development," Kittelson & Associates.

Related domains

Conway Urban Watershed Framework Plan. A Reconciliation Landscape for Little Creek-Palarm Creek Sub-watershed

Prepared by: University of Arkansas Community Design Center, an outreach center of the Fay Jones School of Architecture + Design; Fay Jones School of Architecture + Design; University of Arkansas Department of Biological and Agricultural Engineering, and Office for Sustainability; Arkansas Natural Resources Commission

January 2016

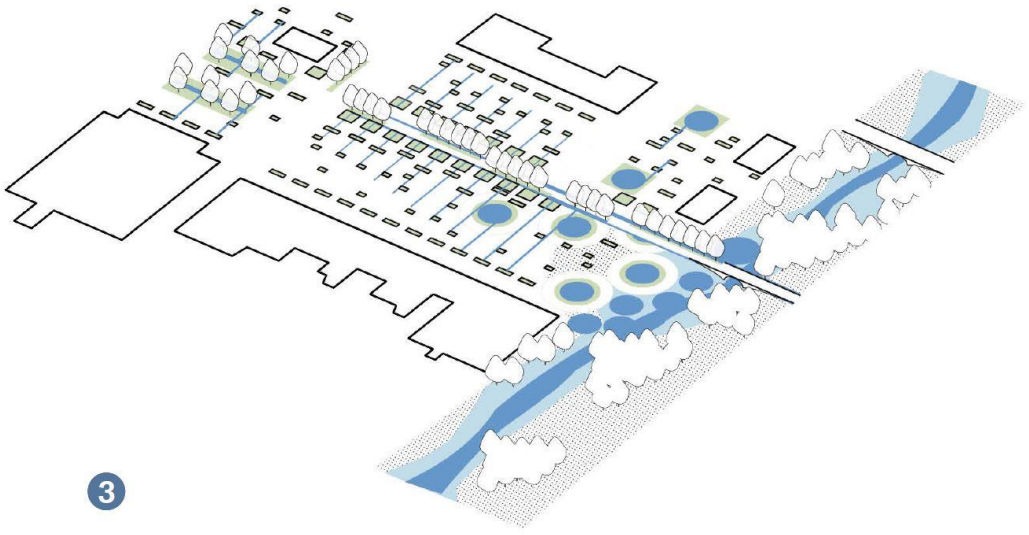
(84 pages)

https://s3.amazonaws.com/uacdc/Conway_Urban_Watershed_Framework_Plan.pdf

Framework Plan: Adaptive Infrastructure

3. Parking Gardens

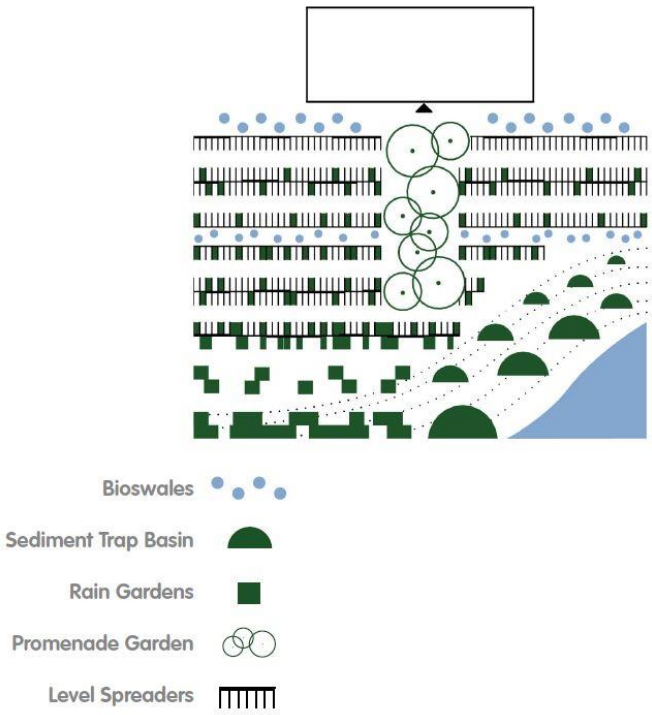
Employing functional water treatment landscapes, parking lots can be designed to metabolize their own pollution generated by stormwater runoff and hydrocarbons from automobiles. (pg 32)



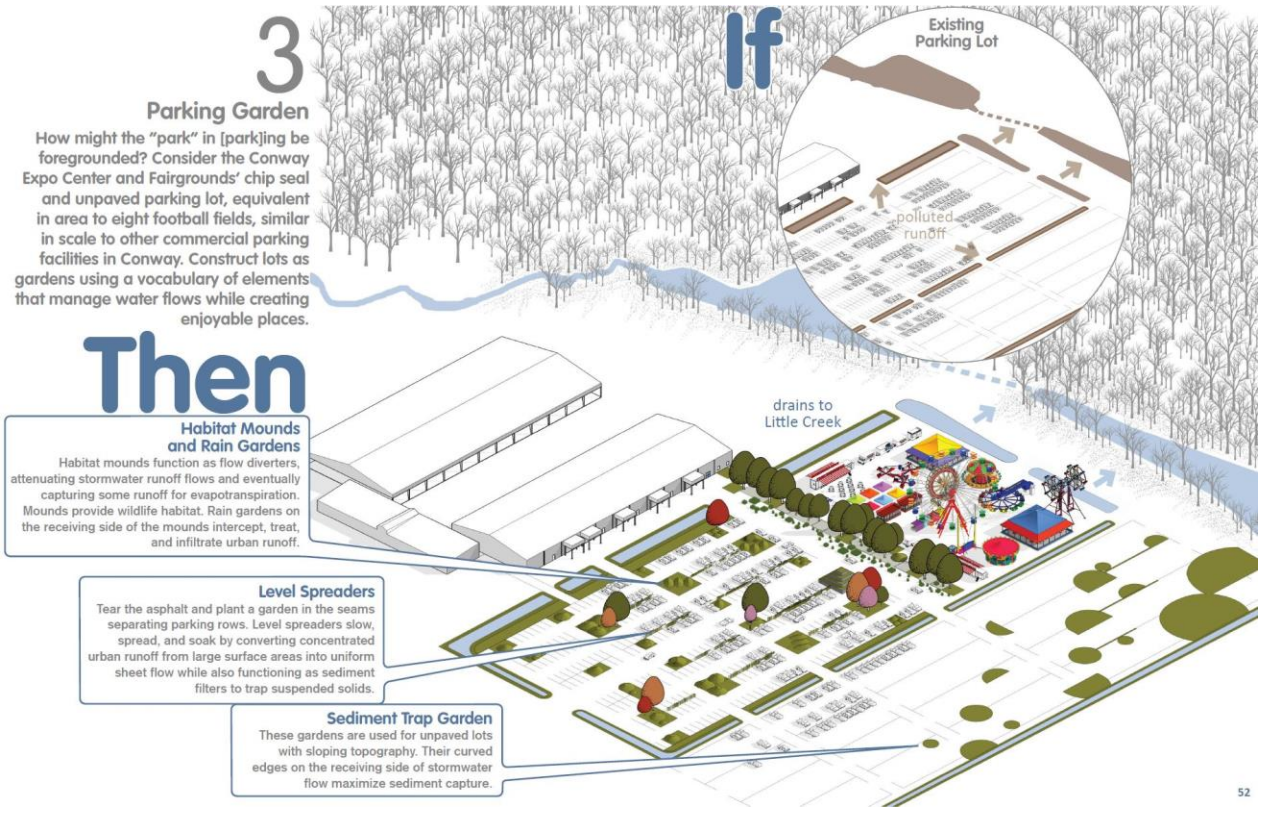
(pg 32)

Why not park the car in its own treatment facility?

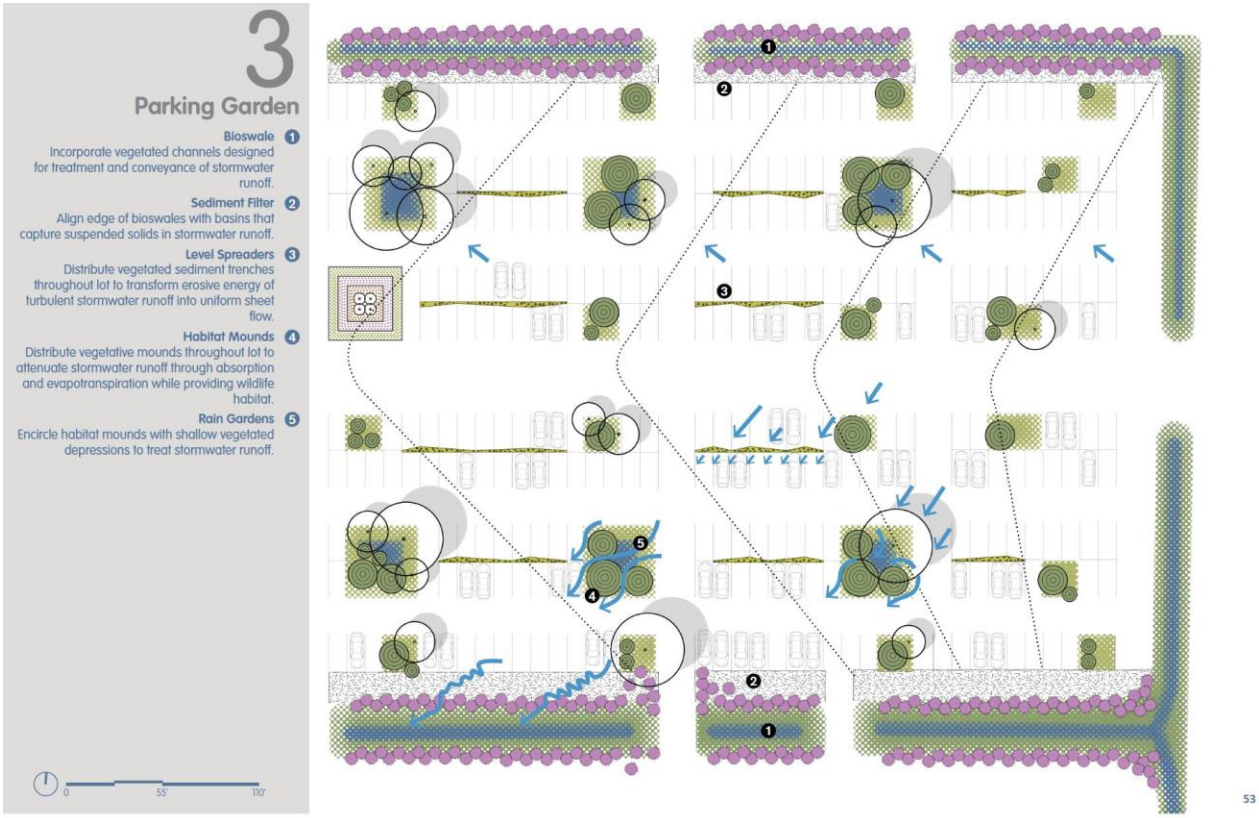
Parking lots can be easily designed as productive landscapes to remediate water pollution and manage urban runoff on site. (pg 51)


Bioswales
Sediment Trap Basin
Rain Gardens
Promenade Garden
Level Spreaders

(pg 51)


3
Parking Garden
How might the "park" in [park]ing be foregrounded? Consider the Conway Expo Center and Fairgrounds' chip seal and unpaved parking lot, equivalent in area to eight football fields, similar in scale to other commercial parking facilities in Conway. Construct lots as gardens using a vocabulary of elements that manage water flows while creating enjoyable places.
If
Existing Parking Lot
polluted runoff
drains to Little Creek
Then
Habitat Mounds and Rain Gardens
Habitat mounds function as flow diverters, attenuating stormwater runoff flows and eventually capturing some runoff for evapotranspiration. Mounds provide wildlife habitat. Rain gardens on the receiving side of the mounds intercept, treat, and infiltrate urban runoff.
Level Spreaders
Tear the asphalt and plant a garden in the seams separating parking rows. Level spreaders slow, spread, and soak by converting concentrated urban runoff from large surface areas into uniform sheet flow while also functioning as sediment filters to trap suspended solids.
Sediment Trap Garden
These gardens are used for unpaved lots with sloping topography. Their curved edges on the receiving side of stormwater flow maximize sediment capture.
52

(pg 52)


3
Parking Garden
Bioswale 1
Incorporate vegetated channels designed for treatment and conveyance of stormwater runoff.
Sediment Filter 2
Align edge of bioswales with basins that capture suspended solids in stormwater runoff.
Level Spreaders 3
Distribute vegetated sediment trenches throughout lot to transform erosive energy of turbulent stormwater runoff into uniform sheet flow.
Habitat Mounds 4
Distribute vegetative mounds throughout lot to attenuate stormwater runoff through absorption and evapotranspiration while providing wildlife habitat.
Rain Gardens 5
Encircle habitat mounds with shallow vegetated depressions to treat stormwater runoff.
0
55'
110'
53

(pg 53)