Policy for Engineering Service Contributions (ESC) for Roads and Stormwater

and

Methodology for the Calculation of Engineering Service Contributions for Road and Storm-Water Infrastructure

City of Johannesburg

(20 January 2014)

Joburg

a world class African city

1. Introduction

The City of Johannesburg's **Policy for Engineering Service Contributions for Roads and Stormwater as approved by Council on 30 January 2014 item 20,** as set out in this document. This new policy replaces the formula for levying a Bulk Services Contribution previously developed in accordance with the Administrators Guidelines, Town Planning and Township Ordinance 1986.

The policy deals with financial or equivalent contributions that must be made by applicants (developers) who are granted enhanced land use rights. This Engineering Service Contributions (ESC) is required to fund the "external" infrastructure that is necessary for the municipality to provide to mitigate the increased load on municipal services as a result of the proposed development. The contributions are also known as bulk service contributions, or payments for the provision of engineering services.

The policy was based on a November 2008 **Policy for Engineering Service Contributions for Roads and Stormwater** report considered by the Mayoral Committee on 2011/07/21. It includes amendments made in response to public comment received from August to October 2011. It has also been updated to bring it in line with the **South African Engineering Service Contribution Manual for Municipal Road Infrastructure**, COTO TMH15, September 2012.

This policy deals with theprinciples, legality, determination, application, utilization and updating of ESC. A separate document, **ESC Roads and Stormwater Implementation Manual**, is availablewhich explains how to calculate the contribution due.

2. Description of Terms

2.1. **Applicant**, in legislation, is the person making the application for a change in land use rights. The applicant is often referred to as the developer and the two words are used interchangeably in this policy.

2.2. **Engineering Services** determined in legislation are water, sewerage, electricity, roads and stormwater drainage. This policy applies only to the calculation and

application of engineering service contributions for the latter two, i.e. roads and stormwater.

2.3. **Engineering service contributions** are financial or equivalent contributions made by the developer towards the capital and related cost of the City of Johannesburg of providing external services.

2.4. **External Engineering Services** are the responsibility of the City. They include services outside the borders of the development, Class 1, 2 and 3 arterial roads which pass through the development, and any widening or upgrading of an internal service required by the City over and above the minimum needed to serve the development.

2.5. **Internal Engineering Services** are the responsibility of the developer. These services are required for the "exclusive" use of the development, e.g. the Class 4, 5 and 6 "access" streets serving erven within the development. Internal services are usually handed over to the municipality (free of charge) when the development is completedand therefore must be provided to municipal standards. However, any requirement to provide land or services over and above the minimum needed for the development is considered external.

2.6. **Master plan** indicates the development framework and the mobility road network required to serve the region or area.

2.7. **Road Services** that are provided by the contribution include any or all of the following:

- Construction related costs, e.g. site establishment and traffic accommodation
- Earthworks
- Grade separation
- Guardrails and safety devices
- Kerbs
- Land (road reserve or servitude)
- Landscaping
- New pavement (roadway)
- Non-Motorized Transport facilities such as paved sidewalks and bicycle lanes
- On-street public transport facilities
- Professional fees, including environmental assessments
- Preparation of a transportation master plan for the affected area.
- Stormwater drainage within the road reserve
- Street lighting
- Strengthening of pavement (roadway)
- Traffic signals, signs and markings

2.8. **Stormwater Services** that need to be funded include any or all of the following:

- Land (servitudes) for bulk stormwater
- Pipes, drains, culverts, canals and related structures.

3. Scope

This policy applies to the calculation and application of engineering services contributions for roads and stormwater.The policy applies in all instances where enhanced land rights are granted, including when the City of Johannesburg oranother government authority is itself the developer.

The policy excludes the cost of:

(a) roads that are owned by national and provincial spheres of government;
(b) maintenance and operations; and
(c) off-street public transport facilities.

4. Policy Principles

The policy complies with all legal, financial and administrative requirements of the Council.

It is based on the following principles:

- **Justified.** The approval of enhanced land use rights, whether new townships or rezonings, will result in the requirement for new or upgraded infrastructure, and/or create an additional load on existing infrastructure and services. It is therefore justified that the beneficiary of the enhanced rights contributes towards the capital cost of those services used. This additional load will be determinedon the basis that existing communities should not have to subsidize new townships by allowing free use of previously provided services.
- **Limited.** The contribution a developer should make is limited to the expected impact on the infrastructure and services. The developer is not asked to contribute to backlog or to provide services in excess of the impact the land use change will have, hence the new township does not have to subsidize existing communities.
- **Full Cost Recovery.** In line with the above two principles, the policy is based on full cost recovery. The impact of the additional demand is calculated, and the full cost of supply to meet the demand is the contribution thus required.

- **Consistent.** The application of the policy is uniform and standardized throughout the City of Johannesburg and has been aligned with National Standards
- **Equity.** All developers are treated equally. The impact is determined based on a fixed set of factors which are predetermined and set for each particular land use and size.
- **Certainty.** Applicants know beforehand what the ESC will be and can build that cost into their viability calculations before making the application.
- **Defendable.** The policy is based on sound engineering principles, has been the subject of extensive research and consultation, is valid in law, is aligned with national standards and is therefore defendable.
- **Efficiency.**The policy is transparent, easily checked and easily applied. There are no extra or hidden costs involved in implementing the policy,to either theapplicant or the Council.

5. Applicability

The Engineering Service Contribution will be uniformly applied based on this policy and the formula described below. The Contribution applies whenever a land use change is granted, regardless of the legislation or method used by the applicant to apply for the change.

6. Determination of the Contribution

6.1. In determining the contribution for roads, the following formula is used:

ESC roads = (new – existing) Trips * Distance / Lane Capacity * Cost of a lane.

Added to this is a contribution towards the strength component if the road must be strengthened due to heavy vehicles generated by the development; plus a proportion of the cost if a boundary road (i.e. an access street (Class 4 and 5) which is not an internal street) is to be provided on the boundary of thedevelopment.

6.2. In applying the formula, the following is relevant:

6.2.1. **Trips**: The number of trips is determined by multiplying the proposed development size and type by the trip generation rate, less any existing land use rights on the site, multiplied by that trip generation rate. The trip generation rates are based on Average Annual Daily Traffic converted back to an equivalent hourly rate to account for the total impact on the road network and not merely the impact during peak hours. The trip generation rates are provided in TMH17 **South African Trip Data Manual**, September 2012

(a copy of which is attached to the Implementation Manual). These are the latest and most accurate trip generation rates available. This policy is based on these national rates, which have been adjusted to local circumstances as provided for in the policy. The City will review these rates from time to time.

6.2.2.**Distance** is the distance travelled on City of Johannesburg owned mobility roads (Class 1, 2 and 3). The distance excludes travel on access streets (Class 4 and 5) as these streets are provided as internal streets at no cost to the City. The distance also excludes national and provincial roads, as these are provided by other authorities at no cost to the City. The distance on mobility roads is divided by two to account for the fact that the origin of the trip will pay for half the trip and the destination for the other half.The distance is provided in TMH17 **South African Trip Data Manual**, September 2012.

6.2.3.**Lane capacity** is the service flow rate (veh/hr/lane). This figure is provided in TMH17 **South African Trip Data Manual**, September 2012.

6.2.4. **Cost per lane** is the cost of providing the land and constructing one lane kilometre of City of Johannesburg mobility arterial road. The cost is comprehensive providing for all the road services defined in 2.5 above. Again these figures are provided in TMH17 **South African Trip Data Manual**, September 2012.

7. Applyingthe Engineering Services Contribution

7.1. The municipality is responsible for providing a master plan to applicants indicating the development framework and the arterial road network required to serve the region or area. If the municipality is not able to provide a master plan for the area, the applicant can offer to pay for the master plan and any modelling required. This master plan is to be prepared under the direction and to the satisfaction of the municipality;

7.2. The following process must be followed by applicants:

7.2.1. As part of the application, the applicant must indicate all new roads and road upgradings required,whether they comply with the master plan for the area,which roads are internal, boundary or external and the road authority (municipal, provincial, national or private), to the satisfaction of the municipality;

7.2.2. The applicant will be given the opportunity to provide the external and boundary road upgradings indicated at his/her cost that fall within City of Joburg's responsibility. Improvements on bordering municipal, provincial or national roads, should be agreed by those authorities. This cost can include land, professional fees, and doing the construction itself;

7.2.3. The City can, in its sole discretion, accept the offer(s) above and agree to offset the costs incurred by the developer on external services against the ESC. The costs offset must be proven actual costs incurred by the applicant.

7.2.4. In the event that the applicant offers to construct services on roads not owned by the City of Johannesburg but owned by bordering municipal, provincial or national road authorities and the City of Johannesburg is in favour of such construction because it is in the interests of the community, then there must be an agreement with the relevant authority in terms of inter-governmental co-operation legislation and may grant the applicant a rebate on the contribution required up to the value of the construction undertaken, but not exceeding the Engineering Service Contributions for Roads and Stormwater;

7.2.5. The City will favour applications by the developer to provide the required "external" infrastructure and will not unreasonably withhold permission.

In the event that the City agrees to the developer providing the infrastructure (and master plan if applicable), one of two events can occur:

i. If the cost to the applicant is less than the ESC, the balance of the ESC must be paid to the City of Johannesburg;

ii. If the cost to the applicant equals or exceeds the ESC, the applicant can decide:
    a) to absorb the cost in the interests of the development;
    b) to only provide infrastructure to the value of the ESC, in which case the City may have to refuse the application if it is to the detriment of existing developments;

The agreement will be recorded in the Engineering Services Agreement.

8. Utilizing the Engineering Services Contribution (ESC)

The ESC for roads and stormwater will be used for providing roads and stormwater infrastructure as defined in this policy and not for any other purpose. Contributions paid to the Municipality will be transferred into JRA's *Road and Stormwater Contribution Account* which has been established for this purpose.

The ESC will be used where the need is greatest, considering:

1) The cost to the applicant for undertaking the master plan on behalf of the Municipality, if applicable;
2) The cost of land provided by the applicant for external roads and stormwater;

3) The cost to the applicant of increasing the size of internal roads and stormwater to serve other developments at the behest of the municipality;
4) The cost to the applicant of providing external services.

Funds in the *Contribution Account* will be utilized in the impacted area of the development, considering:

1) contributions received for specific roads, such as boundary roads;
2) the costs of increasing the size of internal services where the Municipality has instructed the applicant to do so;
3) the cost over and above the ESC spent by the applicant on external roads where an Engineering Services Agreement has made provision for this amount to roll over into another associated development ;

9. Annual Updating

The tariff increase will be updated annually, using the consumer price and civil engineering indices published by Stats SA. In addition, the formula and parameter file data should be reviewed periodically and amended if conditions have changed.

Parameters for the Calculation of Engineering Service Contributions for Roads

1 Jul 2013 to 30 Jun 2014

City of Johannesburg

ESC Parameter spreadsheets

ESC Parameter spreadsheet must be placed in the folder containing the ESC calculation spreadsheets
The parameter spreadsheet must be named ESCRoadsParmYYYY.Xls (or Xlsx)
YYYY Is the financial year. The financial year starts on 1 July YYYY and ends on 30 June YYYY+1

Spreadsheet Based On:

South African Engineering Service Contribution Manual for Municipal Road Infrastructure
South African Trip Data Manual

Land Uses and Codes

		Land Use Size Units	
		Size	Base
	Land Use	**Units**	**Size**
100	**Industrial**		
110	Service Industry	sqm GLA	100
120	Heavy industry/manufacturing	sqm GLA	100
121	Mining	Employees	1
130	Industrial Area (Park)	sqm GLA	100
140	Manufacturing	sqm GLA	100
150	Warehousing and Distribution	sqm GLA	100
151	Mini-Warehousing	sqm GLA	100
200	**Residential**		
210	Single Dwelling Units	D/Unit	1
220	Apartments and Flats	D/Unit	1
225	Student Apartments and Flats	D/Unit	1
231	Townhouses (Simplexes and Duple›	D/Unit	1
232	Multi-Level Townhouses	D/Unit	1
251	Retirement Village	D/Unit	1
254	Old-Age Home	D/Unit	1
260	Recreational Homes	D/Unit	1
300	**Lodging**		
310	Hotel, Residential	Room	1
330	Hotel, Resort	Room	1
350	Guest House	Room	1
400	**Recreational and Sport**		
430	Golf Course	Course	1
473	Casino	sqm GLA	100
480	Amusement Park	ha	1
488	Sport Stadium	Seat	1000
492	Health and Fitness Centre	sqm GLA	100
500	**Institutional**		
520	Public Primary School	Student	1
530	Public Secondary School	Student	1
536	Private School	Student	1
550	University / College	Student	1
560	Places of Public Worship (Weekend	Seat	1
561	Places of Public Worship (Weekday	Seat	1
565	Pre-School (Day Care Centre)	Student	1
566	Cemetery	Ha	1
600	**Medical**		
611	Public Hospital	Bed	1
612	Private Hospital	sqm GLA	100
620	Nursing Home	Bed	1
630	Medical Clinic	sqm GLA	100
700	**Office**		
710	Offices	sqm GLA	100
713	Home offices and undertakings	House	1
720	Medical consulting rooms	sqm GLA	100
770	Business Centre (Park)	sqm GLA	100
780	Conference Centre	Seat	1
800	**Retail**		
812	Building Materials	sqm GLA	100
816	Hardware and Paint Store	sqm GLA	100
817	Nursery (Garden Centre)	sqm GLA	101
820	Shopping Centre	sqm GLA	100
830	Bulk Trade Centre	sqm GLA	100
841	Motor Dealership	sqm GLA	100
890	Furniture Store	sqm GLA	100

900	Services		
931	Restaurant, Quality (Sit-down)	sqm GLA	100
932	Restaurant, Family (Sit-down)	sqm GLA	100
933	Fast Food	sqm GLA	100
946	Filling Station	Station	1
950	Vehicle Fitment Centre	sqm GLA	100

Land Values
1 Jul 2013 to 30 Jun 2014

Escalation Factors

Description	Date	CPI (I_{PC})	Esc Factor I_K	
Escalation adjustment	2013	119.0		Land value escalation based on the
Land-value estimation	2007	89.8	1.325	Consumer Price Index

Land Values No and Region	Estimated Value/ha	Escalated Value/ha	Class 1-3 road costs Cost/km	Veh-km/hr	Boundary road cost/km Class 4	Class 5	Trip length Adj factor F_T
	Road Reserve Widths	Veh-km/hr	32	4128	20	16	
1 Region 1	R 1,000,000	R 1,325,000	R 4,240,000	R 1,027	R 2,650,000	R 2,120,000	100.00%
2 Region 2	R 1,000,000	R 1,325,000	R 4,240,000	R 1,027	R 2,650,000	R 2,120,000	100.00%
3 Region 3	R 1,000,000	R 1,325,000	R 4,240,000	R 1,027	R 2,650,000	R 2,120,000	100.00%
4 Region 4	R 1,000,000	R 1,325,000	R 4,240,000	R 1,027	R 2,650,000	R 2,120,000	100.00%
5 Region 5	R 1,000,000	R 1,325,000	R 4,240,000	R 1,027	R 2,650,000	R 2,120,000	100.00%
6 Region 6	R 1,000,000	R 1,325,000	R 4,240,000	R 1,027	R 2,650,000	R 2,120,000	100.00%
7 Region 7	R 1,000,000	R 1,325,000	R 4,240,000	R 1,027	R 2,650,000	R 2,120,000	100.00%

Note: Land values are determined for farm land with development potential

Construction Cost Rates
1 Jul 2013 to 30 Jun 2014

Costing Parameters - Class 3 roads

Contribution Component	Veh-km/hr E80-km/day	Estimated cost per km	Calculated Esc Factor I_K	Escalated cost per km	Unit Cost Rate
Capacity Component per Veh-km/hr	4128	R 11,542,024	1.248	R 14,404,446	R 3,489
Strength Component per E80-km/day	3044	R 1,501,028	1.248	R 1,873,283	R 615

Costing Parameters - Boundary Roads and Stormwater

Boundary road class	Estimated cost per km	Calculated Esc Factor I_K	Escalated cost per km	Cost Rate per km (m^3)
Class 4 Boundary Roads	R 4,785,317	1.248	R 5,972,076	R 5,972,076
Class 5 Boundary Roads	R 3,457,608	1.248	R 4,315,095	R 4,315,095
Stormwater (1200mm stormwater pipe, 7 m^3/sec)	R 1,500,000	1.248	R 1,872,000	R 267,429

Escalation Factors

Proportion X_{PP} subject to escalation	Labour X_{PL}	Materials X_{PM}	Diesel X_{PF}	Plant X_{PP}
0.85	0.30	0.30	0.05	0.35

CPI and Production Price Indices (Average for year)

Description	Date	CPI (I_{PC})	Materials (I_{PM})	Diesel (I_{PF})	Plant (I_{PP})
Escalation adjustment	2013	119.0	221.2	396.8	188.4
Road construction cost estimation	2007	89.8	176.8	246.3	150.5

Information Sources: Consumer and Production Price In

Statistics published by: Statistics South Africa

Consumer Price Indices (CPI) published in Statistical Releases P0141
Average for the country
Production Price Indices published in Statistical Releases P0142.1
Materials (Civil Engineering Industry)
Fuel - Diesel Oil (Average for country)
Plant (Civil Engineering)
Web: http://www.statssa.gov.za/

Information is also made available by:

The South African Federation of Civil Engineering Contractors
Web: http://www.safcec.org.za/

Base Road Construction Cost Rates

Year estimated: 2007

Class 3 Roads - Capacity Component

Based on a four-lane Class 3 road with 500m intersection spacing

Description	Unit	Rate (R/Unit)	Quantity (Units)	Cost (Vat Excl)
Accommodation of traffic	Per km Road	R 150,000	1	R 150,000
Earthworks	Per m² Pavement	R 40	17900	R 716,000
Pavement (3 000 000 E80 Design)				
Wearing Course	Per m² Pavement	R 95	17900	R 1,700,500
Base Course	Per m² Pavement	R 65	17900	R 1,163,500
Subbase	Per m² Pavement	R 40	19900	R 796,000
Subgrade	Per m² Pavement	R 20	19900	R 398,000
Roadbed	Per m² Pavement	R 7	19900	R 139,300
Subtotal for pavements (3 000 000 E80 Design)				R 4,197,300
Subtract strength component for 3 000 000 E80s				-R 341,143
Kerbs	Per m Kerb	R 130	3920	R 509,600
Sidewalk	Per m² sidewalk	R 130	2940	R 382,200
Guard rails and other safety devices	Per km Road	R 30,000	1	R 30,000
Stormwater drainage (road only)	Per km Road	R 1,150,000	1	R 1,150,000
Public transport facilities	Per facility	R 120,000	4	R 480,000
Grade separation	Per interchange	R 30,000,000	0.005	R 150,000
Landscaping, finishing off and fencing	Per km Road	R 50,000	1	R 50,000
Road signs	Per km Road	R 150,000	1	R 150,000
Traffic signals	Per signal installation	R 300,000	1.5	R 450,000
Street lighting	Per km Road	R 550,000	1	R 550,000
Other items	Per km Road	R 120,000	1	R 120,000
Subtotal				**R 8,743,957**
Preliminary and general items	% of total cost		10%	R 874,396
Professional services and supervision	% of total cost		20%	R 1,923,671
Total construction cost per 1 km of road				**R 11,542,024**

Class 3 Roads - Strength Component

Based on a four-lane Class 3 road with 500m intersection spacing

Description	Unit	Rate (R/Unit)	Quantity (Units)	Cost (Vat Excl)
Pavement (10 000 000 E80 Design)				
Wearing Course	Per m² Pavement	R 95	17900	R 1,700,500
Base Course	Per m² Pavement	R 65	17900	R 1,163,500
Subbase, Upper	Per m² Pavement	R 40	19900	R 796,000
Subbase, Lower	Per m² Pavement	R 40	19900	R 796,000
Subgrade	Per m² Pavement	R 20	19900	R 398,000
Roadbed	Per m² Pavement	R 7	19900	R 139,300
Subtotal for pavements (10 000 000 E80 Design)				R 4,993,300
Additional for strength component for 7 000 000 E80s				R 796,000
Add strength component for 3 000 000 E80s				R 341,143
Additional for strength component for 10 000 000 E80s				**R 1,137,143**
Preliminary and general items	% of total cost		10%	R 113,714
Professional services and supervision	% of total cost		20%	R 250,171
Total strength component cost per 1 km of road for 10 000 000 E80s				**R 1,501,028**

Base Road Construction Cost Rates

Year estimated: 2007

Class 4 Boundary Roads

Based on two-lane road with 9.0m wide road widths

Description	Unit	Rate (R/Unit)	Quantity (Units)	Cost (Vat Excl)
Accommodation of traffic	Per km Road	R 25,000	1	R 25,000
Earthworks	Per m² Pavement	R 35	8820	R 308,700
Pavement				
Wearing Course	Per m² Pavement	R 50	8820	R 441,000
Base Course	Per m² Pavement	R 45	8820	R 396,900
Subbase	Per m² Pavement	R 40	9820	R 392,800
Subgrade	Per m² Pavement	R 20	9820	R 196,400
Roadbed	Per m² Pavement	R 7	9820	R 68,740
Subtotal for pavements				R 1,495,840
Kerbs	Per m Kerb	R 130	1940	R 252,200
Sidewalk	Per m² sidewalk	R 130	1450	R 188,500
Guard rails and other safety devices	Per km Road	R 5,000	1	R 5,000
Stormwater drainage (road only)	Per km Road	R 800,000	1	R 800,000
Public transport facilities	Per facility	R 120,000	0.25	R 30,000
Grade separation	Per interchange	R 30,000,000	0.000	R 0
Landscaping, finishing off and fencing	Per km Road	R 20,000	1	R 20,000
Road signs	Per km Road	R 25,000	1	R 25,000
Traffic signals	Per signal installation	R 300,000	0.25	R 75,000
Street lighting	Per km Road	R 300,000	1	R 300,000
Other items	Per km Road	R 100,000	1	R 100,000
Subtotal				**R 3,625,240**
Preliminary and general items	% of total cost		10%	R 362,524
Professional fees	% of total cost		20%	R 797,553
Total road construction cost per 1 km of road				**R 4,785,317**

Class 5 Boundary Roads

Based on two-lane road with 7.0m wide road widths

Description	Unit	Rate (R/Unit)	Quantity (Units)	Cost (Vat Excl)
Accommodation of traffic	Per km Road	R 25,000	1	R 25,000
Earthworks	Per m² Pavement	R 20	6850	R 137,000
Pavement				
Wearing Course	Per m² Pavement	R 50	6850	R 342,500
Base Course	Per m² Pavement	R 45	6850	R 308,250
Subbase	Per m² Pavement	R 40	7850	R 314,000
Subgrade	Per m² Pavement	R 20	7850	R 157,000
Roadbed	Per m² Pavement	R 7.00	7850	R 54,950
Subtotal for pavements				R 1,176,700
Kerbs	Per m Kerb	R 130	1940	R 252,200
Sidewalk	Per m² sidewalk	R 130	1450	R 188,500
Guard rails and other safety devices	Per km Road	R 0	1	R 0
Stormwater drainage (road only)	Per km Road	R 500,000	1	R 500,000
Public transport facilities	Per facility	R 120,000	0	R 0
Grade separation	Per interchange	R 30,000,000	0.000	R 0
Landscaping, finishing off and fencing	Per km Road	R 20,000	1	R 20,000
Road signs	Per km Road	R 20,000	1	R 20,000
Traffic signals	Per signal installation	R 300,000	0.00	R 0
Street lighting	Per km Road	R 250,000	1	R 250,000
Other items	Per km Road	R 50,000	1	R 50,000
Subtotal				**R 2,619,400**
Preliminary and general items	% of total cost		10%	R 261,940
Professional fees	% of total cost		20%	R 576,268
Total road construction cost per 1 km of road				**R 3,457,608**

Table 3.1: Daily Trip Generation Rates and Parameters

	Land Use	Size Units	Daily Trip rate $AADT_D$	Peaking Factor F_{QD}	Hourly Trip rate $F_{QD}.AADT_D$	Percent Heavy P_{HD}	E80 Axles Per HV E_{HD}	Size Adjustment 1+A/(1+sqm Size/B) Factor A	Factor B
100	**Industrial**								
110	Service Industry	00 sqm GLA	6.00	0.150	0.90	10%	1.34		
120	Heavy industry/manufacturing	00 sqm GLA	1.25	0.150	0.19	10%	2.35		
121	Mining	Employees	0.65	0.150	0.10	10%	2.35		
130	Industrial Area (Park)	00 sqm GLA	6.00	0.150	0.90	10%	2.35		
140	Manufacturing	00 sqm GLA	2.00	0.250	0.50	10%	2.35		
150	Warehousing and Distribution	00 sqm GLA	3.00	0.140	0.42	10%	2.35		
151	Mini-Warehousing	00 sqm GLA	2.50	0.100	0.25				
200	**Residential**								
210	Single Dwelling Units	1 D/Unit	4.00	0.225	0.90				
220	Apartments and Flats	1 D/Unit	2.75	0.225	0.62				
225	Student Apartments and Flats	1 D/Unit	1.25	0.225	0.28				
231	Townhouses (Simplexes and Duplexes)	1 D/Unit	3.75	0.225	0.84				
232	Multi-Level Townhouses	1 D/Unit	3.25	0.225	0.73				
251	Retirement Village	1 D/Unit	3.40	0.110	0.37				
254	Old-Age Home	1 D/Unit	2.50	0.100	0.25				
260	Recreational Homes	1 D/Unit	3.00	0.100	0.30				
300	**Lodging**								
310	Hotel, Residential	1 Room	3.25	0.150	0.49				
330	Hotel, Resort	1 Room	6.00	0.100	0.60				
350	Guest House	1 Room	3.00	0.150	0.45				
400	**Recreational and Sport**								
430	Golf Course	1 Course	650.00	0.050	32.50				
473	Casino	00 sqm GLA	50.00	0.050	2.50				
480	Amusement Park	1 ha	250.00	0.050	12.50				
488	Sport Stadium	1000 Seat	100.00	0.050	5.00				
492	Health and Fitness Centre	00 sqm GLA	32.50	0.300	9.75				
500	**Institutional**								
520	Public Primary School	1 Student	2.00	0.400	0.80				
530	Public Secondary School	1 Student	2.00	0.400	0.80				
536	Private School	1 Student	2.00	0.400	0.80				
550	University / College	1 Student	1.90	0.110	0.21				
560	Places of Public Worship (Weekend)	1 Seat	0.65	0.085	0.06				
561	Places of Public Worship (Weekday)	1 Seat	0.60	0.085	0.05				
565	Pre-School (Day Care Centre)	1 Student	3.00	0.275	0.83				
566	Cemetery	1 Ha	6.00	0.050	0.30				
600	**Medical**								
611	Public Hospital	1 Bed	7.00	0.200	1.40				
612	Private Hospital	00 sqm GLA	16.50	0.110	1.81				
620	Nursing Home	1 Bed	2.25	0.110	0.25				
630	Medical Clinic	00 sqm GLA	40.00	0.150	6.00				
700	**Office**								
710	Offices	00 sqm GLA	8.50	0.250	2.12	5%	1.21		
713	Home offices and undertakings	1 House	25.00	0.250	6.25				
720	Medical consulting rooms	00 sqm GLA	55.00	0.135	7.43				
770	Business Centre (Park)	00 sqm GLA	10.00	0.150	1.50				
780	Conference Centre	1 Seat	1.00	0.300	0.30				
800	**Retail**								
812	Building Materials	00 sqm GLA	45.00	0.090	4.05	5%	1.32		
816	Hardware and Paint Store	00 sqm GLA	60.00	0.085	5.10	3%	1.32		
817	Nursery (Garden Centre)	01 sqm GLA	45.00	0.100	4.50				
820	Shopping Centre	00 sqm GLA	35.00	0.085	2.98	2%	1.32	6.000	3500
830	Bulk Trade Centre	00 sqm GLA	7.50	0.145	1.09	2%	1.32		
841	Motor Dealership	00 sqm GLA	30.00	0.100	3.00				
890	Furniture Store	00 sqm GLA	5.40	0.250	1.35	2%	1.32		

900	Services						
931	Restaurant, Quality (Sit-down)	00 sqm GLA	90.00	0.100	9.00		
932	Restaurant, Family (Sit-down)	00 sqm GLA	140.00	0.100	14.00		
933	Fast Food	00 sqm GLA	200.00	0.100	20.00		
946	Filling Station	1 Station	500.00	0.120	60.00	2%	1.32
950	Vehicle Fitment Centre	00 sqm GLA	22.00				

Table 3.2: Trip Generation Adjustment Factors

	Land Use	Size Units	Percentage reduction for developments in areas with Mixed-use Development	Low vehicle Ownership	Very Low Ownership	Transit nodes or Corridors
100	**Industrial**					
110	Service Industry	100 sqm GLA	5%	20%	30%	15%
120	Heavy industry/manufacturing	100 sqm GLA	5%	20%	30%	15%
121	Mining	1 Employees	5%	20%	30%	15%
130	Industrial Area (Park)	100 sqm GLA	5%	20%	30%	15%
140	Manufacturing	100 sqm GLA	5%	20%	30%	15%
150	Warehousing and Distribution	100 sqm GLA	5%	20%	30%	15%
151	Mini-Warehousing	100 sqm GLA	5%	20%	30%	15%
200	**Residential**					
210	Single Dwelling Units	1 D/Unit	10%	40%	70%	15%
220	Apartments and Flats	1 D/Unit	15%	30%	50%	15%
225	Student Apartments and Flats	1 D/Unit	25%	50%	80%	15%
231	Townhouses (Simplexes and Duplexes)	1 D/Unit	15%	30%	50%	15%
232	Multi-Level Townhouses	1 D/Unit	15%	30%	50%	15%
251	Retirement Village	1 D/Unit	5%	50%	80%	15%
254	Old-Age Home	1 D/Unit	5%	50%	80%	15%
260	Recreational Homes	1 D/Unit	10%	20%	30%	15%
300	**Lodging**					
310	Hotel, Residential	1 Room	20%	20%	30%	15%
330	Hotel, Resort	1 Room	20%	20%	30%	15%
350	Guest House	1 Room	20%	30%	50%	15%
400	**Recreational and Sport**					
430	Golf Course	1 Course	5%	0%	0%	0%
473	Casino	100 sqm GLA	5%	20%	30%	15%
480	Amusement Park	1 ha	5%	30%	50%	15%
488	Sport Stadium	1000 Seat	5%	30%	50%	15%
492	Health and Fitness Centre	100 sqm GLA	15%	20%	30%	15%
500	**Institutional**					
520	Public Primary School	1 Student	30%	50%	80%	15%
530	Public Secondary School	1 Student	30%	50%	80%	15%
536	Private School	1 Student	30%	50%	80%	15%
550	University / College	1 Student	20%	40%	60%	15%
560	Places of Public Worship (Weekend)	1 Seat	10%	50%	80%	15%
561	Places of Public Worship (Weekday)	1 Seat	10%	50%	80%	15%
565	Pre-School (Day Care Centre)	1 Student	5%	50%	80%	15%
566	Cemetery	1 Ha	0%	30%	50%	15%
600	**Medical**					
611	Public Hospital	1 Bed	0%	50%	80%	15%
612	Private Hospital	100 sqm GLA	0%	20%	30%	15%
620	Nursing Home	1 Bed	0%	50%	80%	15%
630	Medical Clinic	100 sqm GLA	0%	50%	80%	15%
700	**Office**					
710	Offices	100 sqm GLA	20%	20%	30%	15%
713	Home offices and undertakings	1 House	10%	20%	30%	15%
720	Medical consulting rooms	100 sqm GLA	10%	30%	50%	15%
770	Business Centre (Park)	100 sqm GLA	15%	20%	30%	15%
780	Conference Centre	1 Seat	10%	20%	30%	10%
800	**Retail**					
812	Building Materials	100 sqm GLA	10%	30%	50%	15%
816	Hardware and Paint Store	100 sqm GLA	10%	30%	50%	15%
817	Nursery (Garden Centre)	101 sqm GLA	10%	30%	50%	15%
820	Shopping Centre	100 sqm GLA	10%	30%	60%	15%
830	Bulk Trade Centre	100 sqm GLA	10%	30%	60%	15%
841	Motor Dealership	100 sqm GLA	5%	20%	30%	15%
890	Furniture Store	100 sqm GLA	5%	30%	50%	15%

900	**Services**					
931	Restaurant, Quality (Sit-down)	100 sqm GLA	10%	10%	15%	15%
932	Restaurant, Family (Sit-down)	100 sqm GLA	10%	30%	50%	15%
933	Fast Food	100 sqm GLA	10%	40%	60%	15%
946	Filling Station	1 Station	0%	0%	0%	0%
950	Vehicle Fitment Centre	100 sqm GLA	0%	0%	0%	0%

Table 4: Trip Lengths

	Land Use	Size Units	Total trip Length L_T (km)	Half trip Length $L_T/2$ (km)	Class 4/5 Half trip P_{45} (km)	Non-Municipal P_N (%)	Adj Trip Length $L_D/2$ (km)	Size Adjustment 1-A/(1+sqm Size/B) Factor A	Factor B
100	**Industrial**								
110	Service Industry	100 sqm GLA	12.00	6.00	1.25	40%	2.35		
120	Heavy industry/manufacturing	100 sqm GLA	15.00	7.50	1.25	40%	3.25		
121	Mining	1 Employees	15.00	7.50	1.25	40%	3.25		
130	Industrial Area (Park)	100 sqm GLA	15.00	7.50	1.25	40%	3.25		
140	Manufacturing	100 sqm GLA	15.00	7.50	1.25	40%	3.25		
150	Warehousing and Distribution	100 sqm GLA	15.00	7.50	1.25	40%	3.25		
151	Mini-Warehousing	100 sqm GLA	10.00	5.00	1.00	32%	2.40		
200	**Residential**								
210	Single Dwelling Units	1 D/Unit	8.50	4.25	1.00	32%	1.89		
220	Apartments and Flats	1 D/Unit	5.00	2.50	0.75	24%	1.15		
225	Student Apartments and Flats	1 D/Unit	3.00	1.50	0.60	16%	0.66		
231	Townhouses (Simplexes and Duplexe	1 D/Unit	7.50	3.75	1.00	32%	1.55		
232	Multi-Level Townhouses	1 D/Unit	7.00	3.50	1.00	32%	1.38		
251	Retirement Village	1 D/Unit	5.50	2.75	1.00	24%	1.09		
254	Old-Age Home	1 D/Unit	5.50	2.75	1.00	24%	1.09		
260	Recreational Homes	1 D/Unit	10.00	5.00	1.50	32%	1.90		
300	**Lodging**								
310	Hotel, Residential	1 Room	7.00	3.50	1.00	32%	1.38		
330	Hotel, Resort	1 Room	8.00	4.00	1.00	40%	1.40		
350	Guest House	1 Room	6.00	3.00	1.00	28%	1.16		
400	**Recreational and Sport**								
430	Golf Course	1 Course	13.00	6.50	1.00	36%	3.16		
473	Casino	100 sqm GLA	14.00	7.00	1.00	40%	3.20		
480	Amusement Park	1 ha	12.00	6.00	1.00	40%	2.60		
488	Sport Stadium	1000 Seat	12.00	6.00	1.00	40%	2.60		
492	Health and Fitness Centre	100 sqm GLA	5.00	2.50	0.75	24%	1.15		
500	**Institutional**								
520	Public Primary School	1 Student	4.00	2.00	1.00	20%	0.60		
530	Public Secondary School	1 Student	5.00	2.50	1.00	28%	0.80		
536	Private School	1 Student	5.50	2.75	1.00	32%	0.87		
550	University / College	1 Student	10.00	5.00	1.50	32%	1.90		
560	Places of Public Worship (Weekend)	1 Seat	6.00	3.00	0.80	28%	1.36		
561	Places of Public Worship (Weekday)	1 Seat	6.00	3.00	0.80	28%	1.36		
565	Pre-School (Day Care Centre)	1 Student	3.50	1.75	0.90	28%	0.36		
566	Cemetery	1 Ha	8.00	4.00	1.00	32%	1.72		
600	**Medical**								
611	Public Hospital	1 Bed	8.50	4.25	1.00	32%	1.89		
612	Private Hospital	100 sqm GLA	8.00	4.00	1.00	32%	1.72		
620	Nursing Home	1 Bed	7.50	3.75	1.00	28%	1.70		
630	Medical Clinic	100 sqm GLA	5.00	2.50	1.00	24%	0.90		
700	**Office**								
710	Offices	100 sqm GLA	9.00	4.50	1.00	28%	2.24		
713	Home offices and undertakings	1 House	7.00	3.50	1.00	28%	1.52		
720	Medical consulting rooms	100 sqm GLA	8.00	4.00	1.00	28%	1.88		
770	Business Centre (Park)	100 sqm GLA	10.00	5.00	1.00	32%	2.40		
780	Conference Centre	1 Seat	10.00	5.00	1.00	40%	2.00		
800	**Retail**								
812	Building Materials	100 sqm GLA	8.00	4.00	1.00	32%	1.72		
816	Hardware and Paint Store	100 sqm GLA	7.00	3.50	1.00	32%	1.38		
817	Nursery (Garden Centre)	101 sqm GLA	6.50	3.25	1.00	24%	1.47		
820	Shopping Centre	100 sqm GLA	10.00	5.00	1.00	32%	2.40	0.740	148000
830	Bulk Trade Centre	100 sqm GLA	10.00	5.00	1.00	40%	2.00		
841	Motor Dealership	100 sqm GLA	6.50	3.25	0.75	32%	1.46		
890	Furniture Store	100 sqm GLA	8.00	4.00	1.00	32%	1.72		

900	Services						
931	Restaurant, Quality (Sit-down)	100 sqm GLA	6.50	3.25	0.80	24%	1.67
932	Restaurant, Family (Sit-down)	100 sqm GLA	5.50	2.75	0.80	24%	1.29
933	Fast Food	100 sqm GLA	4.00	2.00	0.70	20%	0.90
946	Filling Station	1 Station	5.00	2.50	0.50	32%	1.20
950	Vehicle Fitment Centre	100 sqm GLA	8.00	4.00	1.00	28%	1.88