

PARKING LOTS

DESIGN CONSIDERATIONS FOR PARKING LOTS

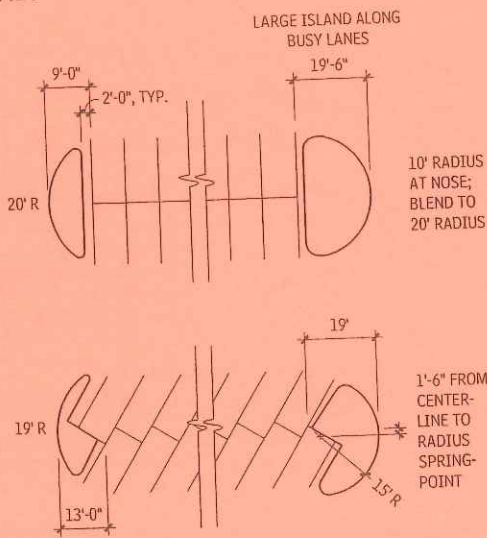
Creating vital places is the job of those who design, build, finance, and plan the built environment. Unfortunately, too often, as acres of asphalt attest, engineering standards are applied cavalierly; they are not used properly to help design the place. Even "just a parking lot" can be made into a place of delight.

Some strategies to employ that go beyond bare-bones engineering are:

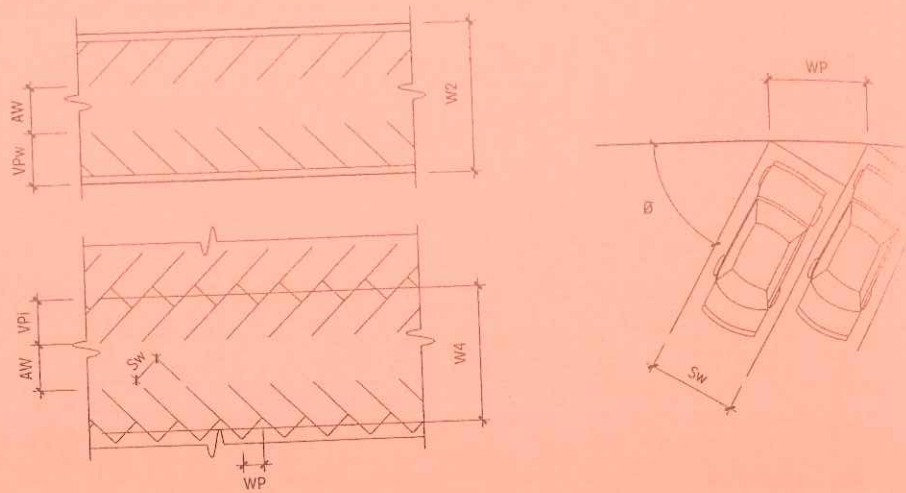
- **Parking courts:** Like the forecourt of a grand English manor, a parking place can serve as the introduction to a building. It may be a formal garden, an entrance hall, or a place to display art.
- **Multiple uses:** For many of the hours in a year, even a busy parking lot stands empty or underused. Find and design for other activities such as youth basketball, or the summer yard of a garden store.
- **Design for pedestrians:** Make the pedestrian activities the highest priority in the placement, size, location, and other details of the site design. Virtually everyone who drives to a parking lot walks out of it.
- **Reduce parking:** Find a means for multiple uses to share a lot over the course of the day or week. Design so that people can park once and go to multiple destinations. Design so that the parking does not impede other modes of transport such as walking, bicycles, or buses.

The tables and diagrams in this section provide the basic guidelines for the size and layout of stalls, grades in parking lots, the geometry of end islands, and the number of accessible stalls. For more detailed information on the design of access driveways, circulation patterns, calculating parking demand, safety, sustainability, and other aspects, refer to *Parking Spaces: A Design, Implementation, and Use Manual for Architects, Planners, and Engineers*, by Mark C. Childs (New York: McGraw-Hill, 1999).

END ISLANDS 7.14



SPACE LAYOUTS 7.13



STALL AND MODULE DIMENSIONS 7.15

ANGLE	CAR TYPES	TURNOVER	STALL WIDTH		STALL DEPTH PARALLEL TO AISLE		AISLE WIDTH (AW) (FT)	MINIMUM MC	
			PARALLEL TO CAR (SW) (FT)	PARALLEL TO AISLE (WP) (FT)	TO WALL (VPW) (FT)	TO INTERLOCK (VPI) (FT)		WALL TO WALL (W2) (FT)	INT TO INT (W) (FT)
			90	Mix	A	9.00	9.0	18.4	18.4
		B	8.75	8.8	18.4	18.4	24.0	60.8	
		C	8.50	8.5	18.4	18.4	24.0	60.8	
		D	8.25	8.3	18.4	18.4	24.0	60.8	
	Small	A	8.00	8.0	15.1	15.1	22.3	52.4	
		B	7.75	7.8	15.1	15.1	22.3	52.4	
		C	7.50	7.5	15.1	15.1	22.3	52.4	
		D	7.25	7.3	15.1	15.1	22.3	52.4	
75	Mix	A	9.00	9.3	19.4	18.6	21.0	59.9	
		B	8.75	9.1	19.4	18.6	21.0	59.9	
		C	8.50	8.8	19.4	18.6	21.0	59.9	
		D	8.25	8.5	19.4	18.6	21.0	59.9	
	Small	A	8.00	8.3	16.2	15.4	20.0	52.5	
		B	7.75	8.0	16.2	15.4	20.0	52.5	
		C	7.50	7.8	16.2	15.4	20.0	52.5	
		D	7.25	7.5	16.2	15.4	20.0	52.5	
70	Mix	A	9.00	9.6	19.5	18.4	18.6	57.5	
		B	8.75	9.3	19.5	18.4	18.6	57.5	
		C	8.50	9.0	19.5	18.4	18.6	57.5	
		D	8.25	8.8	19.5	18.4	18.6	57.5	
	Small	A	8.00	8.5	16.4	15.3	17.9	50.6	
		B	7.75	8.2	16.4	15.3	17.9	50.6	
		C	7.50	8.0	16.4	15.3	17.9	50.6	
		D	7.25	7.7	16.4	15.3	17.9	50.6	
65	Mix	A	9.00	9.9	19.4	18.0	16.1	54.9	
		B	8.75	9.7	19.4	18.0	16.1	54.9	
		C	8.50	9.4	19.4	18.0	16.1	54.9	
		D	8.25	9.1	19.4	18.0	16.1	54.9	
	Small	A	8.00	8.8	16.4	15.0	15.7	48.5	
		B	7.75	8.6	16.4	15.0	15.7	48.5	
		C	7.50	8.3	16.4	15.0	15.7	48.5	
		D	7.25	8.0	16.4	15.0	15.7	48.5	

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ANGLE	CAR TYPES	TURNOVER	STALL WIDTH		STALL DEPTH PARALLEL TO AISLE		AISLE WIDTH MINIMUM (AW) (FT)	MINIMUM MODULES		
			PARALLEL TO CAR (SW) (FT)	PARALLEL TO AISLE (WP) (FT)	TO WALL (VP ^W) (FT)	TO INTERLOCK (VP ^I) (FT)		WALL TO WALL (W2) (FT)	INTERLOCK TO INTERLOCK (W4) (FT)	
90°	Mix	A	9.00	10.4	19.1	17.5	13.7	51.9	48.7	
		B	8.75	10.1	19.1	17.5	13.7	51.9	48.7	
		C	8.50	9.8	19.1	17.5	13.7	51.9	48.7	
		D	8.25	9.5	19.1	17.5	13.7	51.9	48.7	
	Small	A	8.00	9.2	16.3	14.7	13.6	46.1	42.9	
		B	7.75	8.9	16.3	14.7	13.6	46.1	42.9	
		C	7.50	8.7	16.3	14.7	13.6	46.1	42.9	
		D	7.25	8.4	16.3	14.7	13.6	46.1	42.9	
	50°	Mix	A	9.00	11.0	18.7	16.9	11.2	48.7	45.1
			B	8.75	10.7	18.7	16.9	11.2	48.7	45.1
			C	8.50	10.4	18.7	16.9	11.2	48.7	45.1
			D	8.25	10.1	18.7	16.9	11.2	48.7	45.1
Small		A	8.00	9.8	16.0	14.2	11.5	43.5	39.8	
		B	7.75	9.5	16.0	14.2	11.5	43.5	39.8	
		C	7.50	9.2	16.0	14.2	11.5	43.5	39.8	
		D	7.25	8.9	16.0	14.2	11.5	43.5	39.8	
30°		Mix	A	9.00	11.7	18.2	16.2	11.0	47.4	43.3
			B	8.75	11.4	18.2	16.2	11.0	47.4	43.3
			C	8.50	11.1	18.2	16.2	11.0	47.4	43.3
			D	8.25	10.8	18.2	16.2	11.0	47.4	43.3
	Small	A	8.00	10.4	15.7	13.6	11.0	42.4	38.2	
		B	7.75	10.1	15.7	13.6	11.0	42.4	38.2	
		C	7.50	9.8	15.7	13.6	11.0	42.4	38.2	
		D	7.25	9.5	15.7	13.6	11.0	42.4	38.2	
	15°	Mix	A	9.00	12.7	17.5	15.3	11.0	46.1	41.5
			B	8.75	12.4	17.5	15.3	11.0	46.1	41.5
			C	8.50	12.0	17.5	15.3	11.0	46.1	41.5
			D	8.25	11.7	17.5	15.3	11.0	46.1	41.5
Small		A	8.00	11.3	15.2	12.9	11.0	41.4	36.9	
		B	7.75	11.0	15.2	12.9	11.0	41.4	36.9	
		C	7.50	10.6	15.2	12.9	11.0	41.4	36.9	
		D	7.25	10.3	15.2	12.9	11.0	41.4	36.9	

	STALL		SOURCE
	LENGTH	OTHER	
Accessible loading	22' minimum	Platform 5' wide, 20' long, 9.5' clear height	ADAAG 4.6.5 and 4.6.6
Truck loading	30'-60'	Add truck length per additional truck.	Weant & Levinson
Drop-offs/taxi	50'	Add 25' per additional vehicle.	Weant & Levinson
Paired (length per pair)	44'-50'	20' stalls	Hunnicut, p. 666
Compact	19'		Hunnicut, p. 666
End stall	20'		Hunnicut, p. 666
Interior stall	22'-24'		Hunnicut, p. 666

CURBSIDE BUS LOADING

		WHEEL POSITION FROM CURB		
	6"	1'	One 40' bus	Additional per bus
Upstream of intersection	L + 85' +	L + 65' +	105'-125'	L + 5' +
Downstream of intersection				
Street width > 39'	L + 55' +	L + 40' +	80'-95'	L
Street width 32'-39'	L + 70' +	L + 55' +	95'-110'	L
Midblock				
Street width > 39'	L + 135' +	L + 100' +	140'-175'	L
Street width 32'-39'	L + 150' +	L + 115' +	155'-190'	L

Notes: Adapted and recalculated from Parking, Robert D. Weant and Herberts Levinson, 1990, Eno Foundation; Parking Structures: Planning, Design, Construction, Maintenance and Repair, Anthony P. Chrest, Mary S. Smith, Sam Bhuyan, Chapman & Hall, 1996; Ricker, 1957.

GRADES IN PARKING LOTS
7.18

GRADE	CONDITION
6% maximum	Continuous slope in parking lot
12% maximum, 30' long	Nonparking automobile ramps with pedestrians allowed
15% maximum	Nonparking automobile ramps with signs banning pedestrians
> 6% change	A vertical curve transition is required; see Figure 7.
1% minimum/2% rec.	Slope to drain asphalt
.5% minimum/2% rec.	Slope to drain concrete
2% (1:50) maximum	Slope within accessible stalls in any direction
5%	Accessible route running slope (2% cross slope)

STALL DIMENSIONS FOR SPECIAL CONDITIONS
7.19

	WIDTH (FT)	LENGTH (FT)	CLEAR HEIGHT (FT)
Separated large	9	18.5 to 20	
Separated truck ^a	9	18.5	
Nonseparable curb	8 + 5 for aisle	17.5	
Nonseparable van ^b	8 + 8 for aisle	17.5	8.16
Separated (to car or van)	11 + 5 for aisle	8.16	
Separated	7.5	17	
Separated	7.83 to 8.16	15.58 to 16.42	
Separated	2.5	6	
Separated	3.33	7	

← ADA
TURNOVER INFO

Turnover categories: A = very high turnover, such as at a post office or convenience store; B = high turnover, such as at a general retail store; C = medium turnover, such as at airports or hospitals; D = low turnover, such as at an employee parking lot.
This table defines the dimensions used in this table. Stalls at angles other than 90° and 60° are confusing as to whether the aisle is one-way or two-way. Aisles are advocated by some because the right-hand side parking is easier into an angled stall; however, making a left-hand turn to enter a 75° stall is difficult. A minimum of 22 ft is necessary for two-way aisles. Stalls at angles between 45° and 0° (parallel parking) are not generally accessible because they are space-inefficient and confusing.

d. Stall stripes are often painted 6 to 10 in. shorter than the stall depth to encourage drivers to pull fully into the stall.
e. The table uses a minimum aisle width of 11 ft. This dimension is minimal sufficient to allow passage of cars and pedestrians. In high turnover or special situations such as lots primarily serving the elderly or children, a pedestrian walkway and/or a wider aisle should be provided.
7.16 a. From Charles E. Däre, "Consideration of Special Purpose Vehicles in Parking Lot Design," ITE Journal, May 1985.
b. (ATBCB) Architectural and Transportation Barriers Compliance Board, Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Guidelines (ADAAG). 36 CFR Part 1191, 1991.
c. (ATBCB) Architectural and Transportation Barriers Compliance Board, Bulletin #6: Parking, 1994.

d. From Robert H. Burrage and Edward G. Morgen, Parking (Eno Foundation for Highway Traffic Control, 1957), p. 242.
e. From James Hunnicutt, "Parking, Loading, and Terminal Facilities" in Transportation and Traffic Engineering Handbook (Prentice Hall, 1982, p.50).
f. From Robert Weant and Herbert Levinson, Parking (Eno Foundation for Highway Traffic Control, 1990), p. 167.
7.17 a. Bus-loading statistics adapted from First name or initials Homburger and First name or initials Quinby, "Urban Transit," in Transportation and Traffic Engineering Handbook, 2nd ed. (Prentice Hall, 1982).
b. L = length of bus.
7.18 Adapted from Chrest, Smith & Bhuyan, 1996; ITE, 1982; and Untermann, 1984.
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2 ELEMENT G: BUILDING SITEWORK SITE IMPROVEMENTS

REQUIRED NUMBER OF ACCESSIBLE STALLS 7.19

GENERAL CASE	
TOTAL IN PARKING LOT	REQUIRED MINIMUM NUMBER OF ACCESSIBLE SPACES
1-25	1
26-50	2
51-75	3
76-100	4
101-150	5
151-200	6
201-300	7
301-400	8
401-500	9
501-1000	2% of total
1001 and over	20 + 1 per 100 over 1000
Number of accessible spaces	Required minimum number of van-accessible spaces
1-8	1
33 and over	1 additional van-accessible per 8 accessible spaces
SPECIAL CASES	
PLACE	REQUIREMENT
Medical outpatient units	10% of total stalls in lots serving visitors and patients
Medical units that specialize in persons with mobility impairments	20% of total stalls in lots serving visitors and patients
Valet parking	No stalls required; however, an accessible loading zone is required, and it is strongly recommended that self-park stalls be provided.
Residential	1 for each accessible dwelling unit and 2% for all additional units. Guest, employee, and nonresident parking must comply with table.

LOTS ACCESSIBLE TO THE MOBILITY IMPAIRED

Parking is a critical element of accessibility. In fact, the first federal court case that resulted in a civil penalty under Title III of the Americans with Disabilities Act (ADA) was for failure to make parking accessible.

The ADA is a civil rights law, meaning that the Department of Justice is charged with enforcing the law. People who believe they have been discriminated against may sue the property owner. The ADA Accessibility Guidelines for Buildings and Facilities (ADAAG) issued by the government are not building codes subject to state or local approval or variances.

The information in this section was compiled from publications of the United States Architectural and Transportation Barriers Compliance Board (United States Access Board) and other sources, as noted. Note, however, that the law and best practices continue to evolve, so designers are cautioned to review materials and conditions specific to the project at hand. Note that lots owned by government agencies generally follow Title II rules, which are usually more stringent than the Title III rules for privately owned lots discussed in this section.

REQUIRED NUMBER OF ACCESSIBLE STALLS

Whenever parking is supplied, no matter how the total amount is determined, a portion of the stalls must be accessible to people with mobility impairment (hereafter called *accessible stalls*). Local

codes may exceed the federal requirement for required number of accessible stalls listed in Table 7.19; the more stringent rule governs. When a facility has more than one parking lot, the required number of stalls is determined lot by lot. In employee or contract lots, accessible stalls must be provided, but "accessible spaces may be used by persons without disabilities when they are not needed by (persons) with disabilities" (Bulletin #6: Parking, Architectural and Transportation Barriers Compliance Board, 1994). When the use of a facility—for example, a senior center—indicates that more accessible stalls are needed than are required according to Table 7.19, a study should be conducted to determine an adequate supply of accessible stalls.

LOCATION OF ACCESSIBLE STALLS

The location of accessible stalls must give mobility-impaired persons preferential treatment in terms of access, and must not discriminate against them in terms of amenities (e.g., if the general stalls have hail protection canopies, the accessible stalls must also). The shorthand rule is that accessible stalls should be located with the shortest possible route to the entrance(s). Relevant U.S. regulations include the following:

- "Accessible parking spaces serving a particular building shall be located on the shortest route of travel from adjacent parking to an accessible entrance. In parking facilities that do not serve a particular building, accessible parking shall be located on the shortest accessible route of travel to an accessible pedestrian entrance of the parking facility. In buildings with multiple accessible entrances with adjacent parking, accessible parking shall be dispersed and located closest to the accessible entrances."
- "Accessible spaces can be provided in other lots or locations, or in the case of parking garages, on one level only when equal or greater access is provided in terms of proximity to an accessible entrance, cost and convenience. The minimum number of spaces must still be determined separately for each lot..."

VAN-ACCESSIBLE STALLS

Van-accessible stalls must be marked as such, but this does not restrict the stall to use by vans (Bulletin #6, "title," XXXX).

ACCESSIBLE STALL LAYOUT GUIDELINES

Design guidelines for the layout of parking stalls are as follows:

- Two accessible stalls may share an access aisle. However, this should be done only when the stalls are at 90° and allow both front-in and back-in parking.
- Curb ramps or other obstructions may not be within the stall's access aisle, but may begin at the curb face when vehicles overhang a curb (Chrest, Smith & Bhuyan, 1996, p. 212).
- Car overhang may not obstruct the clear width of a sidewalk access route. Wheel stops and/or a reinforced sign post may help limit car overhang.

ACCESSIBLE SIGNAGE

Parking spaces that are to be accessible should be designated by signage indicating the spaces are reserved. Van-accessible spaces should have the words "van-accessible" printed below the universal symbol of accessibility. The ADAAG requires that the sign not be obscured by a car or parked van. Centering the sign on the access aisle may improve its visibility.

ACCESSIBLE EQUIPMENT

Equipment such as parking meters, automated teller machines, pay stations, and ticket dispensers must have accessible controls. Most such equipment is now designed with operating mechanisms that are considered accessible, so the designer's major role is to place the controls at a proper level and to provide clear access to them.

Specifically, parking meters for accessible stalls should be placed at or near the head or foot of the parking space, to ensure that no obstruction occurs for the operation of a side lift or a passenger side transfer. The meter should be placed a maximum of 42 in.

above the public sidewalk. The accessible stall should be a minimum of 30 in. by 48 in.

ACCESSIBILITY OF EXISTING LOTS

Existing lots must be made accessible when it is practical. ADAAG established minimum requirements for new construction or alterations. However, existing facilities not being altered are subject to requirements for access. This requirement is defined by regulations issued by the Department of Justice. Under these regulations, barrier removal must comply with ADAAG requirements to the extent that is readily achievable to do so. If it is not readily achievable to provide the full number of accessible spaces required by ADAAG, a lesser number may be provided as a requirement to remove barriers, however, removal is not a permanent obligation; what is not readily achievable at one point may be readily achievable in the future."

When alternations are made (e.g., realigning striping or resurfacing, but not routine maintenance), whatever is altered must be made accessible unless technically infeasible and improvements to the path of travel to the lot must be made, up to a cost equal to 2 percent of the project budget.

PASSENGER LOADING ZONES

There must be at least one passenger loading zone for the mobility impaired whenever designated loading zones are provided. There must also be an access aisle at least 5 ft wide and 20 ft long adjacent and parallel to the vehicle pull-up space. A clear height of 9 ft-6 in. is required at the loading zone and along the vehicle aisle, to, from, and within the zone. The vehicle space and the access aisle must be level with surface slopes not exceeding 1.5% (1/4 percent) in all directions. Neither curb ramps nor street furniture may occupy the access aisle space.

PEDESTRIAN PAVING

DESIGN CONSIDERATIONS

Additional design guidelines for working with unit paving systems include the following:

- Drainpipes may be omitted at well-drained areas.
- Provide positive outflow for drainpipes.
- Do not use unsatisfactory soil (expanding organic). Satisfactory soil must be compacted to 95 percent.
- Hand-tight paving joints are preferred over mortar joints. However, when mortar joints are required, and freezing and thawing are frequent, use latex-modified mortar.
- Install concrete footing for edging 10 to 14 in. wide and 4 to 6 in. deep. It is preferable to place the bottom of the footing at freezing depth. If the freezing depth is deeper than the bottom of the footing, provide 4 in. of gravel below the footing.
- Interlocking pavers are available in concrete, hydraulically pressed concrete, asphalt, and brick in different weight classifications, compressive strengths, surface textures, finishes, and colors. Consult local suppliers for availability.
- Subject to the manufacturer's recommendations and local code requirements, use interlocking concrete pavers in areas subject to heavy vehicle loads at speeds of 30 to 40 mph.
- Be aware that concrete interlocking unit paver sizes may be based on metric dimensions. When paver shape permits, use the herringbone pattern for paving that is subject to vehicular traffic.
- Continuous curb or other edge restraint is required to anchor pavers in applications subject to vehicular traffic.

Contributors:

Mark Childs, University of New Mexico, Albuquerque, New Mexico, from *Parking Spaces: A Design, Implementation, and Use Manual for Architects, Planners, and Engineers* (New York: McGraw-Hill, 1999).