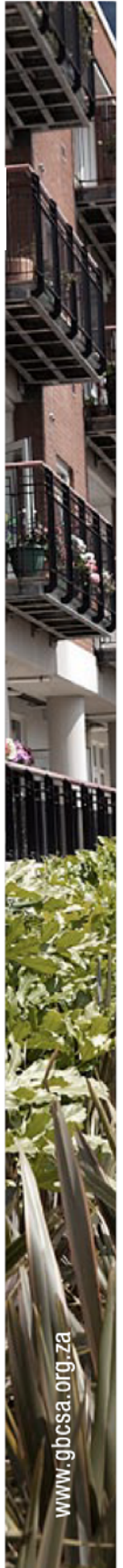# Green Star SA - Multi Unit Residential v1

COMMUTING MASS TRANSPORT CALCULATOR GUIDE
Version 1.0

greenstar
Multi Unit Residential v1
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Green Star SA Multi Unit Residential v1

Commuting Mass Transport Calculator Guide

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Change Log

Date	Changes

Green Star SA - Multi Unit Residential v1
COMMUTING MASS TRANSPORT CALCULATOR GUIDE
Version 0.1

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1   Introduction

The Green Building Council of South Africa (GBCSA) has developed a Commuting Mass Transport Calculator (the 'Calculator'), which is used in Green Star SA rating tools to determine how well a building is located in relation to public mass transport networks and to reward points accordingly. The Calculator determines the number of points earned out of those available for the Green Star SA credit Tra-4 'Commuting Mass Transport'. The number of points available varies for the different tools, as discussed in Section 3 below. This Guide should be used in conjunction with the Calculator in the Green Star SA rating tools.

The Calculator allows projects to be compared using a common standard benchmark. The Calculator determines the number of points awarded based on the type of mass transport, the 'average interval between services during peak periods', and the proximity of the mass transport stops to the development.

2   Acknowledgements

The Commuting Mass Transport Calculator and Guide are based on the versions produced by the Green Building Council of Australia for the Australian Green Star rating tools. The Green Building Council of South Africa acknowledges technical consultants WSP and Arup for the work in adapting these documents for the South African Green Star SA rating tools.

3   Differences between Green Star SA rating tools

In each Green Star SA rating tool, there are slight differences in the Calculator because it is designed to assess the specific transport needs for different building types and market sectors. The Green Star SA - Retail v1 Calculator added Saturdays to reflect the specific conditions of the market sector, but for the Green Star SA – Multi Unit Residential v1 Calculator, Saturdays have been removed and the Calculator reverts to the format used in the Green Star SA - Office v1 Calculator. Green Star SA – Multi Unit Residential v1 does provide points for Saturdays, Sundays and public holidays, but the calculator is not used for these periods.

Points available for each Green Star SA tool for credit Tra-4 are as follows:

Rating Tool	With Calculator		Without Calculator	Total Points
	Weekday	Saturday	Sat, Sun & Holiday	
GS SA Office v1	5	-	-	5
GS SA Retail Centre v1	4	1	-	5
GS SA MUR v1	3		2	5

Table 1. Commuting Mass Transport Guide Green Star SA Tool Variations

4   About the Calculator

The Calculator determines the number of Green Star SA points achieved based on scores representing the type and 'average interval between services during peak periods' of mass transport routes, as well as their proximity to the development. Points are awarded in proportion to the proximity of a development to mass transport stops and the frequency of the mass transport services.

5   How to Use the Calculator

The Calculator is embedded in the Green Star SA rating tools, which are located on the GBCSA website, www.gbcsa.org.za. The Calculator can be found on a tab in the rating tool spreadsheet after the Transport Category.

5.1   Step 1: Determine Mass Transport Stops

Identify the number and type of mass transport modes stopping within 0-250 metres, 250-500 metres, 500-750 metres and 750-1,000 metres of the development, measured as actual pedestrian walking distances, not 'as the crow flies'.

Distance is measured from the public entrance of the development site; where there is more than one entrance used by pedestrians, the one most convenient for walking to the relevant mass transport stop(s) may be used in the distance measurement, provided documentation requirements are met for demonstrating that the chosen entrance is open to the public.

Documentation must be provided as per the relevant Technical Manual.

Mass Transport
- Mass transport includes publicly accessible buses, midibuses, minibuses and trains.
- Hired taxis and airplanes are not considered modes of mass transport.
- Future transport, private mass transport and public transport interchanges may be considered if they meet the criteria in section 6.

Mass Transport Route
- The route is considered the course followed by a mode of transport.
- A service is a mass transport vehicle travelling along a given route.
- Routes with an 'average headway between services during peak periods' of more than 30 minutes cannot be inserted into the Calculator.
- Any route that terminates within 2 km of the development entrance is counted as half a route, therefore insert 0.5 instead of 1 in the Calculator.
- If a route goes from A to B via C, and another route goes from A to B via D, these are considered two different routes with distinct services.
- A route with services for two directions (e.g. northbound and southbound) is considered two separate routes (refer to Example 2).
- A route with services for two directions (e.g. northbound and southbound) where one direction only has services in the morning and the other direction only has services in the afternoon is considered one route (refer to Example 3).

Mass Transport Stops
- Mass transport stops are considered only if vehicle stopping areas allow for safe and convenient passenger waiting, boarding and alighting.
- Only one stop per route can contribute to the calculations. Even if services on a route stop at more than one stop within 1,000 m from the development entrance, only one stop is considered because building occupants are likely to use the nearest one.
- It must be demonstrated that safe, well-lit, dedicated pedestrian facilities are provided between the public building entrance(s) of the development and the adjacent street network. These must conform to *SANS 10246:2003 Edition 1 - Accessibility of buildings to disabled persons* which sets minimum design requirements for access to and circulation in buildings and related facilities to permit general use by disabled people.
- If a stop on an adjacent road is included in the calculations, there must be a road crossing opportunity for pedestrians within 50 m of the development entrance. If this is in not in accordance to municipal authority requirements, a crossing opportunity

must be planned with the approval of municipal authority at the closest location possible to the development entrance.

5.2   Step 2: Weekday Frequency of Services

Determine the peak travel hours for the frequency of services by selecting any two-hour window between 06h30 and 09h30 for the morning peak period and any two-hour period between 15h30 and 18h30 for the afternoon peak period. The same two-hour windows must be used for all transit modes for regular weekdays. Public holidays are excluded from this calculation.

Determine the average interval, in minutes, of services on each route during the peak hours from timetables, surveys or Current Public Transport Records (CPTR). Only one source may be used for each route.

The 'average service frequency' during the peak periods for a route can be calculated by either of the following two methodologies.

1.   Time between services

The project team needs to determine the average interval (in minutes) of each service during weekday peak hours from current timetables, surveys or CPTR.

The average interval of services during the peak periods for a route is calculated as shown in the example below.

Example 1:

Route A: Northbound Morning Peak Service 07h30 - 09h30		Route A: Northbound Afternoon Peak Service 16h00 – 18h00	
Time	**Time between services (minutes)**	**Time**	**Time between services (minutes)**
7h25		16h20	
7h45	20	16h40	20
8h00	15	16h55	15
8h15	15	17h05	10
8h25	10	17h15	10
8h35	10	17h25	10
8h50	15	17h35	10
9h05	15	17h45	10
9h25	20	18h00	15
9h40	15	18h15	15
		18h30	15
Total	**135mins**	**Total**	**130mins**

Table 2. *Example of time between services*

The average interval in a peak period EQUALS the SUM of Time Between Services DIVIDED BY the Effective Number of Services during peak period.

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The Effective Number of Services is calculated by counting the number of "Time between services" in the tables above.

Number of morning peak services = 9

Number of afternoon peak services = 10

Average morning peak frequency = 135 ÷ 9 = 15mins

Average afternoon peak frequency = 130 ÷ 10 = 13mins

The Average Service Frequency is (15 + 13) ÷ 2 = 14mins

2.   Number of services in two-hour period

Average Service Frequency = 120 minutes / actual number of services in the peak two-hour period

The average of the morning and afternoon frequencies is then calculated.

Calculations are required for each route servicing the stop. Only services which arrive at the stop can be used to calculate the average interval for the morning peak period; conversely only services that depart from the stop can be used to calculate the afternoon peak period.

Two examples (Examples 2 & 3) are provided.

Example 2:
53 m from the development entrance is a bus route with northbound and southbound services in the morning and afternoon, therefore the northbound is considered one route (A) and the southbound is considered one route (B).

Route A: Northbound Morning Peak Service 07h30 - 09h30		Route A: Northbound Afternoon Peak Service 16h00 – 18h00	
Time		Time	
07h00		15h30	
07h25		15h45	
07h45		16h00	
08h00		16h20	
08h15		16h50	
08h25		17h20	
08h35		17h20	
08h50		17h50	
09h05		18h20	
09h25		18h50	
09h40		-	
Total Services	8	Total Services	6

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Route B: Southbound Morning Peak Service 07h30 - 09h30		Route B: Southbound Afternoon Peak Service 16h00 – 18h00	
Time		Time	
06h45		-	
07h15		15h45	
07h30		16h10	
07h45		16h15	
08h00		16h45	
08h15		17h00	
08h30		17h20	
08h15		17h15	
08h30		17h30	
08h45		17h40	
09h00		18h00	
09h15		18h15	
10h00		-	
Total Services	10	Total Services	9

The Average Service Frequency is calculated as follows:

Route A: Northbound
Average Service Frequency = 120 minutes / number of services during peak period

Number of morning peak services = 8

Number of afternoon peak services = 6

Average frequency morning peak = 120 ÷ 8 = 15 minutes

Average frequency afternoon peak = 120 ÷ 6 = 20 minutes

The Average Service Frequency is (15 + 20) ÷ 2 = **17.5 minutes**

Route B: Southbound
Average Service Frequency = 120 minutes / number of services during peak period

Number of morning peak services = 10

Number of afternoon peak services = 9

Average frequency morning peak = 120 ÷ 10 = 12 minutes

Average frequency afternoon peak = 120 ÷ 9 = 13.3 minutes

The Average Service Frequency is (12 + 13.3) ÷ 2 = **12.6 minutes**

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Example 3:

622 m from the development entrance is a bus route with northbound services only in the morning and southbound services only in the afternoon. Therefore, together these services comprise only one route.

Route C: Northbound		Route C: Southbound	
Morning Peak Service		Afternoon Peak Service	
07h30 - 09h30		16h00 – 18h00	
Time		Time	
3:30pm		6:45am	
3:45pm		7:15am	
4:00pm		7:30am	
4:20pm		7:45am	
4:50pm		8:00am	
5:20pm		8:15am	
5:20pm		8:30am	
5:50pm		8:15am	
6:20pm		8:30am	
6:50pm		9:00am	
-		9:30 am	
-		9:45am	
-		10:00am	
Total Services	**6**	**Total Services**	**9**

The Average Service Frequency can be calculated as follows:

<u>Route C: Northbound & Southbound</u>

Average Service Frequency = 120 minutes / number of services during peak period

Number of morning peak services = 6

Number of afternoon peak services = 9

Average frequency morning peak = 120 ÷ 6 = 20 minutes

Average frequency afternoon peak = 120 ÷ 9 = 13.3 minutes

The Average Service Frequency is (20 + 13.3) ÷ 2 = **16.6 minutes**

5.3   Step 3: Saturday Service Frequency (Green Star SA - Retail Centre Only)

The Mass Transport Calculator for retail centre developments includes Saturdays, and the same process is to be followed as in Step 2 above. Saturday peak period is defined as any two-hour window between 09h00 and 17h00. The same two-hour window must be used for all transit modes on Saturdays, and public holidays are excluded.

5.4   Step 4: Populate Transport Calculator

Enter the number of routes (NOT individual services or vehicles passing by) into the Mass Transport Calculator, based on distance and frequency. The results from Examples 2 and 3 are included in the Mass Transport Calculator as follows:

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No. of Bus, Midibus or Minibus Routes				
	Contracted		**Uncontracted**	
	Frequency of Service During Peak Periods		**Frequency of Service During Peak Periods**	
Walking Distance from Building Entrance to Public Transport	**15 min**	**30 min**	**15 min**	**30 min**
0-250m	1	1 ←			← Route A
250-500m	↑				
500-750m		1 ←			← Route C
750m-1km					

Route B

6 Additional Guidance

6.1 Supporting Evidence

For all mass transport modes the following documentation is considered valid for submission:

- **Timetables**
- **Surveys**
- **Current Public Transport Records** (CPTRs)

A timetable, survey or Current Public Transport Record (CPTR) may be used for each route. The services of any one route cannot be proved with more than one type of evidence.

Surveys need to be carried out by a qualified professional. Survey of observed mass transport routes (contracted and un-contracted) must identify the location of the stops and frequency of services during peak periods. Routes must also be identified for the different transport modes (e.g. route names, numbers). The CPTR data is satisfactory documentation to determine routes.

Where surveys are provided for contracted transport, confirmation is required from the transport operator that the routes are contracted by the local, provincial or national authority, or if the transport is part of a site development process, proof of an agreement is required.

The above documentation cannot be older than one year prior to the date of the first round of the Green Star SA submission.

6.2 Contracted/un-contracted operations

In general, contracted transport modes are considered transport routes operating under contract to the municipality, operating on a fixed route and schedule. In some cases in South Africa the contracted operations do not have timetables or the timetables are outdated (older than 1 year). The project can then decide to carry out a traffic survey for the transport mode in order to include the calculations under contracted operations; the project must provide

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confirmation from the transport operator stating that the routes are contracted by a local, provincial or national authority.

6.3 Future Services

Future public transport services may be included in calculations for the TRA-04 Commuting Mass Transport credit. Where train, bus, midibus or taxi services are included for credit (as mainline, feeder or connecting service) but not operational at the time of the Green Star SA submission, the flowing documentation must be provided:

- Proof of a contract signed by the relevant transport authority and the service provider, and the planned service frequency, hours of operation and route; and
- Proof of an undertaking to have the necessary transport stops constructed, whether on a public road or the development site.

6.4 Private Bus Transport

Private bus transport with established routes and timetables equivalent to public transport may be included in the Calculator contingent upon the project's ability to demonstrate that the future operations of these services are as certain as public transport. The project must provide documentation demonstrating alternative but equivalent compliance in respect to longevity of the service, available timetables, etc. in addition to the other required documentation in the Documentation Requirements section for this credit in the relevant Technical Manual.

6.5 Public Transport Interchange

A public transport interchange is a location where passengers move between services of the same or different transport mode. If the site is within 15 minutes of a public transport interchange via a public transport connecting service, with the connecting service having a frequency of no more than 30 minutes, then the routes available from the interchange can be included in the Calculator with the following modifications:

- Only connecting services operating under contract to the municipality on a fixed route and schedule may be included.
- The number of routes at the interchange is halved.
- The distance to be entered for routes at the interchange is equal to the distance from the development to the connecting service, plus 250m.
- Any connecting service from the interchange that terminates within 1,000m of the interchange only counts as half of one service, which is then halved again because it is from the interchange (e.g. enter 0.25).

Example 4:

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The train route that stops 600m from the building services a Transport Interchange within a travel time of 12 minutes AND six additional bus routes service the Transport Interchange; three arriving routes and three departing.

Morning Peak Period Services 'To' and 'From' Transport Interchange					
Bus A		Bus B		Bus C	
Route 1 To Transport Interchange	Route 2 From Transport Interchange	Route 3 To Transport Interchange	Route 4 From Transport Interchange	Route 5 To Transport Interchange	Route 6 From Transport Interchange
Time	Time	Time	Time	Time	Time
7h25	7h20	7h18	7h45	7h15	-
7h45	7h40	7h48	8h30	8h00	6h25
8h00	8h00	8h18	9h15	8h10	7h45
8h15	8h20	8h48	10h00	8h20	8h45
8h30	8h40	9h18	-	8h30	9h45
8h45	9h00	9h48	-	8h40	-
9h00	9h20	-	-	8h50	-
9h15	9h40	-	-	9h00	-
9h35	-	-	-	9h45	-
Number of services Route 1	7	Number of services Route 3	4	Number of services Route 5	7
Number of services Route 2	6	Number of services Route 4	3	Number of services Route 6	2
Average Interval Between Services Route 1	17.14 min	Average Interval Between Services Route 3	30 min	Average Interval Between Services Route 5	17.14min
Average Interval Between Services Route 2	20 min	Average Interval Between Services Route 4	40min	Average Interval Between Services Route 6	60 min

Afternoon Peak Period Services 'To' and 'From' Transport Interchange					
Bus A		Bus B		Bus C	
Route 1 To Transport Interchange	Route 2 From Transport Interchange	Route 3 To Transport Interchange	Route 4 From Transport Interchange	Route 5 To Transport Interchange	Route 6 From Transport Interchange
Time	Time	Time	Time	Time	Time
16h25	16h30	16h50	16h40	16h15	16h29
16h45	16h50	17h20	16h55	16h45	16h32

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17h00	17h10	17h50	17h10	17h15	16h35
17h05	17h20	18h20	17h25	17h20	16h58
17h10	17h30	18h50	17h40	17h25	17h13
17h15	17h40	-	17h55	17h30	17h22
17h20	18h00	-	18h10	17h35	17h30
17h30	18h20	-	18h25	17h40	17h43
18h00	18h40	-	18h40	17h45	17h59
18h15	-	-	-	18h00	18h22
18h30	-	-	-	18h30	18h28
18h45	-	-	-	19h00	18h43
Number of services Route 1	10	Number of services Route 3	4	Number of services Route 5	10
Number of services Route 2	8	Number of services Route 4	8	Number of services Route 6	10
Average interval Between services Route 1	12 min	Average interval Between services Route 3	30 min	Average interval Between services Route 5	12 min
Average interval Between services Route 2	15 min	Average interval Between services Route 4	15 min	Average interval Between services Route 6	12 min

Summary of the Average Interval between Services:

Average Interval Between Services During Peak Periods for Bus A **Route 1** = 14.57 minutes = **15 minutes**	Average Interval Between Services During Peak Periods for Bus B **Route 3** = **30 minutes**	Average Interval Between Services During Peak Periods for Bus C **Route 5** = 14.57 minutes= **15 minutes**
Average Interval Between Services During Peak Periods for Bus A **Route 2** = 17.50 minutes= **18 minutes**	Average Interval Between Services During Peak Periods for Bus B **Route 4** = 27.50 minutes= **28 minutes**	Average Interval Between Services During Peak Periods for Bus C **Route 6** = **36 minutes**

The "Average Interval Between Services" for each route can be entered into the Calculator as follows. The distance is 600m to the train station + 250m = 850m. Note that Route 6 cannot be entered as the headway is greater than 30 min.

WEEKDAY SERVICES					
No. of Bus, Midibus or Minibus Routes					
		Contracted		**Uncontracted**	
Walking Distance from Building Entrance to Public Transport		**Frequency of Service During Peak Periods**		**Frequency of Service During Peak Periods**	
		15 min	**30 min**	**15 min**	**30 min**
0-250m					
250-500m					
500-750m					
750m-1km		1	1.5		

Route 1 and Route 5 should be entered in this cell as '*0.5*' each

Route 2, 3, 4 should be entered in this cell as "0.5' each

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7   Mass Transport Calculator

The Calculator determines the number of points achieved based on the following criteria:

- Type of mass transport; and
- Walking distance from the development to the stop/station; and
- Frequency of service during peak commuting periods.

The following tables provide the relative weighting of cells within the Calculator by indicating the score per route in each category. These weightings are automatically reflected in the number of points achieved.

WEEKDAY/SATURDAY WEIGHTINGS				
for Bus, Midibus or Minibus Routes				
Walking Distance from Building Entrance to Public Transport	Contracted		Uncontracted	
	Frequency of Service During Peak Periods		Frequency of Service During Peak Periods	
	15 min	**30 min**	**15 min**	**30 min**
0-250m	6	4	3	1
250-500m	5	3	2	
500-750m	4	2	1	
750m-1km	3	1		

WEEKDAY/SATURDAY WEIGHTINGS		
For Train Routes		
Walking Distance from Building Entrance to Public Transport	Frequency of Service During Peak Periods	
	15 min	**30 min**
0-250m	7	5
250-500m	6	4
500-750m	5	3
750m-1km	4	1

The Mass Transport Calculator multiplies the number of routes entered for each of the above categories and adds all the scores together to give a single Mass Transport Calculator Score. Weekday and Saturday scores are added together and are not weighted differently.

The number of points is then determined, based on the total score achieved, in accordance with the tables below:

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For **Office** developments:

Total Mass Transport Calc. Score	Number of Points for Tra-4
Weekday Services	Weekday Services
10	1
20	2
40	3
60	4
80	5

For **Retail Centre** developments:

Total Mass Transport Calc. Score	Number of Points for Tra-4
Weekday Services	Weekday Services
10	1
20	2
40	3
60	4
Saturday Service	Saturday Service
20	1

For M**ulti Unit Residential** developments:

Total Mass Transport Calc. Score	Number of Points for Tra-4
Weekday Services	Weekday Services
10	1
20	2
40 +	3

For example, based on Examples 2 and 3 previously:

No. of Bus, Midibus or Minibus Routes				
Walking Distance from Building Entrance to Public Transport	Contracted		Uncontracted	
	Frequency of Service During Peak Periods		Frequency of Service During Peak Periods	
	15 min	30 min	15 min	30 min
0-250m	1 x *6*	1 x *4*		
250-500m				
500-750m		1 x *2*		
750m-1km				

Total Mass Transport Calculator Score = 6 + 4 + 2 = 12, and $10 \leq 12 \leq 20$, therefore **1 point for Tra-4 is achieved**.

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