PARKING REQUIREMENTS FOR THE CITY OF TSHWANE

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1. Background

Parking is an important and integral part of the transportation system in a metropolitan area. The provision of parking is expensive. The parking rates required for parking at developments should be sufficient, but care should also be taken not to provide too much parking. Insufficient parking, on the other hand, can result in overflow or queuing on the street network and illegal parking on the sidewalks and in the road reserve. A parking policy and parking provision requirements are essential element of any urban transport plan.

Surveys were undertaken by the former Centurion Town Council (CTC) and on an ad hoc basis by the former City Council of Pretoria (CCP). This information was combined and recommended rates were determined for different land uses.

The approach followed was not to obtain statistically reliable data (as it is impossible with the available data), but to:

< obtain a reasonable indication of the parking rates of existing land uses, and
< compare between the parking rates determined with new surveys and the parking rates required in previous studies (some were done several years ago), which are included in the existing documentation.

The existing documents on parking standards, listed below, were used by different councils to determine the number of parking bays needed for several new developments or where the land use changed. If a specific land use was not specified in the Town Planning Scheme of that specific council, some of these documents were used to determine the preferred parking rate to be used.

1. City Council of Pretoria, *Pretoria Town Planning Scheme, 1974, with amendments up to 1 July 1996*.
2. Centurion Town Council, *Centurion Town Planning Scheme, 1992.*
3. Akasia Metropolitan Council, *Akasia Town Planning Scheme*.
4. Department of Transport, *Parking Standards, Second Edition*, November 1985.
5. Institute of Transportation Engineers, *The Parking Handbook for Small Communities,*1994.
6. Institute of Transportation Engineers, *Parking Generation,* September 1987.

7. Highway Research Board, *Parking Principles, Special Report 125,* 1972.
8. Extract from a document received from CCP (Regarding Rezonings), used for some land uses by the City Council of Pretoria.
9. Institute of Transportation Engineers, *Parking Generation*, September 1987.
10. Other parking studies undertaken by the City Council of Pretoria, Transportation Engineering and Roads Department for specific land uses.

The two main reasons why new surveys were undertaken, are:

< there are too few data points available per land use in order to determine a reliable rate, and
< a need was identified for new type of land uses which are the latest trend of development and to determine parking rates for those type of land uses which were not determined previously.

This paper describes the processes and methods used to compile new parking guideline documents for both the CCP and CTC. The documents compiled for these two councils are the:

a) *Guidelines on Parking Requirements for the Pretoria area*, City Council of Pretoria, June 2000.
b) *Parking Guidelines, First Revision*, Centurion Town Council, November 1999.

2. Reliability of Data

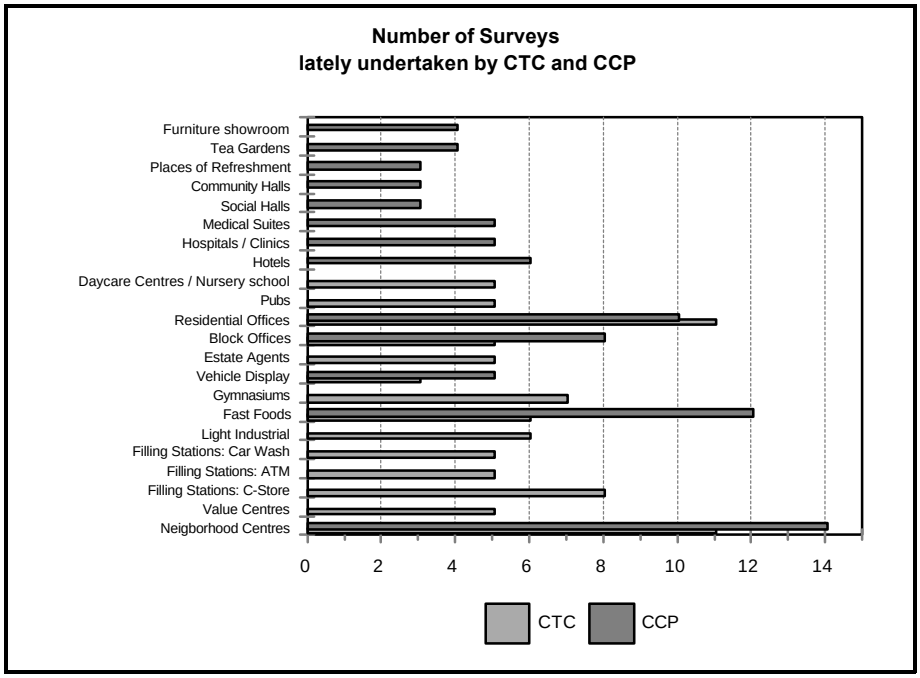
For the surveys which are undertaken to determine parking rates, reliability of data is influenced, *iter alia*, by four aspects, namely:

1) the number of surveys which were undertaken,
2) the compatibility of the data from different surveys,
3) the correctness of the counts, and
4) the unit used to determine the recommended rate.

2.1 The number of surveys undertaken

The number of surveys which were undertaken for the recommended rates, were, in many cases and for most of the existing and latest documents, too few data points to be able to determine a statistically reliable recommended rate, for many of the existing and latest documents. The reason for this is most of the time due to a limited budget available.

The CTC and CCP lately done some surveys for specific land uses. The number of surveys undertaken, is shown in the following graph:



2.2 Compatibility of the data

The compatibility of the data from surveys done for different documents, for specific situations and for different councils, also creates problems, for example:

- the surveys which were undertaken for the same land use with the same character and most probably the same peak time, were done on different times of the day,
- the parking demand was counted in different time intervals, eg. for one survey, the parking demand was determined in 5 or 10 minute intervals, the other in 15 or 20 minute intervals, etc., which make the comparison of data difficult,
- there may be different peak times for the same land use, for example, for restaurants at different locations such as in a restaurant situated in a regional shopping centre or as part of a neighborhood centre,
- the type and character of developments may differ extremely which may have a direct influence on the parking demand, eg. such as sit-down restaurants, take-away restaurants, pub-type restaurants, family-type restaurants, coffee shops, etc.

2.3 The basis of the parking surveys

The parking surveys which were done for specific land uses were not always executed on the same basis, such as if the tenant- and management parking were included or exclude in the surveys. This may cause a discrepancy if the data or recommended rates are to be compared.

For example, when the parking used by the tenants and management at residential offices is included or excluded, or for example when the parking used by the doctors and personnel at medical suites is included or excluded, may even have a 20% to 30% influence on the parking demand.

2.4 The units used to determine the parking rate

The unit used and the correctness of the extent (number) of the unit to determine the recommended parking rate, have a significant influence on the rate. It is very difficult to obtain, for example, the correct gross leasable area (GLA) of a development which already exist. If it could not be obtained from the tenants or the owner of the building, it creates a problem. Even if it could be obtained, it is not always clear if the corridors, public facilities, store rooms, etc. are included or excluded with the area obtained.

The type of unit used, plays a significant role in the recommended parking rate. For example, at two specific pub-type restaurants in Centurion where parking surveys were undertaken, the gross leasable area of the one restaurant is less than that of the other, while the number of chairs of that same restaurant is much more than that of the other. The recommended parking rate based on GLA for these two restaurants will therefore be the opposite of the recommended parking rate based on the number of chairs.

3. Methodology and Land uses investigated

Two different methods were used by the Centurion and Pretoria Councils to compile their latest parking documents (mentioned above). For the CCP, a total of 37 land uses were investigated and for the CTC, a total of 11 land uses. The land uses which were addressed are, *inter alia*, different residential land uses, neighborhood centres, value centres, filling stations, light industries / commercial, fast foods, gymnasiums, vehicle display rooms, estate agents, offices (home offices and block offices), pubs, nursery schools, etc.

3.1 Method used to compile the latest CTC document

For the CTC, parking surveys were undertaken at specific land uses on the peak time of the day during the peak period of the year, as far as it could be determined. The 11 land uses which were surveyed, represent most of the latest proposed developments in the area. A limited number of surveys were undertaken for each land use. The recommended rate was determined for some land uses, but if the range of data points was too wide, it was recommended that additional surveys should be undertaken before a parking rate can be recommended.

3.2 Method used to compile the latest CCP document

The CCP executed several parking studies during the past two years at different land uses. Several other surveys have also been done, but no comprehensive document exist that combine all the data. This new document is a summary and comparison of existing documentation and the recommendation of rates based on previously undertaken surveys and recommended rates in existing documentation. Some recommended rates were based on the data of surveys which were undertaken, and others, where no or limited surveys were available, the recommended rates were based on the recommended rates of existing documentation. The land uses that are included in the CCP report, were obtained from the documentation which were made available by the City Council of Pretoria, as well as other international and national documents used for parking rates in South Africa (mentioned above). The data from the surveys undertaken by CTC was also included in this document.

4. Reduction in Parking Rates

For specific situations, a reduction in the recommended parking rate can be used, such as when:

1) Parking is shared by a mixed land use development and the peak parking demand of the different land uses does not co-incide, or

2) Where it can be showed that the peak parking demand of a development can be accommodated with a reduction in the parking rate as a result of inter alia:

   < a different urban character, socio-economic structure of the population and residential density in the market, or where the influence area is such that it can be proved as not normal,
   < where the car ownership is extremely low,
   < where high utilisation of public transport takes place, etc.

For the situation where mixed land uses and shared parking is applicable, it is proposed that the parking accumulation curves for the specific land uses, be superimposed on each other. The survey point with the highest rates during the peak periods should be used as a guideline. In other words, the peak periods surveyed for each development should be "plotted" on one graph (for the same time and day, eg. Saturday morning or Weekday afternoon) to determine the maximum required parking rate for that specific time and day for the specific combination of land uses. It is important to ensure that the combination of the different days and different peak periods of all the land uses be considered and interpreted with care.

Other aspects which may also be considered when a reduction in parking rate is requested, are:

< the availability of other on-street or off-street parking in the vicinity,
< the price of parking, and
< the extent of traffic congestion on adjacent streets and the peak time of the development versus the peak time of the street network.

5. Recommended Rates

The principle applied in *Parking Standards, Second Edition* of the DoT [(2)], was to use the maximum parking rate observed. This is a conservative approach, as it assumes that the parking of a similar type of development will be the same as the highest rate observed for existing developments. The reason for this conservative approach was that if the parking demand is higher than the supply, it results in illegal and overspilled parking in the road reserve of the adjacent streets.

For the CTC, the 75th percentile value for the peak 15 minute demand interval per peak period for all the survey points was used as the recommended rate. This will imply that 25% of all observed values will be higher than the forecasted values, but only during the peak period(s) of, which may be for as short as 15 minutes. The locality, surrounding area and type of development will also have an influence on the parking demand, and should carefully be investigated and taken into consideration in the application of the recommended rate. The recommended rate (see **Appendix A**) is the minimum rate which should be applied, and more parking should be provided by the developer if possible or if required by the Council.

For the new Pretoria Guidelines on Parking Requirements, the calculation of the recommended parking rate per land use was based on a combination of the surveys undertaken and the "Recommended rates in other documents". The surveys undertaken by the CTC and CCP were compiled in one document, with all the recommended rates obtained from different other parking sources. The 85th percentile value was used to determine a recommended rate. The recommended rates obtained from other documents for the same land use, was also used to determine the final recommended rate. If this new determined 85th percentile value, based on all the surveys which were done for that land use, do not fall within the 95% confidence interval (explained below), or within the 90% confidence interval, the outliers in the data were eliminated and the 85th percentile value was then determined on the data excluding the outliers.

6. Comparison of old and new rates

The list of land uses included in the CCP document, with the range of rates obtained from other documents, as well as the recommended rates from the surveys done for CTC and the recommended rates contained in previous documents, is attached as **Appendix A**.

The 85th percentile value, as well as the recommended rates for some of the surveys undertaken by CTC and CCP, is shown in the following graph. Refer to the attached table in **Appendix A** to see the unit on which the rate is based, such as "rate / 100m²", or "rate / chair", or "rate / child". This graph shows the differences in the recommended rates, even for two "adjacent" council areas, where the character of the areas and developments should almost be the same.

For some land uses, the new parking rates differ extremely from the recommended rates in the existing and previously compiled documents (also see the table in **Appendix A**).

7. Applicability of empirically determined parking rates versus analytical measures

The way that new parking rates were determine in the past, was always to undertake new parking surveys, then to determine either the maximum demand or a percentile value of the maximum interval values of all the survey points, and after that to decide on a recommended rate, which are also influenced by the reliability and correctness of the data.

It should be asked if this is the correct way to determine the parking demand and recommended parking rates. The results if parking rates are determined in an empirical way or analytical way, should be investigated and tested.

The analytical way to determine parking rates, will entail:

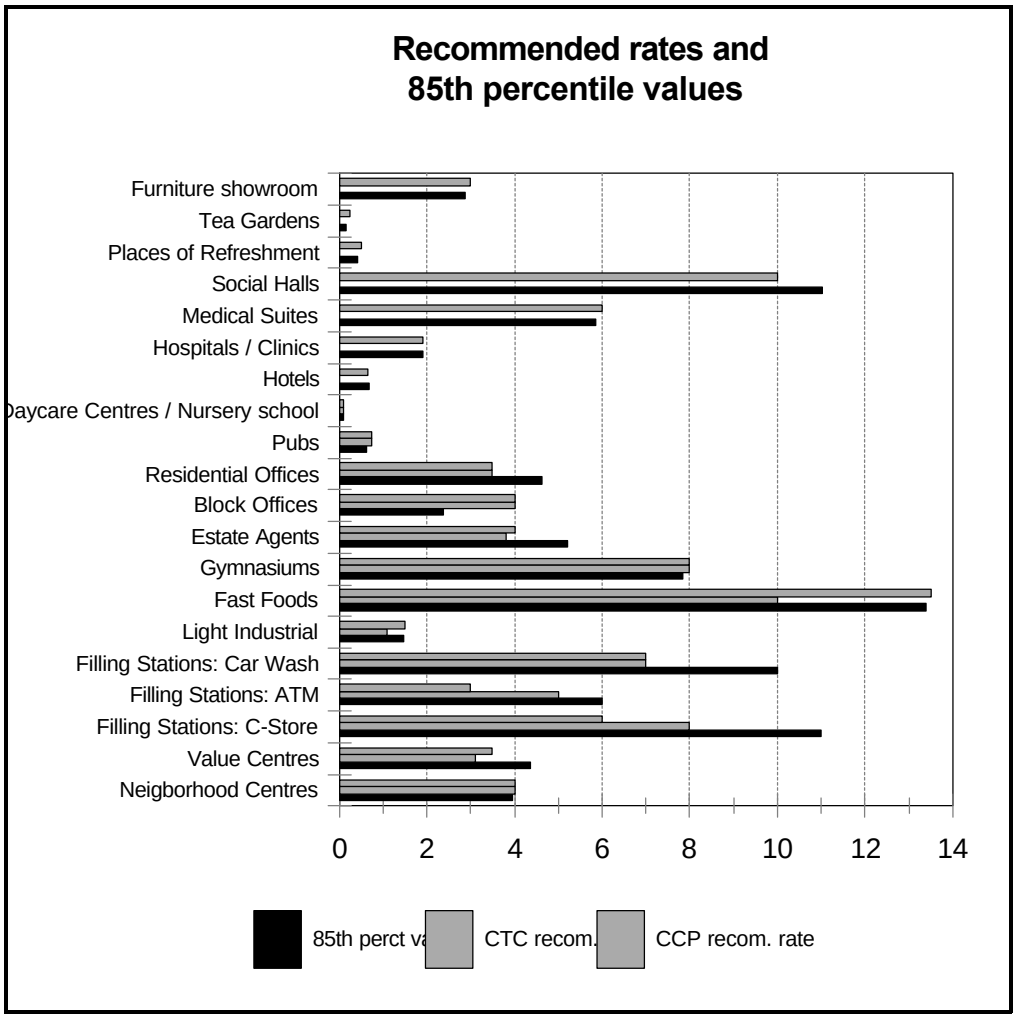
- a unit on which the parking rate should be based, should be decided on for a specific development,
- values must then be calculated in an analytical way based on a unit, say per 100m² GLA or per chair for restaurants in order to determine the recommended rate for that development specifically.

Another way to determine parking rates can also be considered, namely:

< to get a good knowledge and feeling of the parking demand at “similar developments” in practice (based on what happens in the field and not based on the recommended rates stated in existing documentation). Similar developments should have almost the same character, extent, size, surrounding area, etc.,

< to get an average or maximum of the parking demand at these “similar developments”, and

< to use this as the required parking rate for a new development, and not the rates as recommended in a document where different type of developments with different characters are combined.



8. Conclusion

Recommended parking rates which are used by different councils to determine the number of parking bays needed for a new development, are many times based on insufficient data, different approaches to determine the recommended rate, different units used as basis for the determination of the recommended rate, etc.

Recommended parking rates should not be blindly applied. For some developments, if the recommended parking rate of that specific council is not applicable for that specific type of development, the parking rate for a new development should be determined combining:

- a study of the recommended rates in available documents,
- a proper study of the surrounding area,
- consideration of the characteristics of the surveys undertaken to determine the recommended rate,
- consideration of the characteristics of this new development in relation to that of the surveys undertaken,
- the peak hour of the development,
- basis on which the surveys and recommended rate was done, such as if the tenant parking was included or excluded, the unit used for the recommended rate, etc., and
- most important of all, *good engineering judgement* for each situation.

11. References

1. City Council of Pretoria, Guidelines on Parking Requirements for the Pretoria area, June 2000.
2. Centurion Town Council, *Parking Guidelines, First Revision*, November 1999.
3. City Council of Pretoria, *Pretoria Town Planning Scheme, 1974, with amendments up to 1 July 1996*.
4. Centurion Town Council, *Centurion Town Planning Scheme, 1992.*
5. Akasia Metropolitan Council, *Akasia Town Planning Scheme*.
6. Department of Transport, *Parking Standards, Second Edition*, November 1985.
7. Institute of Transportation Engineers, *The Parking Handbook for Small Communities,*1994.
8. Institute of Transportation Engineers, *Parking Generation,* September 1987.
9. Highway Research Board, *Parking Principles, Special Report 125,* 1972.
10. Extract from a document received from CCP (Regarding Rezonings), used for some land uses by the City Council of Pretoria.
11. Institute of Transportation Engineers, *Parking Generation*, September 1987 (for the land uses which were included in the Centurion Town Council Parking Guidelines, First Revision).
12. Other parking studies undertaken by the City Council of Pretoria, Transportation Engineering and Roads Department, namely:
    a) Parking Requirements for Selected Land Uses, June 1997, Louis Roodt, including:
        - Mixed Suburban Offices, Hospitals and Medical Consulting Rooms, Household and Domestic Retail Outlets, Menlyn Motor City.

    l) Parking Requirements for Selected Land Uses, June 1997, Jeffares and Green Incorporated, including:
        - Restaurants, Fast Food Outlets with drive-through facilities, Fast Food Outlets without drive-through facilities, Tea Gardens.

    m) Trip Generation and Parking Requirements for Home Offices, June 1998, AJ Kruger & Partners.

    n) Parking Requirements and Trip Generation: Hotels and Local Convenience Retail, August 1998, Louis Roodt.

    o) Report on Parking Requirements for Selected Land Uses, December 1998, Jeffares and Green Incorporated, including:
        - New Vehicle Showrooms, Furniture Showrooms, Community Halls, Social Halls

Appendix A: Parking Rates

SUMMARY TABLE

Land Use Number	Range of rates		Sample Size		85th percentile value of surveys	RECOMMENDED RATE (for the CTC Parking Requriements Document)	RECOMMENDED RATE (for the CCP Parking Guidelines Document)
	From surveys undertaken	From recommended rates in other documents	Surveys	Documents			
1. Residential 1: Erf of 750m² or smaller	-	3 paved or unpaved bays/erf	0	1	-	-	**3 paved or unpaved bays/erf**
2. Residential 2, 3 or 4	-	1 covered and 1 open bay/unit plus 1 bay per 3 units for visitors	0	1	-	-	**1 covered and 1 open bay/unit plus 1 bay per 3 units for visitors**
3. Flats	-	1 bay/equal or less than 3 bedroom flat, ***or:*** 2 bays/equal or greater than 4 bedroom flat, ***plus:*** 1 bay/3 flats for visitors, or 1 bay/93m² GLA, or 1.2 bays/dwelling unit	0	3	-	-	**1 bay/equal or less than 3 bedroom flat, *or:* 2 bays/equal or greater than 4 bedroom flat, *plus:* 1 bay/3 flats for visitors**
4. Duplex Dwellings	-	1 covered bay/unit with 3 bedrooms or less, ***or:*** 1 covered bay plus 1 uncovered bay/4 bedrooms or more, ***plus:*** 1 bay/3 units for visitors	0	1	-	-	**1 covered bay/unit with 3 bedrooms or less, *or:* 1 covered bay plus 1 uncovered bay/4 bedrooms or more, *plus:* 1 bay/3 units for visitors**
5. Hotels	0.41 - 0.72 bays/unit	1 bay/leasable room plus 6 bays/100m² open floor space, or 0.52 - 0.81 bays/room	6	7	0.67 bays/unit	-	**0.66 bays/leasable room plus 6 bays / 100m² open floor space (excluding reception area)**

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Land Use Number	Range of rates		Sample Size		85th percentile value of surveys	RECOMMENDED RATE (for the CTC Parking Requriements Document)	RECOMMENDED RATE (for the CCP Parking Guidelines Document)
	From surveys undertaken	From recommended rates in other documents	Surveys	Documents			
6. Group Housing	-	1 covered bay/unit with 3 bedrooms or less, or 1 covered bay plus 1 uncovered bay/4 bedrooms or more	0	2	-	-	**1 covered bay/unit with 3 bedrooms or less, or 1 covered bay plus 1 uncovered bay/4 bedrooms or more**
7. Old Age Home	-	1 bay/3 units + 1 bay/3 units for visitors and 1 bay/12 staff, or 1 bay/20 patients + 1 bay/6 beds for visitors and 1 bay/12 beds for staff, or 1 bay/6 beds for patients + 1 bay/6 beds for staff, or 0.27 - 0.28 bays/unit	0	6	-	-	**Use the rates as on detail Land use sheet in Appendix A (from EX), or 0.3 bays/unit**
8. Juvenile House	-	1 bay/(no unit was specified)	0	1	-	-	**1 bay/(no unit was specified)**
9. Guest Houses	-	1 bay/room and 1 for caretaker	0	1	-	-	**1 bay/room and 1 for caretaker**
10. Banks, Building Societies	-	4 bays/100m²	0	2	-	-	**4 bays/100m²**
11. Hospital, Clinics		0.95 - 4.5 bays/bed or 6 bays/100m² medical unit and 1 bay/bed	5	7	1.92 bays/bed plus 4.29 bays/100m² medical practitioner	-	**1.9 bays/bed plus 4.3 bays/medical practitioner**
12. Medical Suites		5 - 6 bays/practitioner or 6 bays/100m² GLA or 4.11 bays/1000 Gross ft²	5	6	5.85 bays/practitioner or 4.29 bays/100m² of medical rooms	-	**6 bays/medical practitioner**

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	From surveys undertaken	From recommended rates in other documents	Surveys	Documents			
13. Schools (Primary, Secondary)	-	1 bay/class room and or office	0	3	-	-	**1 bay/class room and or office**
14. Nursery School (Daycare Centres)		0.06 - 0.11 bays/child or 1 bay/class room	5	4	0.11 bay/child	**0.1 bay/child plus area for on- and off-loading**	**0.1 bay/child plus area for on- and off-loading**
15. Lecture Hall	-	1 bay/4 seats	0	2	-	-	**0.25 bays/seat**
16. Places of Public Worship	-	1 bay/4.5 - 5 seats or 0.36 - 0.43 bays/person	0	6	-	-	**Subject to situation and motivation**
17. Social Halls	1 bay/seat or 10.6 - 11.1 bays/100m²	1 bay/4 seats or 5 - 20 bays per 100m²	3	3	11.03 bays/100m²	-	**Depending on the usage of the facility: min 10 bays/100m² and max 20 bays/100m²**
18. Community Halls	1.17 - 19.44 bays/100m² or 0.1 - 0.21 bays/seat	10 bays/100m² GLA	3	2	Data not reliable (insufficient)	-	**Data not sufficient (3 data points, variate too much)**
19. Places of Refreshment / Restaurants	0.21 bays/seat - 0.49 bays/seat 1.8 bays/100m² - 18.4 bays/100m²	0.5 bays/seat 9.8 - 17.1 bays/100m²	33	32	0.41 bays/seat 14.86 bays/100m²	-	**0.5 bays/seat The data based on 100m² is not sufficient (3 data points, variate too much)**
20. Fast Foods	0.19 - 1.15 bays/seat or 5 - 14.8 bays/100m² (1.15 bays/seat is an outlier and was ignored in calculations)	0.55 bays/seat or 10 - 15.22 bays/100m²	612	14	0.32 bays/seat 13.39 bays/100m²	**10 bays / 100m²**	**0.32 bays/seat OR 13.5 bays/100m²**
21. Tea Gardens	0.06 - 0.18 bays/seat or 3 - 10.1 bays/100m²	0.25 bays/seat	43	1 -	0.17 bays/seat 9.98 bays/100m²	-	**0.25 bays/seat**

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	From surveys undertaken	From recommended rates in other documents	Surveys	Documents			
22. Pubs (Public House)	0.13 - 0.85 bays/seat or 18.4 bays/100m²	0.75 bays/seat or 6 - 16 bays/100m²	61	12	0.64 bays/seat	**1,5 bay / 2 chairs**	**0.75 bays/seat**
23. Retail / Shops	-	5 - 7 bays/100m²	0	7	-	-	**6 to 7 bays/100m²** **(depending on extent and area)**
24. Neighbourhood Centres / Local Convenience	1.1 - 7.9 bays/100m²	4 - 7 bays/100m²	25	6	3.96 bays/100m²	**4 bays/100m²**	**4 bays/100m²**
25. Value Centres	1.1 - 6.1 bays/100m²	3.1 - 6.5 bays/100m²	5	3	4.36 bays/100m²	**3.1 bays/100m²**	**3.5 bays/100m²**
26. Warehouse	-	1 bay/100m²	0	2	-	-	**1 bay/100m²**
27. Furniture Showroom	1.52 - 3.12 bays/100m²	2 bays/100m²	4	1	2.87 bays/100m²	-	**3 bays/100m²**
28. Filling Stations	5 - 11 bays/convenience store 3 - 6 bays/ATM facility 4 - 10 bays/car wash	8 bays/convenience store 5 bays/ATM facility 4 - 7 bays/car wash	8 C-stores 5 ATM facility 5 car wash	1 C-Store 1 ATM facility 2 car wash	11 bays/C-Store 6 bays/ATM 10 bays/car wash	**8 bays/ C-store**, **5 bays/ATM facility**, **7 parking bays/car wash**	**6 bays/100m² leasable area in the C-store,** **3 bays/ATM facility,** **7 parking bays/car wash**
29. Industries	-	1 - 2 bays/100m² or 1.48-1.55 bays/1000 ft²	0	22	-	-	**1.5 bays/100m²**
30. Light Industries / Commercial	0.54 - 2.4 bays/100m²	1 - 6 bays/100m² or 1 bay/5 workers	6	91	1.49 bays/100m²	**1.1 bays/100m²**	**1.5 bays/100m²**
31. Gymnasiums	4.2 - 9 bays/100m²	3.89 - 10 bays/100m²	7	4	7.83 bays/100m²	**8 bays/100m²**	**8 bays/100m²** **(depending on the type of gym)**
32. Putt-putt Courts	-	1 bay/hole	0	1	-	-	**1 bay/hole**

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	From surveys undertaken	From recommended rates in other documents	Surveys	Documents			
33. Vehicle Display Rooms	0.2 - 9.62 bays/100m²	1 - 6 bays/100m² or 2 bays/100m² plus 4 bays/100m² office space	8	5	7.84 bays/100m²	**1 bay / 100m²**	**Cannot be determined. Additional surveys needed.**
34. Motor Workshops	-	2 - 6 bays/working bay or 4 bays/service point or 2 bays/100m² sales area or 4 bays/working bay + 2 bays/100m² spares and sales	0	5	-	-	**Cannot be determined. Additional surveys needed.**
35. Estate Agents	1.6 - 7.3 bays/100m²	1.2 - 3.8 bays/100m²	5	3	5.2 bays/100m²	**3.8 bays/100m²**	**4 bays/100m²**
36. Office: Block (General) Offices	1.1 - 3.04 bays/100m²	2.5 - 4 bays/100m²	13	8	2.39 bays/100m²	**4 bays/100m²**	**4 bays/100m²**
37. Residential Offices	0.5 - 1.2 bays/employee or 0.8 - 3.5 bays/100m²	0.8 bays/employee or 2.5 - 3.5 bays/100m²	516	16	1 bay/employee or 4.62 bays/100m²	**3.5 bays/100m²**	**3.5 bays/100m²**

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CURRICULUM VITAE - ELMARIE DU TOIT

Full Name	**ELIZABETH MARIA DU TOIT (ELMARIE)**
Specialisation	Traffic Engineering and Transportation Planning, Statistics and Project Management
Years of Experience	10

Elmarie du Toit has a BSc Degree in Mathematical Statistics, University of Pretoria, obtained in 1990, and obtained her BSc (Hon) in Transportation Planning, Faculty of Engineering, University of Pretoria, 1998.

Key experience

In February 2000, she joined Innovative Traffic Solutions (pty) Ltd as a director of the firm. She became responsible for the managing of specific company, personnel and administrative functions, as well as for the execution and management of major projects. Extensive experience was gained in the Outdoor Advertising field with the appointment by the South African National Roads Agency Ltd, for the Evaluation of Applications for Outdoor Advertising along National Roads in Gauteng, Mpumalanga, North West and Northern Province.

She is responsible for and involved in traffic engineering and transportation planning projects for different authorities and private companies all over the country and internationally. Projects she were involved in and responsible for included traffic impact studies, access management plans, road master plans, development of parking guidelines, implementation of parking control systems and other parking related projects. It also included the development of signage and application for signage, street closures, solution of access problems to developments, filling station development and feasibility studies. Before and after studies for the implementation of traffic calming measures, determination of need for public transport facilities, traffic forecasts for the construction of a main road in Mozambique and a feasibility study for the deepening of Walvis Bay harbour were also part of the projects undertaken.

From July 1995 to January1997 at BKS (Pty) Ltd, she was involved in the formulation of transport policy documents and incorporation of comments and submissions on related documents; and the compilation and finalisation of transport status quo documents and transport plans for the Highveld District Council, Lowveld District Council, Eastern Gauteng Services Council and the Greater Pretoria Metropolitan Council. She was intensively involved in the development of co-ordination and liaison structures to address the role and responsibilities of provincial and local government in public transport for the Eastern Gauteng Services Council and the Greater Pretoria Metropolitan Council. The statistical analysis of passenger attitudinal and public transport demand surveys for the Highveld District Council, Lowveld District Council, Eastern Gauteng Services Council and the Greater Pretoria Metropolitan Council was her responsibility. She was also involved in the planning, design and implementation of various cemetery development projects. In addition, Elmarie was responsible for project administration, project co-ordination and act as assistant project manager and project leader for design and implementation projects, passenger transport projects and policy formulation projects. She also acted as contact person and project manager for the sub-consultants involved. She also have experience in various research projects such as the analyses of the current transport situation (status quo), interviews and meetings with the officials and all other stakeholders, research and literature studies, identifying of alternative solutions, the composition of reports as well as the co-ordination and management of the projects and the project teams of several projects. Specific experience was gained in health services in the East Rand, the planning and design of cemeteries in the East Rand, as well as the design and development of a computerised information system for cemeteries.