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## South African Parking Standards

T.C. MACKEY, O.A.W. VAN ZYL, AND J.C. VORSTER

Certain minimum desirable parking standards were developed in the Urban Transport Branch of the South African Department of Transport during 1979-1980. This was done to provide guidance and requirements for uniform parking standards. This paper conveys these standards and some of the background to the development of the standards. The subject is dealt with in two parts: standards for parking dimension and requirements for parking provision. In the first section, the establishment of a South African design vehicle is discussed—motor cars in South Africa are generally smaller than those in the United States and slightly larger than the European cars. From the design vehicle, at present proposed to be 4.8 m in length and 1.8-m wide, the dimensions of parking bays and aisle widths are derived and certain standards proposed. For 90° parking a basic standard module width is 17.5-m wide aisles. Dimensions for angle parking and for on-street parking are also proposed as well as dimensions for certain parking garages. In the second section, the background to the development of requirements for provision of off-street parking is discussed. A questionnaire on current parking provision requirements was sent to all local authorities in the five declared metropolitan areas in South Africa. The results of this survey were compared with findings of parking demand surveys and South African and overseas proposed standards. A summary of the recommended minimum desirable standards for parking provision is then given.

Parking is a very important and integral part of the total transportation system in any metropolitan area. Because of the ever-increasing cost of land and construction of parking facilities and also because of the influence of on-street and off-street parking on traffic flow, it is necessary for all authorities to ensure compliance with adequate, realistic, and effective parking requirements and standards. The Urban Transport Branch of the Department of Transport therefore compiled a report on parking standards (1), of which this paper is a summary. The object of the report was to propose (a) standards for parking dimension and (b) requirements for parking provision to provide national guidance and requirements for uniform parking standards and also to assist the National Transport Commission in evaluating requests for subsidies for parking facilities.

The National Transport Commission accepted, in principle, the parking-dimension standards and parking-provision requirements, as laid down in the report, as the minimum desirable standards for the urban areas of South Africa. The commission further agreed that the report be distributed to all local authorities in the declared metropolitan transport areas, that it should be recommended to the core cities for possible acceptance and application in their respective transport plans, and that all local

authorities should consider inclusion of the parking provision requirements in their town planning schemes, with the understanding that deviations would be possible if adequate motivation proves it necessary.

The purpose of the report was to cover only those aspects of parking that may differ from available overseas standards and requirements. The use of other literature on parking in conjunction with this report is thus recommended [e.g., (2)].

### STANDARDS FOR PARKING DIMENSIONS

#### South African Design Vehicle

Minimum standards and desirable standards for dimensions of parking bays can be laid down. For the purpose of this report, we decided to propose only one desirable standard that will be applicable to most circumstances. Good judgment is necessary, however, in the application of these standards, and certain deviations may be necessary. These standards apply only to ordinary private vehicles such as motor cars, minibuses, and light delivery vehicles but not to trucks and buses. South African motor cars are generally smaller than those in the United States and probably slightly larger than European cars; therefore, it was necessary to develop a South African design vehicle from which dimensions of parking bays can be derived.

A number of people, including the city engineer's department of Durban (3), Olivier (4), Uys and Van der Merwe (5), and the Division of Highway Traffic Engineering of the South African Institute of Civil Engineers (6), did some work on the dimensions of a South African design vehicle. Most of the above-mentioned studies based the design vehicle on the 95 percentile value of the different dimensions. This represents a conservative working value that covers the overall majority of vehicles. Cumulative frequency diagrams were plotted for such factors as the length, width, turning circle, and height of vehicles from which the 95 percentile values can easily be determined.

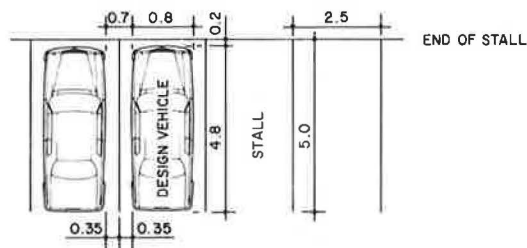
Uys and Van der Merwe (5) found a definite trend toward smaller cars in South Africa. Volkswagen South Africa (7) confirmed this after studying the change in buying habits of the South African motoring public. They found an increase of 15 percent in

Table 1. Comparison of design vehicle dimensions.

Place	Source	Length (m)	Width (m)	Turning Circle (m)
United States	Eno Foundation (8)	5.49	1.98	14.18
	Eno Foundation (9)	5.72	2.03	14.98
	Institute of Traffic Engineers (10)	5.90	2.00	
	Institute of Transportation Engineering (11)	5.80	2.05	14.60
Europe	Glanville and Seymer (12)	4.78	1.78	9.92
South Africa	Durban Corporation (3)	4.88	1.83	12.20
	South African Institution of Civil Engineers (6)	4.85	1.85	
	Olivier (4)	4.85	1.85	12.0
Proposed	Uys and Van der Merwe (5)	4.75	1.80	12.4
		4.80	1.80	12.4

Note: The following factors are generally accepted to play a role in determining dimensions of parking bays: vehicle size dimensions, operational characteristics, driving ability, and user convenience.

Figure 1. Design vehicle and 90° stall.



the number of new small cars sold in the period 1973 to May 1979 and a further increase was expected.

After the available data were compared, the following basic dimensions for the South African design vehicle were proposed:

Item	Dimension (m)
Length	4.8
Width	1.8
Turning circle	12.4

A comparison between these dimensions, as set by various sources for the United States, Europe, and South Africa, is presented in Table 1. The following additional characteristics for the South African design vehicle were then chosen (the front, rear, and side overhangs were based on limited data only):

Item	Dimension (m)
Wheel base	2.85
Front overhang	0.75
Rear overhang	1.20
Side overhang	0.2
Minimum turning radius, inside rear wheel	3.1
Minimum turning radius, outside point, front bumper	6.2
Overall height	2.0

The vehicle size dimensions will, to a certain extent, affect the bay and aisle dimensions. The most important dimensions are the following:

1. Vehicle width;
  2. Vehicle length;
  3. Minimum turning radius, inside rear wheel;
  4. Minimum turning radius, outside front bumper;
- and
5. Rear overhang.

These dimensions affect the maneuverability of a vehicle directly and, therefore, the parking layout and dimensions. Another important factor is the lateral spacing between vehicles when parked or be-

tween a vehicle and a wall or other fixed objects, primarily for the opening of doors. After consideration of proposals by various authors and the variation in car positioning in the stall, a standard of 0.7 m was proposed for design purposes. Kanaan and Witheford (13) found that parkers did not, on the average, pull all the way into a parking bay. Therefore it was proposed that an additional 0.2 m should be added to the length of the design vehicle in determining stall lengths. No provision was made for vehicles parking with part of the overhang extending over curbs or sidewalks because parking like that might interfere with pedestrian activities and might also damage certain vehicles.

#### Off-Street Parking

If the tolerances mentioned above are added to the dimensions of the design vehicle, it results in a proposed general 90° bay size of 5.0 m in length and 2.5 m in width, as shown in Figure 1. A parking bay next to a wall should be 0.35 m wider, however, to allow for the opening of doors. This results in a bay size of 5 m in length and 2.85 m in width.

When the standard parking bay width is known, the width parallel to the end-of-stall line can be determined for different angles. The stall depth perpendicular to a wall or the end-of-stall line for different parking angles, with or without the interlocking of bays, can also be determined. A summary of these dimensions is given in Table 2.

Ricker (14) derived a formula for determining the aisle width between a row of parked cars and a wall or obstruction. This formula produces rather wide aisle widths, and, therefore, parking maneuvers were also simulated graphically to determine the proposed aisle widths given in Table 2. The proposed aisle width for 90° parking is 7.5 m. A parking module, which represents two rows of parking bays together with the aisle in between, is a standard dimension in planning and designing a specific parking lay-out configuration. For 90° parking, the proposed module width is 17.5 m.

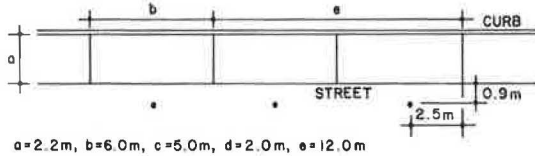
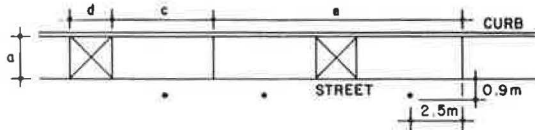
#### On-Street Parking

There are basically two types of on-street parking--parking at an angle and parallel parking. Parking at an angle on-street is generally viewed as unsafe and should be avoided. There are three basic types of curb stalls--end stall, interior stall, and paired parking, which are shown in Figures 2 and 3.

Paired parking is preferred to the interior stall layout in South Africa. The widths of curb stalls are prescribed in the different road traffic ordinances of the provinces as 2.2 m. To allow the driver and occupants of the vehicle to safely enter or leave the vehicle, the width of the traffic lane adjacent to curb parking should be increased, where

**Table 2. Summary of proposed parking dimensions.**

Interlocking Bays	Parking Angle (degrees)	Stall		Aisle Width (m)		Module Width (m)	
		Width (m)	Depth (m)	Two-Way	One-Way	Two-Way	One-Way
None	90 <sup>a</sup>	2.4	5.0	8.0	8.0	18.0	18.0
		2.5	5.0	7.5	7.5	17.5	17.5
		2.5	5.0	7.0	7.0	17.0	17.0
On one side	60	2.5	5.3	5.4	4.4	16.0	15.0
	45	2.5	4.9	5.2	4.2	15.0	14.0
	60	2.5	4.8	5.4	4.4	15.5	14.5
On both sides	45	2.5	4.7	5.2	4.2	14.3	13.3
	60	2.5	4.8	5.4	4.4	15.0	14.0
	45	2.5	4.2	5.2	4.2	13.6	12.6

<sup>a</sup>Basic proposed standard.**Figure 2. The interior stall.****Figure 3. Paired parking.**

possible. The proposed dimensions for on-street parking are shown in Figures 2 and 3.

### Parking Garages

Although parking garages or structural parking is a comprehensive subject on its own, vertical clearance, slope of floors, and certain ramp characteristics are discussed briefly. A minimum vertical clearance of 2.1 m is proposed for parking garages, which implies careful placement of lighting fixtures and overhead signs. However, the vertical clearance on the ground floor or part thereof of any parking garage should conform to the maximum vertical height laid down in the ordinance (i.e., 4.1 m). The slope of floors should not exceed 3 percent in directions longitudinal to parking stalls or 5 percent for cross slopes or aisles (2). The preferable maximum grade for sloping floor self-park garages is 4 percent (15).

Ramps should be skid-free and the maximum proposed grade is 15 percent (15). A 10 percent grade is preferred for high-volume ramps. The width of a straight one-way ramp without a sidewalk and curbs should not be less than 3.5 m and with sidewalk and curbs not less than 3.0 m. A two-lane straight ramp with sidewalk and curbs should have a width of not less than 6.0 m for one-way operation and 7.0 m for two-way operation. The width of a circular ramp should not be less than 4.5 m.

### PARKING PROVISION REQUIREMENTS

#### Off-Street Parking Requirements

In order to safeguard traffic flow on adjacent arterials, ensure effective access, and protect the transportation system's general functioning, a sufficient number of off-street parking spaces must be provided at all the different types of development

in urban areas. Requirements for such parking provision are normally contained in the town planning scheme for a particular area. Where it is the purpose of this report to develop and recommend such desirable minimum standards, these standards should be applied with the necessary care. The following factors may require these standards to be adjusted in a specific case:

1. Size and nature of the development;
2. Urban character, socioeconomic structure of the population, and residential density in the market or influence area;
3. Availability of public transport;
4. Availability of other on-street or off-street parking in the vicinity; and
5. Certain combinations of land uses, such as offices or theaters in shopping centers that may reduce the total combined parking requirement where the peak parking demand for the different land uses do not occur at the same time.

In the central areas of major cities different situations exist from those in the outlying areas of central business districts (CBDs) of smaller cities and towns. Factors such as the high density of development, available public transport, major pedestrian flows, and scarcity and cost of land, may prohibit or limit the provision of parking in relation to outlying areas or smaller town centers. Therefore, a separate parking policy normally exists for the CBD of a large city.

#### Data Collection

Questionnaires on requirements for provision of off-street parking were distributed during June 1979, with the assistance of the relevant provincial administrations, to all the local authorities within the five metropolitan areas of Johannesburg, Pretoria, Cape Town, Port Elizabeth, and Durban. Most local authorities and provincial administrations responded, and an excellent return of 44 completed questionnaires was achieved.

Analysis of the completed questionnaires showed that there is a great diversity in the standards for off-street-parking-provision requirements as applied by the local authorities. For example, among the 44 cities and towns there are no less than 26 different parking requirements for general offices. This great diversity indicates the need for guidelines on the uniformity of parking standards.

In the analyses of the completed questionnaires we also endeavoured to determine whether there is any relation between the size of the city or town and the parking demand or requirement for the various land uses. The local authorities were divided into three groups, depending on population size and the parking-provision requirements compared within each of these three groups. No trend or special

Table 3. Summary of recommended minimum standards for off-street parking.

Land Use	Buildings	Standard <sup>a</sup>
Residential	Single and attached dwelling units	
	One habitable room	1.0 space/unit
	Two habitable rooms	1.0 space/unit
	Three habitable rooms	1.25 spaces/unit
	Four or more habitable rooms	1.5 spaces/unit
	Visitors	0.5 additional space/unit
	Hotel and motel	1 space/habitable room + 10 spaces per 100 m <sup>2</sup> PAA
	Residential hotel and boarding house	0.6 spaces/habitable room
	Old-age home and orphanage	0.3 spaces/habitable room
	Office	General office
Bank, building society, and other public trade office		4 spaces/100 m <sup>2</sup> PFS
Shopping center		
Business	Neighborhood (< 5000 m <sup>2</sup> )	7 spaces/100 m <sup>2</sup> PFS
	Community (5000-15 000 m <sup>2</sup> )	6 spaces/100 m <sup>2</sup> PFS
	Regional (> 15 000 m <sup>2</sup> )	5 spaces/100 m <sup>2</sup> PFS
	Hypermarket <sup>b</sup>	7 spaces/100 m <sup>2</sup> PFS
Medical	Single shop, excluding car showroom and plant nursery	6 spaces/100 m <sup>2</sup> PFS
	Consulting room	6 spaces/100 m <sup>2</sup> PFS
	Small private hospital and clinic	1 space/bed
Industrial and commercial	General hospital	1 space/bed
	Manufacturing	1 space/100 m <sup>2</sup> PFS
	Warehousing	1 space/100 m <sup>2</sup> PFS
	Dairy, bakery, and laundry	1 space/100 m <sup>2</sup> PFS
Public garage	Storage yard	1 space/100 m <sup>2</sup> PFS
Place of public worship		4 spaces/working bay + 2 spaces/100 m <sup>2</sup> spaces and sales area
Educational	Nursery school	0.15 space/seat
	Primary school	1 space/classroom or office
	Secondary school	1 space/classroom or office
	College	0.25 space/student
	University	0.4 space/student
	Community center	2 spaces/100 m <sup>2</sup> PFS
Recreation, sport, and entertainment	Hall	0.25 space/seat or 20 spaces/100 m <sup>2</sup> PFS
	Movie and theater	
	Within shopping center	0.1 space/seat
	Isolated	0.2 space/seat
	Sport stadium	0.25 space/seat
	Swimming pool	0.25 space/seat
	Library and museum	2 spaces/100 m <sup>2</sup> PFS

Note: PAA = public accessibility area, PFS = permissible floor space.

<sup>a</sup>Not applicable in CBD of large cities.

<sup>b</sup>A hypermarket is a large discount store that sells many items, including food, clothing, and furniture.

relation within the groups or differences among the groups was noticed, and we therefore concluded that, at this stage, there is no noticeable or specific difference in parking demand for different sizes of local authorities.

The requirements and proposals obtained from the questionnaires were also compared with other surveys of parking demand made in South Africa. Kruger, Van Zyl, and Du Plessis (16) used the results of their own surveys and surveys done by University of Pretoria students to propose parking indices for certain land uses. Jordaan and Switala (17) also compared results of a large number of surveys done by students of the University of Pretoria. Guidelines were also prepared by the South African Institute of Civil Engineers (18) for off-street parking provision. Cognizance was also taken of other South African surveys and proposals for parking-provision requirements.

Off-Street Parking Requirements for Different Land Uses

The existing parking requirements, as applied by the different local authorities, were compared with South African and overseas recommendations in order to derive a minimum standard that can be applied under existing conditions to the average South African city or town. A summary of the recommended minimum standards is shown in Table 3. The complete comparison of parking requirements for different land uses, as well as definitions of the most important descriptive units, is discussed in detail in the original report (1).

CBD Off-Street Parking Requirements

As mentioned before, parking requirements for central areas of large cities are generally substantially less than the requirements shown in Table 3. In some cases no parking is required or the provision thereof prohibited. This may be due to good public transport access, the high density and high cost of land, and the pedestrian flow, which should not be interrupted by vehicle entrances. Parking provision can also be limited in order to limit the influx of traffic into the CBD.

On the other hand it may be necessary to provide sufficient parking to combat decentralization and deterioration of the CBD. Specific policies in relation to on-street parking as well as core parking for short-term shoppers and fringe parking for long-term workers should be adopted.

The large South African cities reported that they have specific requirements for their central areas. Some smaller cities and towns indicated that, although there is no difference in their parking requirements for their CBDs compared with their outlying areas, they do allow, with the consent of the administrator, that a sum of money shall be used for the provision of the required number of parking spaces as a public-parking facility in the vicinity of the site in question. This is paid in their CBD payment, in lieu of the provision of the number of parking spaces.

Pretoria divided its CBD into two zones. Zone A, which is the core, is about 25 street blocks in extent and no parking is allowed. In zone B, which is a fringe area around zone A, the parking must be

provided as is the case for the remainder of Pretoria, except in the case of shops where 1 space/116 m<sup>2</sup> GFA ( $\pm 0.9$  space/100 m<sup>2</sup>) must be provided.

In Johannesburg the central area is divided into four zones (A, B, C, and D). Except in certain special cases, no parking may be provided for any building in the core (i.e., zone A). In zones B and C it may only be provided for sites of 1480 m<sup>2</sup> or greater in extent and in zone D on sites of 900 m<sup>2</sup> or larger. If parking is provided in these zones, it may not exceed a certain number of spaces, as specified in the town planning scheme. These requirements are much less than those for the remainder of Johannesburg.

It is not possible to recommend minimum standards for the central areas of large cities as they depend on the local circumstances and also on the parking policy adopted by the local authority. The above summary of the requirements for the central areas of Pretoria and Johannesburg do, however, give some indication of what such requirements could be and the principle of precluding the provision of parking in highly pedestrianized areas is supported in these circumstances.

#### CONCLUSION

We hope that the minimum desirable standards for parking dimensions and parking provision requirements developed in the report and summarized in this paper will provide guidance in South Africa and also contribute to some uniformity in parking standards in other countries. These are standards to be applied with the necessary care and understanding; properly motivated deviations will be necessary from time to time. It will also be necessary to revise and update the report from time to time. Comments on the report will thus be welcome.

#### ACKNOWLEDGMENT

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## Implementation of a Regional Parking Policy: Institutional and Political Considerations

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Parking policy in most U.S. cities consists of the independent actions of a large number of transportation and parking agencies, each implementing different parking management strategies to achieve a wide variety of urban goals. How-

ever, the use of the provision of parking as a policy lever for attaining urban objectives in a comprehensive and consistent manner requires the formulation and implementation of a regional parking policy. This paper examines the in-