Curb Parking Findings Revisited

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ABSTRACT

Findings of research into curb parking problems include accident data for Local, Collector and Major streets. Congestion effects are discussed. The need for curb parking along residential local streets is identified, together with means of limiting it. Recommended dimensions are given for residential garage sizes, door widths, and driveway aprons.

INTRODUCTION

Curb parking along major streets generates two problems—accidents and congestion. The purpose of this paper is to review some past studies and discuss the convenience issues—especially for parking along local residential streets where accidents and congestion only become a problem if the off-street parking supply is inadequate or of limited accessibility. The accessibility issue includes width of driveway, size of garage, and width of garage doors. This paper includes recommended dimensions for these elements.

ACCIDENTS

Historical Data

There are two faces to the use of street curb space for the temporary storage of parked vehicles; the accident hazard and congestion effect versus the convenience and public preference issue. Most of the studies of accidents and congestion caused by curb parking are dated, perhaps because traffic engineers may feel the subject well covered already. Some of the older studies may be superior to current ones, due to the practice among growing numbers of police departments to increase the dollar reporting level of accidents. This, of course, reduces the number of reported accidents and diminishes the sample sizes for our analysis.

More than 50 years ago, Smith identified curb parking as the cause of about 17% of urban accidents (*1*). He also reported a student thesis by Bender as having found 5% to 28% of accidents to involve curb parking from a survey of ten large cities. About 35 years ago, Box found 71% of midblock accidents on 115 miles of local and collector streets in Skokie, Illinois, to be directly or indirectly related to curb

parking (*2*). The proportion of accidents caused by curb parking, by land use, is shown below:

Single family	72%
Multiple family	77%
Business	63%
Industrial	56%

In a follow-up 4-year study, curb parking was found to be a factor in 12% of major street accidents and 18% of citywide accidents, as reported in the Congressional Record (*3*) and in another Box publication (*4*).

Hazard Elements

Parking Principles, a publication by the Highway Research Board of a U.S. Bureau of Public Roads research project, summarized the five primary hazards of curb parking (*5*).

- The fixed object represented by the vehicle in the roadway.
- Vehicles leaving the parked position.
- Vehicles entering the parked position.
- Occupants exiting parked vehicles on the street side.
- Sight distance restrictions at driveways and intersections caused by parked vehicles.

The degree of hazard is related to several elements such as:

- Functional classification of street.
- Operating speed of the street.
- Density of curb parking.
- Parking turnover.
- Width of street.

In several publications (*6*, *7*) the ITE has followed recommendations of others and listed an appropriate hierarchy of urban surface streets to be:

- Major.
- Collector.
- Local.

Curb parking is more hazardous along Major streets due to its having the highest operating speed of the three types, its often high parking density, and its frequent turnover. One study (*4*) found accident frequencies per mile per year to vary directly with functional type and density of development:

- Major streets (mixed land use) 14
- Local streets:
  - Business use 3.5
  - Apartment use 3.1
  - Single family 1.0

The study found angle parking at the curb, although seldom allowed, to range as high as 63 accidents per mile per year on one Local business street! A discussion of angle parking is given in the ITE Handbook (*8*).

In one year, the City of Chicago reported a fourth of all surface street accidents as involving curb parking.

A study made for the Federal Highway Administration covered 170 miles of streets in ten cities and five states (*9*). Data were collected on 4,800 curb parking accidents by:

- Classification of street.
- 1-way versus 2-way operation.
- Types and severity.
- Adjacent land use.
- Density of curb parking.
- Parking angle.
- Street width.

Table 1 relates parking accident type to street operation on Major streets, and shows that maneuvers to park and unpark have a somewhat higher proportion of accidents on 1-way streets than 2-way.

Similar data for Collector streets are given in Table 2 and show how the proportion of their total accidents which involve parked vehicles has increased, relative to Major streets. This is expected, because lower volume generates less conflict with other moving vehicles, such as at driveways and intersections.

Table 3 gives data for 2-way and 1-way Local streets and shows a still-greater proportion of their total accidents to involve stationary vehicles.

These three tables also identify the increasing significance of curb parking as an accident factor with decreasing traffic volume. Overall, the study found that installation of parking prohibitions could reduce midblock accident rates from 19% to 75%, which is equivalent to total on-street accident rate reductions (including intersections) of 8% to 30%.

This summary has been intended to illustrate the types and severity of the parking accident problem on typical urban streets. Planners, as well as engineers, should strive for zoning codes and development designs that minimize curb parking.

TABLE 1 Major Street Parking Accidents by 2-way and 1-way Operation

	Proportion of Total Accidents	
Type of Accident	2-Way Streets	1-Way Streets
Open door	3%	2%
Maneuver to park	5%	8%
Stationary parked car	21%	29%
Maneuver to unpark	13%	21%
Parking Total	42%	60%

SOURCE: Table 16, Ref. 11.

TABLE 2 Collector Street Parking Accidents by 2-Way and 1-Way Operation

Type of Accident	Proportion of Total Accidents 2-Way Streets	1-Way Streets
Open door	1%	0%
Maneuver to park	1%	11%
Stationary parked car	50%	49%
Maneuver to unpark	13%	15%
Parking Total	65%	75%

SOURCE: Tables 20 and 21, Ref. 11.

CONGESTION

The Problem

It has been extensively documented in the literature that curb parking restricts and hinders efficient traffic flow. *Parking Principles* (*5*) along with other publications such as the ITE Handbook (*8*) have addressed the effect of curb parking along Major streets on reduced capacity, due typically to loss of a curb lane, plus the added friction of the parking activity next to a moving traffic stream. While difficult to quantify, a friction effect is produced by the need of a driver operating next to parked cars to compensate for several factors not present in a "clean" lane. These include:

- Potential for a preceding driver to slow down unexpectedly to park.
- Potential of a parked car door to be opened on the street side.
- Reduced sight distance relative to other vehicles exiting from driveways or side streets.

Headways are expected to increase with these conditions.

In follow-up to the known problems of curb parking, the ITE Recommended Practice, Guidelines for Urban Major Street Design (*6*), states:

TABLE 3 Local Street Parking Accidents by 2-Way and 1-Way Operation

Type of Accident	Proportion of Total Accidents 2-Way Streets	1-Way Streets
Open door	1%	13%
Maneuver to park	2%	0%
Stationary parked car	61%	74%
Maneuver to unpark	6%	0%
Parking Total	70%	87%

SOURCE: Tables 24 and 25, Ref. 11.

Parking on major urban streets consumes expensive areas for storage of vehicles. In most cases off-street parking could be provided at far less cost, and with greater convenience for users, especially those not greatly skilled in the street parking maneuver. The abutting property owners along major routes where curb parking is allowed are reaping a personal gain at the expense of the general public. The property owner could be considered being subsidized at the expense of the general public. The provision of adequate width to accommodate on-street parking on major streets is costly in terms of accidents and reduced roadway capacity and is not a realistic burden to place on the public.

Treatments

The amount of curb parking is a product of adjacent land use type and density as related to local policies—particularly off-street parking supply. Older cities with inadequate zoning requirements for off-street parking are living with streets solidly packed with automobiles. Philadelphia has streets with parking allowed down the center. Hoboken, New Jersey, has allowed all-night double parking on both Local and Major streets.

Cities have addressed congestion problems along Major streets by sometimes totally prohibiting (and enforcing) curb parking. Rush hour restrictions are more common and operational practices such as 1-way flow are used on both Major and Local streets where prohibitions are impractical. Warrants for parking restrictions are discussed in the ITE Handbook (*8*). The width of streets is a significant factor, when related to parking density. The Major street width is driven by capacity aspects. In some cases, state highway departments have widened urban highways to include parking lanes, paid for by local agencies. Unless these lanes are at least 10 feet wide, significant friction will exist with the adjacent travel lane. A second reason for use of 10-foot lanes is the potential for their future use as through, right turn or deceleration lanes to serve abutting property, with parking prohibited.

In downtown areas, cities have addressed curb parking congestion by developing centralized off-street parking lots and garages. Examples of appropriate studies are given in *Parking Principles* (*5*) and techniques for proper location are listed in the ITE Guidelines for Parking Facility Location and Design (*10*).

The ITE Recommended Practice Guidelines for Local and Collector Street Design are intended for use in new subdivisions, using 2-way traffic flow (*7*). The width of Collector and Local streets largely depends on parking density. Most Collector streets operate well at 36 feet, even with relatively solid parking on both sides, provided three lanes are opened up on the immediate approach and departure sides at major intersections. Local streets 28 feet wide operate well if only occasional curb parking is found, such as in single family residential areas having 2-car off-street parking requirements. With lesser zoning control, frequent curb parking occurs, often on both sides, and the common most practical treatment is 1-way posting.

CONVENIENCE ASPECTS

The Shopper and the Merchant

In the absence of convenient and adequate off-street parking, drivers will first search for the nearest location at the curb. If a diligent search is unfruitful, the second choice will be

a parking lot. Both of these parking areas provide open vistas and a feeling of better security than the confines and often confusing routing of a large, public-access garage.

The owners of retail businesses who have not invested in the provision of adequate off-street parking for their customers typically claim their "life blood" is the availability of curb parking. Studies finding employees or owners themselves occupying these curb spaces do not seem to refute such claims.

Certainly it is not practical for every small business along a retail street of an older city to build a parking lot. One method of providing a practical supply of off-street parking, and to allow the part-time or total prohibition of curb parking, is the development of small lots in each block. An existing building is condemned and replaced by a lot constructed by the City and hopefully financed by assessment against the remaining properties along the block face. The walking distance to and from such lots is relatively short, so that they represent an excellent replacement for curb parking. The lots may contain space for both retail customers and employees; however, the latter typically walk farther and are often better accommodated by less convenient facilities.

Table 4 gives typical walking distances found in studies of various users and in a range of city size.

For the local lot to be equitably financed, the assessment should allow credit for any existing off-street parking already provided by land owners. It also may consider distance, with adjacent businesses paying a higher rate than those farther away. Also, the system may be considered in apartment or even single family areas.

A second and more common method of supplying off-street parking is construction of a centralized facility serving several blocks. These have been built in the central business district area of many, if not most, cities in the United States. Here the assessment is spread over a large area and part of the land and/or construction cost is borne by revenue bonds paid off by parking fees. A detailed discussion of methods and financing is given in *Parking Principles* (*5*).

RESIDENTIAL PARKING

Spaces Needed

Most vehicular trips begin and end at the residence of the owner. The responsibility for the care, feeding, and "home" of the private vehicle rests with the owner. Proper zoning

TABLE 4 Parker Walking Distances (feet) by City Size

Pop. Group of Urban Area (1,000s)	Shop	Personal Business	Work
10-50	240	220	340
50-250	410	340	450
250-1,000	560	520	660

SOURCE: Condensed from *Parking Principles*, Table 2.11, Ref. 5.

charges the owner with this responsibility by requiring 2 or 3 off-street spaces per single family home and 1.5 to 2 spaces per apartment for typical subdivisions. In 1998, 16% of new U.S. homes were reported to include 3-car garages—up from 12% in 1993. Redevelopments in the inner-city also require off-street parking, although lesser amounts may be appropriate when located near rapid transit facilities. Apartment dwellers in other areas also may have lower vehicle ownership rates and require less parking if near suburban rail stations, for example. In all cases, zoning should specify appropriate off-street parking to serve likely current and future needs. The curb of a public street should never be considered as a source of resident-owned overnight vehicle parking.

In a residential area, some curb parking is needed to serve delivery and visitor parking overflow beyond the driveway building setback area capacity. While it is both practical and desirable for the homeowner to construct a setback sufficient to store two, or sometimes three or four cars, it is impractical and unreasonable to expect the capacity to handle party-goers, for example. A garage setback of 20 feet will provide overflow space of two cars for a 2-car garage, or three cars for a 3-car garage. Such space will accommodate most visitor parking and/or absorb overflow for car ownership exceeding garage capacity (a common problem for suburban families with teenage children).

Garage Design

In order to efficiently and comfortably handle full-size cars, most builders and architects need to rethink garage design. For the suburbanite—and to a lesser degree other single family owners—the garage has several functions serving as:

- The primary route used by adults to access the property.
- A primary storage area for gardening tools, snow blowers, ladders, hoses, bicycles, etc.
- A primary or secondary area for power tools, such as table saws, small hand tools, paint supplies, surplus lumber, etc.
- Space to store the cars, to walk around the vehicles, and to open the car doors enough to comfortably enter and leave.

The needed dimensions exceed those of a typical garage—often by a considerable amount. A recent survey by a housing market analyst found a cramped garage was one of the biggest reasons given by people who moved. Many cars are left outside in the driveway, or parked on the street, due to inadequate garage size. For certain dimensions, a “minimum” and a “desirable” can be specified. For garage door sizes, however, the minimum and the desirable are the same. Table 5 gives dimensions that have been found to be appropriate.

The recommended minimum dimensions are based on full size cars, with sufficient door opening space for 4-door vehicles (2-door cars can be accessed, but with less convenience) and some tool hanging along one garage wall. The “desirable” dimensions increase the wall hanging space and also open up the end of the garage for cabinets, work bench, garden equipment, storage, etc. A full size car is currently defined as 6 feet wide and 17.5 feet long (*10*) although several vehicles are 18 feet long, with a

TABLE 5 Recommended Residential Garage and Driveway Dimensions for Specification in Building and Zoning Codes (Feet)

Feature	Minimum	Desirable
Garage setback	20	25
Garage door width, 1-car	9*	9
Garage door width, 2-car	18**	18
Garage inside width, 1-car	11	13
Garage inside width, 2-car	20	22
Garage inside length	21	24
Apron width in setback area, 1-car	13	15
Apron width in setback area, 2-car	20	22

*Some garages have doors only 8 feet wide.
**Most garages have doors only 16 feet wide.

few older models approaching 19 feet. The latter dimension plus a 7-foot width is still used by the AASHTO as the design passenger vehicle (*11*).

While many vehicles currently sold can fit into garages 2 feet narrower and 2 feet shorter than the recommended dimensions, there are strong reasons to avoid "downsizing." First, the sizes of future vehicles cannot be predicted. A home is designed for a useful life of 50 to 60 years or more. The cars of the 70s were downsized in the 80s but some regrowth has occurred in the 90s. Size reductions have been driven by weight reduction needs in terms of fuel efficiency. However, use of lighter materials (plastic, aluminum) and the inevitable development of more efficient engines are likely to allow "full-sizes" to thrive. It is unlikely, however, that the 7 × 19 foot behemoths of the 50s and 60s will return.

A second reason for constructing garages to at least "minimum" size is the added storage space for small size vehicle owners. Garage storage is far cheaper to construct and does not require finishing, heating or cooling, as compared with space inside the residence. For example, it currently costs about $25 a square foot to build an attached garage in Arizona versus $80 a square foot if the same storage area is constructed as part of the living area.

The recommended garage dimensions also apply to duplexes and townhomes. Parking lots for apartment dwellers omit the storage capacity, while garages for them group the cars in common areas, while sometimes providing individual storage compartments of limited size. The ITE Guidelines include information on designing parking lots and garages that are applicable to vehicle storage needs of apartments (*10*).

Alleys

In older residential areas of most cities, alley garages are commonplace. A few newer subdivisions in cities such as Dallas and Amarillo have provided alleys behind single family homes. Such designs eliminate the front driveway, thus relegating most visitors to on-street

parking. Alley-access garages need a minimum of 21 feet and preferably 25 feet for maneuver space to enter and park. The minimum setback from the alley therefore is related to the alley width; however, a garage door setback of at least 5 feet (preferably 8 feet) is needed to open up sight distance down the alley.

Alley-facing garages or open sheds also are used at some apartments. Setback requirements are even more critical due to the greater traffic volume—hence greater conflict—in such alleys.

SUMMARY

Several points have been presented in this paper:

- Curb parking, if allowed, contributes unduly to accidents, ranging from about 40% of total accidents on 2-way Major streets to 70% on Local streets. Higher proportions are found on 1-way streets.
- Curb parking increases congestion in two ways: by denial of a moving lane and by reducing capacity of an adjacent moving lane.
- On business streets, workable treatments are available to develop off-street parking and allow restriction of curb use.
- Residential driveways and garages can be designed to encourage and enhance parking of private vehicles off the street.

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