

Technical Note

DESIGN OF ANGLED PARKING BAYS

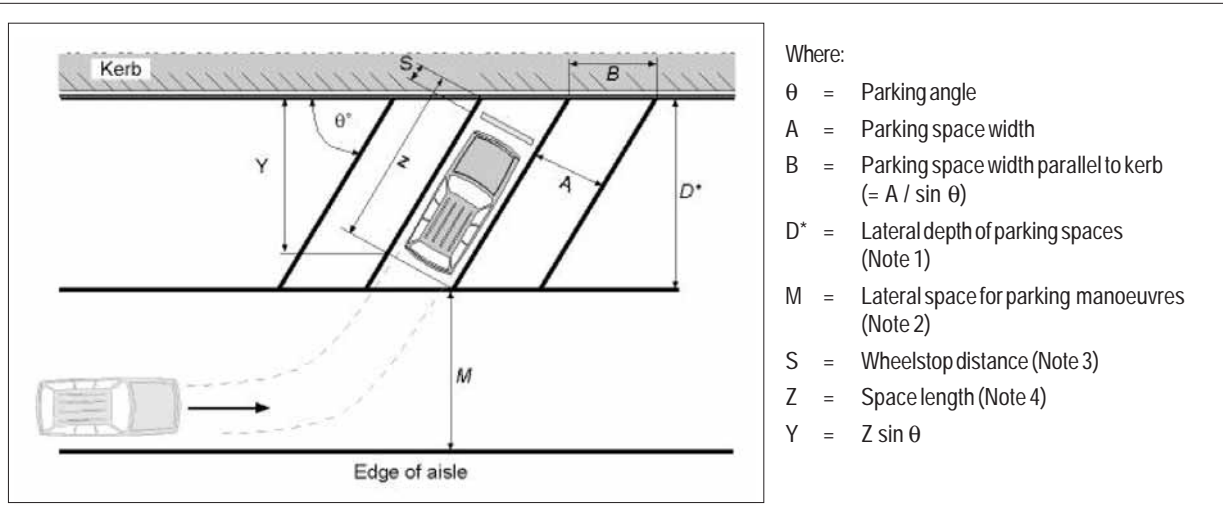
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Following the release of Australian and New Zealand Standard AS/NZS 2890.1-2004: *Off-street parking*, a review was undertaken to ascertain that Standard's consistency with Australian Standard AS 2890.5-1993: *On-street parking*, and whether both documents were easily interpreted by practitioners. The review specifically focused on those parts of the standards relating to the design of angle parking modules, and in particular Table 1.1 and Figure 2.2 of AS/NZS 2890.1-2004, and Table 2.2 and Figures 2.2-2.5 of AS 2890.5-1993.

In the process of completing the review, a cross section of practitioners from local and state government were consulted and their feedback collated. The general feedback was consistent with the broader findings of the review, which highlighted a number of inconsistencies in the tables and figures. In addition, it was identified that the interpretation of the Standards could benefit from provision of additional guidance on requirements for manoeuvring in and out of parking spaces.

The most obvious inconsistency between the two Standards is the inclusion of user categories 1A and 3A in Table 1.1 of AS/NZS 2890.1-2004, which do not appear in AS 2890.5-1993 (*Table 1*). However, there would also seem to be several other minor inconsistencies in the tables and figures, which are only obvious after back calculation and detailed scrutiny.

There would appear to be good justification for the Standards for on-street and off-street parking to be made more consistent with each other. On this basis, the figures contained in the two Standards have been updated and are presented in *Figure 1* for off-street parking and *Figure 2* for on-street parking.



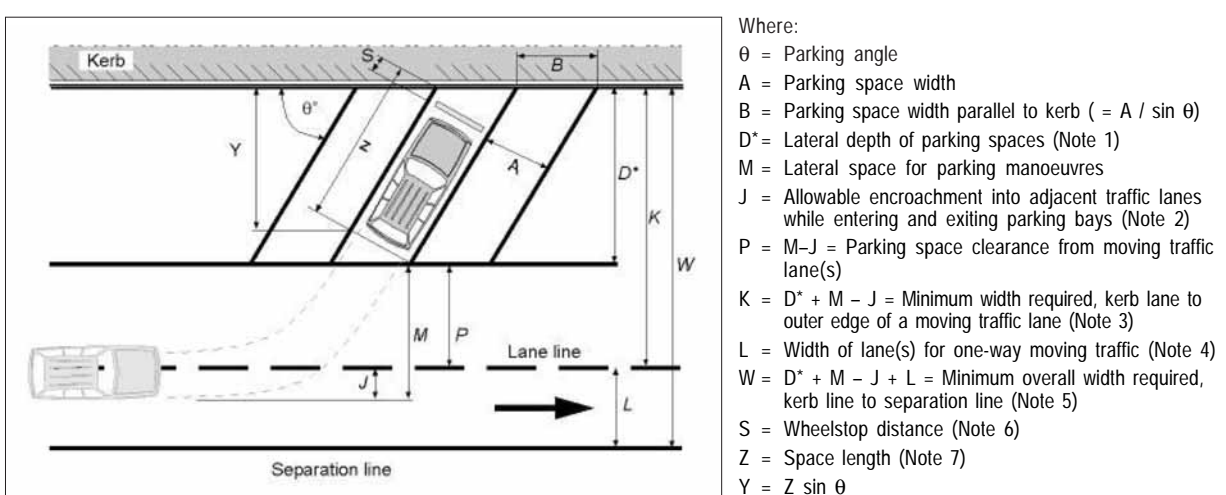
Where:
 θ = Parking angle
 A = Parking space width
 B = Parking space width parallel to kerb
 (= $A / \sin \theta$)
 D^* = Lateral depth of parking spaces
 (Note 1)
 M = Lateral space for parking manoeuvres
 (Note 2)
 S = Wheelstop distance (Note 3)
 Z = Space length (Note 4)
 $Y = Z \sin \theta$

θ	User class (Note 5)	Dimension, m					
		A	B	D ¹	D ²	D ³	M
30°	1,1A	2.1	4.2	4.4	4.1	4.5	3.1
	2	2.3	4.6	4.4	4.1	4.7	3.0
	3	2.5	5.0	4.4	4.1	4.9	2.9
	3A	2.5	5.0	4.4	4.1	4.9	3.45
	4	3.2	6.4	4.4	4.1	5.5	2.9
45°	1,1A	2.4	3.4	5.2	4.8	5.5	3.9
	2	2.5	3.5	5.2	4.8	5.6	3.7
	3	2.6	3.7	5.2	4.8	5.7	3.5
	3A	2.6	3.7	5.2	4.8	5.7	4.2
	4	3.2	4.5	5.2	4.8	6.1	3.5
60°	1,1A	2.4	2.8	5.7	5.1	5.9	4.9
	2	2.5	2.9	5.7	5.1	6.0	4.6
	3	2.6	3.0	5.7	5.1	6.0	4.3
	3A	2.6	3.0	5.7	5.1	6.0	5.1
	4	3.2	3.7	5.7	5.1	6.3	4.3
90°	1	2.4	2.4	5.4	4.8	5.4	6.2
	1A	2.4	2.4	5.4	4.8	5.4	5.5
	2	2.5	2.5	5.4	4.8	5.4	5.8
	3	2.6	2.6	5.4	4.8	5.4	5.8
	3A	2.6	3.2	5.4	4.8	5.4	6.6
	4	3.2	3.2	5.4	4.8	5.4	5.8

(Adapted from AS/NZS 2890.1 to be more consistent with AS 2890.5)

- NOTES:
- Dimension D^* is selected as follows:
 D^1 – where parking is to a wall or high kerb not allowing any overhang
 D^2 – where parking is to a low kerb which allows 600mm overhang
 D^3 – where parking is controlled by wheelstops installed at right angles to the direction of parking
 - The driver may use full aisle width for manoeuvring purposes.
 - $S = 0.6$ m for front-to-kerb parking and 0.9 m for rear-to-kerb parking.
 - In Australia, $Z = 5.4$ m desirable minimum, however as an absolute minimum it may be reduced to 5.0 m where it is permitted (for example, for small car bays).
 In New Zealand, $Z = 5.0$ m desirable minimum, however as an absolute minimum it may be reduced to 4.5 m where permitted (for example, for small car bays).
 The width of a small car bay in both Australia and New Zealand may be reduced to $A = 2.3$ m (or 2.1 m for 30 degree parking).
 Note that the practitioner will need to calculate their own values of dimensions B , D^* and M for all parking bays in New Zealand as well as for small car bays in both countries.
 - User classes are defined in Table 1.

Figure 1
 Layouts for off-street angle parking bays



θ	User Class	Dimension, m									
		A	B	D^1	D^2	D^3	M	P	K	W (Note 4)	
										0-800 vehicles/h	800-1600 vehicles/h
30°	1,1A	2.1	4.2	4.4	4.1	4.5	3.1	0.6	5.1	8.6	11.6
	2	2.3	4.6	4.4	4.1	4.7	3.0	0.5	5.2	8.7	11.7
	3	2.5	5.0	4.4	4.1	4.9	2.9	0.4	5.3	8.8	11.8
	3A	2.5	5.0	4.4	4.1	4.9	3.45	0.95	5.85	9.35	12.35
45°	1,1A	2.4	3.4	5.2	4.8	5.5	3.9	1.4	6.9	10.4	13.4
	2	2.5	3.5	5.2	4.8	5.6	3.7	1.2	6.8	10.3	13.3
	3	2.6	3.7	5.2	4.8	5.7	3.5	1	6.7	10.2	13.2
	3A	2.6	3.7	5.2	4.8	5.7	4.2	1.7	7.4	10.9	13.9
60°	1,1A	2.4	2.8	5.7	5.1	5.9	4.9	2.4	8.3	11.8	14.8
	2	2.5	2.9	5.7	5.1	6.0	4.6	2.1	8.1	11.6	14.6
	3	2.6	3.0	5.7	5.1	6.0	4.3	1.8	7.8	11.3	14.3
	3A	2.6	3.0	5.7	5.1	6.0	5.1	2.6	8.6	12.1	15.1
90°	1,1A	2.4	2.4	5.4	4.8	5.4	6.2	3.7	9.1	12.6	15.6
	2	2.5	2.5	5.4	4.8	5.4	5.8	3.3	8.7	12.2	15.2
	3	2.6	2.6	5.4	4.8	5.4	5.8	3.3	8.7	12.2	15.2
	3A	2.6	2.6	5.4	4.8	5.4	6.6	4.1	9.5	13	16
90°	4	3.2	3.2	5.4	4.8	5.4	5.8	3.3	8.7	12.2	15.2

(Adapted from AS 2890.5 to be more consistent with AS/NZS 2890.1)

- NOTES: 1 Dimension D^* is selected as follows:
 D^1 – where parking is to a wall or high kerb not allowing any overhang
 D^2 – where parking is to a low kerb which allows 600 mm overhang
 D^3 – where parking is controlled by wheelstops installed at right angles to the direction of parking
- 2 J = 2.5 m, appropriate to traffic speeds of 60 km/h or less past the site. At higher speeds it is recommended that J be reduced by 1.0 m for each 10 km/h by which the speed exceeds 60 km/h, with a minimum value of J=0.
- 3 K may be reduced for low traffic flows and speeds (for example, when traffic calming measures are introduced).
- 4 L = 3.5 m for 0-800 vehicles/h and 6.5 m for 800-1600 vehicles/h, where the traffic volumes are one-way hourly volumes, total of all lanes, during the times parking is permitted.
- 5 W, P and K are quoted based on values of D^3 and J = 2.5 m. The practitioner shall calculate their own value of W, P and K if D^1 or D^2 are used or if the design speed exceeds 60 km/h.
- 6 S = 0.6 m for front-to-kerb parking and 0.9 m for rear-to-kerb parking.
- 7 In Australia, Z = 5.4 m as a desirable minimum. An absolute minimum of 5.0 m may be used where it is permitted (for example, for small car bays).
 In New Zealand, Z = 5.0 m as a desirable minimum. An absolute minimum of 4.5 m may be used where permitted (for example, for small car bays).
 The width of a small car bay in both Australia and New Zealand may be reduced to A=2.3 m (2.1 m for 30 degree parking).
 Practitioners will need to calculate their own values of dimensions B, D^* , M, P, K and W for on-street parking in New Zealand as well as for small car bays in both Australia and New Zealand.

Figure 2
 Typical parking layout for 30, 45, 60 and 90 degree angle parking bays

Table 1
Classification of car parking facilities

User class	Required door opening	Required aisle width	Examples of users (Note 1)
1	Front door, first stop	Minimum for single manoeuvre entry and exit	Employee and commuter parking (generally all day parking)
1A	Front door, first stop	Three point entry and exit into 90° parking spaces only, otherwise as for User Class 1	Residential, domestic and employee parking
2	Full opening, all doors	Minimum for single manoeuvre entry and exit	Long-term city and town centre parking, sports facilities, entertainment centres, hotels, motels, airport visitors (generally medium-term parking)
3	Full opening, all doors	Minimum for single manoeuvre entry and exit	Short term city and town centre parking, parking stations, hospital and medical centres
3A	Full opening, all doors	Additional allowance above minimum single manoeuvre width to facilitate entry and exit	Short term, high turnover parking at shopping centres
4	Size requirements are specified in AS/NZS 2890.6 (Note 2)		Parking for people with disabilities

Notes:

1 Except for the requirements specified in Clause 1.4 relating to User Classes 1A and 4, the examples of uses are intended to be flexible and allow for progressive improvement both in the ease of manoeuvring into and out of parking spaces, and in leaving and re-entering the vehicle as one progresses up the user class scale from 1 to 3A. The modelling of vehicle manoeuvring into Class 1A spaces shows however, that many drivers may have difficulty driving into and out of such spaces, especially those with vehicles larger than the B85 vehicle. Furthermore, they may have difficulty entering and leaving the vehicle in the narrower spaces. Safety issues associated with delays and congestion caused by manoeuvres into and out of Class 1A spaces in large parking areas should also be taken into account. See also Appendix B, Paragraph B4.8.

2 In preparation, see footnote to Clause 1.2.

Source: Reproduced from AS/NZS 2890.1-2004, Table 1.1

Figure 1 provides the minimum design dimensions of parking bays for each user category shown in Table 1. It provides additional useful design guidance for the practitioner in support of AS/NZS 2890.1, in particular relating to manoeuvring in and out of spaces. It should be noted that a few of these dimensions differ from those given in AS/NZS 2890.1 to reflect the above review. It is noted that the minimum length of a parking bay generally allowed is 5.4 m; however, a length of 5.0 m or less is permitted in New

Zealand and in some Australian jurisdictions under certain circumstances.

Parking bay dimensions for on-street front-in parking angles of 30, 45, 60 and 90 degrees are shown in Figure 2 for each user category defined in Table 1. It should be noted that some of the dimensions given in Figure 2 differ slightly from the minimum dimensions given in AS 2890.5. These dimension changes have been incorporated so as to coincide better with those

dimensions given in AS/NZS 2890.1 and to correct a few other minor inconsistencies.

It is worth noting that the Australian Road Rules do not make reference to parking angles other than 45 (the reverse being 135) and 90 degrees. This situation may present enforcement difficulties in those jurisdictions where 30 and 60 degree parking is used and local laws do not address the issue.

The minimum widths between the barrier line or edge of road / median and the kerb for parking angles of 30, 45, 60 and 90 degrees respectively are also illustrated in *Figure 2*.

It is important to note that the classification given in *Table 1* is not a rigid requirement. For example, a lower user class resulting in narrower parking bays may be required in a CBD and other high land cost locations. It is recommended that a road safety audit or other form of safety assessment should be carried out to determine if the proposed car park design is safe in these cases.

It is also important to note that *Table 1*, *Figure 1* and *Figure 2* do not replace or supersede Table 1.1 and Figure 2.2 of AS/NZS 2890.1-2004, and Table 2.2 and Figures 2.2-2.5 of AS 2890.5-1993. Rather, they are purely proposals presented for the benefit of practitioners and suggested as potential enhancements in any future update of the Standards.

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