ACCESS BY PUBLIC TRANSPORT

CALCULATOR GUIDE

DECEMBER 2015

This guide is to be used for the 'Access by Public Transport' criterion in both the *Green Star – Design & As Built* and *Green Star – Interiors* rating tools.

Document Information

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This document is routinely updated to ensure it is accurate, clear and easy to use. It can be found at www.gbca.org.au.

Change Log

Release	Date	Description of changes
Green Star - Design & As Built v1 *Release 1*	16/10/2014	Initial release.
Green Star - Design & As Built v1 Green Star - Interiors v1 *Release 2*	8/05/2015	Based on industry feedback, the benchmarks used in calculations have been updated from fixed benchmarks to variable, percentage benchmarks based on the Greater Capital City Statistical Area (GCCSA) Population data for the project's location. This method of calculation is intended to more accurately reflect the accessibility of the site by public transport.
Green Star - Design & As Built v1.1 Green Star - Interiors v1 *Release 1*	22/07/2015	Released for Design & As Built v1.1, no changes. Remains applicable to Interiors v1.
Green Star - Design & As Built v1.1 Green Star - Interiors v1.1 *Release 1*	03/12/2015	Released for Interiors v1.1, no changes. Remains applicable to Design & As Built, v1.1.

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Table of Contents

1   INTRODUCTION

The Green Building Council of Australia (GBCA) and AECOM have developed the 'Access by Public Transport' calculator ('the Calculator') to determine how well a particular destination is served by public transport. The Calculator is to be used for projects undertaking the 'Prescriptive Pathway' under the 'Sustainable Transport' credit in either the *Green Star – Design & As Built* or *Green Star – Interiors* rating tool.

The 'Prescriptive Pathway' is an alternative to the 'Performance Pathway' in the 'Sustainable Transport' credit. This Calculator is relevant to the 'Access by Public Transport' criterion which falls under the 'Prescriptive Pathway' (see Figure 1).

The Calculator determines the number of points awarded out of the three points available for the 'Access by Public Transport' criterion. This Calculator Guide ('the Guide') should be used in conjunction with the Calculator and the relevant *Green Star – Design & As Built* or *Green Star – Interiors* Submission Guidelines.
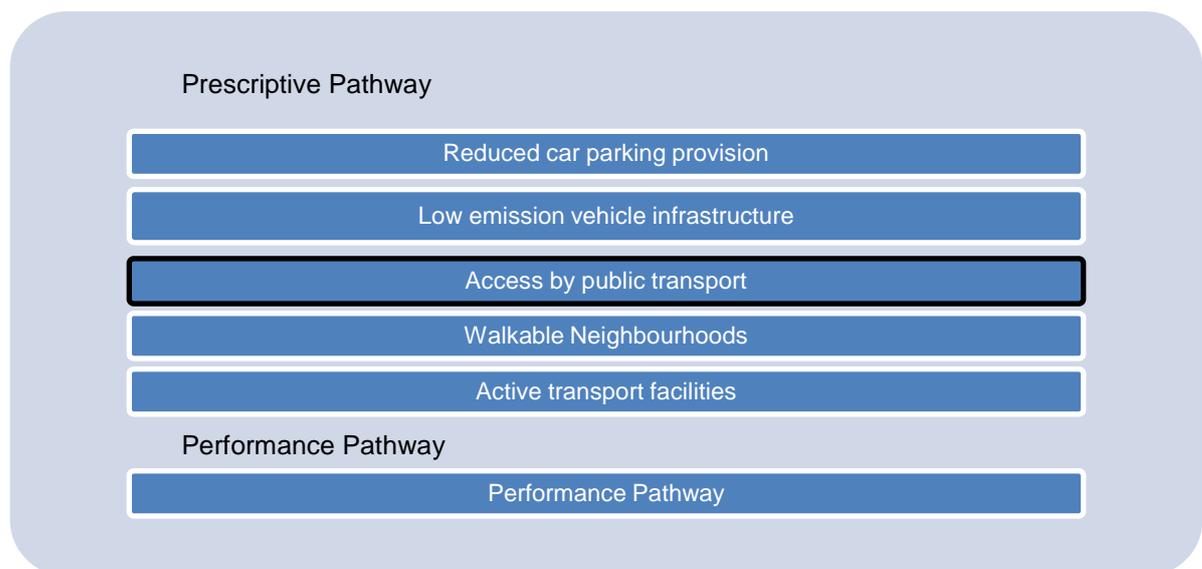

Figure 1: The 'Prescriptive' and 'Performance' Pathway under the 'Sustainable Transport' credit

2   'ACCESS BY PUBLIC TRANSPORT' DEVELOPMENT

The 'Access by Public Transport' criterion involves the use of a uniquely developed Public Transport Accessibility Index (PTAI) to determine the project's accessibility. The project's accessibility reflects how well a particular destination is served by public transport.

The measure of the accessibility relates to the number of project occupants that can access the nominated destination through the use of public transport within a 45 minute travel time threshold during morning peak hour.

The 45 minute travel time threshold includes:

- Walk time to and from the public transport stop at both ends of the trip;

- In-vehicle time;

- Wait/transfer times; and

- "Dead" time – the difference between the desired arrival time and the actual arrival time.

3 HOW THE CALCULATOR WORKS

The Calculator works by:

1. Using Google Maps to search for the nominated project address and allocate a statistical area (SA2);

2. Querying data sourced from Google Transit to determine which other SA2's contain a population of residents that can access the nominated destination through the use of public transport within a 45 minute travel time threshold during morning peak hour, with the exception of Victoria. The analysis for Victorian based locations is based on AECOM's analysis of existing public transport services databases. Dynamic data is not currently available for Victorian based public transport networks.

3. 2011 Census data is then used to determine the population of the SA's that meet the design parameters.

4. The total population that can access the location within a 45 minute travelled time is compared to the total population in the Australian Bureau of Statistics, Greater Capital City Statistical Areas (GCCSA)

It is important to note that due to the data being sourced from Google Transit servers, there is a limit of three complete spreadsheet calculations (i.e. run through to 100%) that can be run from any given IP address per day.

Project Limit = Three 'Access by Public Transport' calculations per day per IP address

The data is then presented in text format (see 3.2), as well as a graphical representation (see Figure 5).

3.1 Where to Find the Calculator and How to Enter Data

The Calculator can be found at the following web address:

- Green Star – Design & As Built: http://www.gbca.org.au/green-star/green-star-design-as-built/the-rating-tool/.

- Green Star – Interiors: http://www.gbca.org.au/green-star/green-star-interiors/the-rating-tool/.

Step 1: Enter either the address or the coordinates of the building or fitout undertaking Green Star certification. You can choose whether you would like to enter an address or coordinates by using the drop-down box titled "Location".

Addresses must be entered in the following format:

<Street Number>, <Street Name>, <Street Type>, <Suburb>, <State Code (e.g. NSW)>, <Postcode>

Coordinates must be entered using latitude and longitude in decimal degrees in the World Geodetic System 1984 (WGS 84) coordinate system. An example is shown in Figure 2.

Location	Address
Address	179, Elizabeth, St, Sydney, NSW, 2000
Latitude	-33.87206
Longitude	151.20979

Figure 2: Project address / coordinates input

Step 2: Press the 'Calculate' button. You will need to wait a few minutes until the calculation is complete.

The time indicator will inform you of the progress (0%→100%) through the calculation process.

Figure 3: Calculation progress bar

3.2   Results Output

The Calculator will generate results in the following format.

Address	121 Don St, Bendigo VIC 3550
Latitude	*-33.87206*
Longitude	*151.20979*
ABS GCCSA Region	Rest of Vic.
ABS GCCSA Population	1,345,727
Public Transport Population Catchment	39,288
Percentage Achieved	2.9%
Points	**0 / 3**
Car Parking Accessibility Index	Accessibility Rating 1
Browser link for map	No outputs or mapping available for Victorian addres

Figure 4: Project results output

Find following a description of the output results of the calculator.

Table 1: Description of results output

Category	Description
ABS GCCSA Region	A short description of the ABS GCCSA region that the nominated destination is located within.
ABS GCCSA Population	The total population of the GCCSA region that the nominated destination is located within.
Public Transport Population Catchment	An approximation of the number of residents that can access the nominated destination through the use of public transport within a 45 minute travel time threshold during morning peak hour. This is based on statistical area (SA2) population data sourced from the 2011 Census.
Percentage Achieved	The percentage of residents that can access the nominated destination through the use of public transport compared to the total GCCSA population for the region.
Points	Points achieved for the credit (0 points, 1 point, 2 points, 3 points)
Car Parking Accessibility Index	Relates to the 17B.2 'Reduced Car Parking Provision' criterion and determines the projects Car Parking Accessibility Index. (Accessibility Rating 1, Accessibility Rating 2, Accessibility Rating 3)

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	Please note that the 17B.2 'Reduced Car Parking Provision' criterion is applicable to the *Green Star – Design & As Built* rating tool only and not *Green Star – Interiors*.
Browser link for map	Browser link for project to access the graphical display of the calculation results. This web page will automatically open upon completion of the calculation; however, this link can be used to access this display any time after the calculation has been run. The link is best opened using the Google Chrome browser.

3.2.1 Detailed Outputs

The blue "Outputs" tab in the spreadsheet shows the detailed results of the calculations, with the effective time ("EffTime") and the "Population" being the key outputs for each SA2 statistical area. The overall 'Public Transport Population Catchment' is simply the sum of the population of all the SA2s with an effective time of less than 45 minutes.

Also shown is up to four public transport options for arriving at the destination by 8:30AM on the morning the calculator is run, with the time for each option including walk, wait/transfer and in vehicle time (but not dead time).

For a detailed explanation of how the 'Public Transport Population Catchment' is calculated, please refer to Appendix B.

3.2.2 Graphical Display

As well as the results described in Table 1 and in the "Outputs" tab, the Calculator also generates a graphical output of the results from the "Outputs" tab.
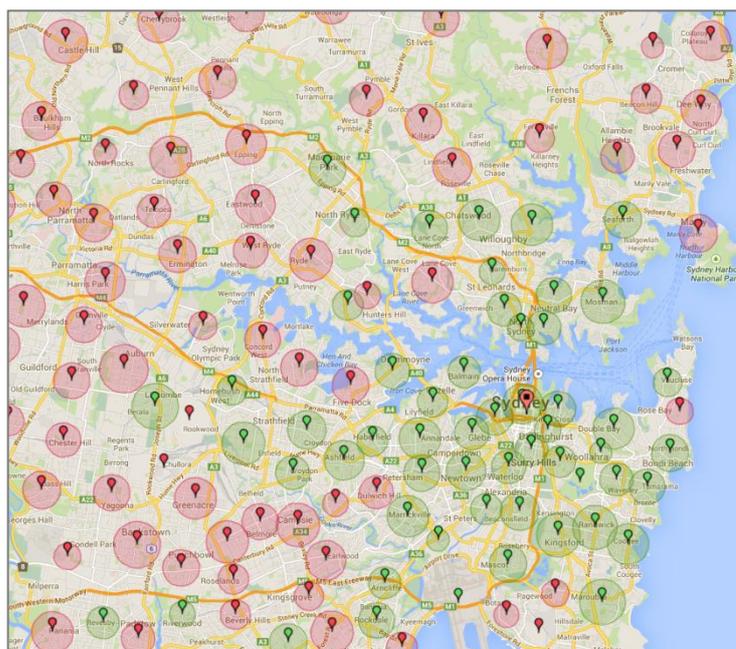

Figure 5: Public Transport Accessibility calculator graphical display

Legend

Project site location

Compliant SA2 – falls within the compliance criteria

Non-compliant SA2 – does not falls within the compliance criteria

The size of the circle associated with an SA2 gives an indication of the SA2's population

By clicking on any of the SA2 location icons, the graphical display will also generate the detailed outputs for that SA2.
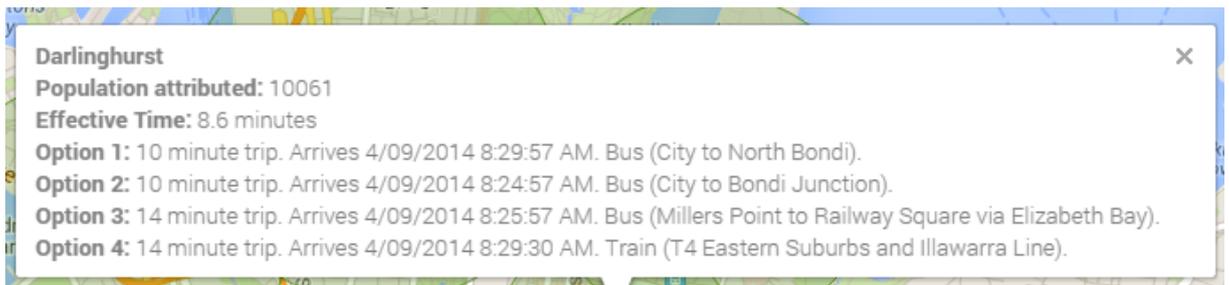
Figure 6: Travel options and times from selected SA2 to project site location via public transport

3.3 Victorian Based Projects

Due to the lack of dynamic public transport data (i.e. Google Transit data) available for Victoria, no graphical output will be displayed. Instead, Victorian based projects will be presented with only the results output found in Figure 4.

Once Victorian dynamic public transport data becomes available, projects will then be required to produce the graphical display as part of their submission to the GBCA.

4 DETERMINING POINTS FROM THE CALCULATOR

Up to three points are available for the 'Access by Public Transport' criterion based on the number of residents that can access the nominated destination through the use of public transport within a 45 minute travel time threshold during morning peak hour. This population catchment is compared to the total population of the ABS Greater Capital City Statistical Area (GCCSA). Table 2 shows the percentage of the GCCSA population which must be within 45 minutes travel time by public transport to achieve a given number of points.

Table 2: Point Assignment

Number of Points	0	1	2	3
Proportion of GCCSA population	Less than 5%	5% to 10%	10 to 15%	Greater than 15%

For locations with lower populations, or less access to public transport infrastructure it is not possible to achieve a score above zero. Project teams should consider using the 'Performance Pathway' to demonstrate improvements in sustainable transport for their project.

5 CHALLENGING RESULTS

If the user believes that the results returned by the Calculator are erroneous, it will be necessary for the user to provide evidence of this to the GBCA. There are two components that could be erroneous:

1. Population of a particular SA2 could be erroneous. The population for each SA2 was correct as of 2011, however there could be an SA2 within 45 minutes effective time from the building being assessed that has grown significantly in population since 2011.

    For example, if there is an SA2 that is 35 minutes effective time from the origin that had a population of 10,000 in 2011 but has a population of 20,000 now, the applicant may provide evidence to the GBCA that this has occurred and the GBCA may allow the score to be increased by 10,000. This may or may not lead to an increase in the number of points achieved for the credit.

2. Effective time between an SA2 centroid and the building being assessed may be erroneous. If the applicant can prove to the GBCA that the results returned from Google Transit are erroneous, they may apply for an SA2 to be included in the 'Public Transport Population Catchment' that would not be otherwise.

    For example, if an SA2 that has a population of 10,000 is deemed to have an effective time of 47 minutes, but the applicant can provide evidence that this should have an effective time of 42 minutes, the GBCA may allow the 'Public Transport Population Catchment' score to be increased by 10,000. This may or may not lead to an increase in the number of points achieved for the credit.

6 LINK TO THE CAR PARKING ACCESSIBILITY INDEX

The result output from Calculator includes a designation of the site's 'Car Parking Accessibility Index' (see section 3.2). This Accessibility Index (i.e. Accessibility Rating 1, Accessibility Rating 2, or Accessibility Rating 3) is to be used when determining the projects Compliance Requirements for the related 'Reduced Car Parking Provision' criterion.

Please note that the 17B.2 'Reduced Car Parking Provision' criterion is applicable to the *Green Star – Design & As Built* rating tool only and not *Green Star – Interiors*.

7 DOCUMENTATION REQUIREMENTS

Refer to the relevant Submission Guidelines for the project's Documentation Requirements for either the 'Design Review' or 'As Built' submission.

APPENDIX A: PROJECT EXAMPLES

Example 1

The Green Building Council of Australia's Sydney Office: 179 Elizabeth St, Sydney, NSW, 2000.

Once the project address has been inserted according to Section 3.1, press the "Calculate" button.

Address | 179, Elizabeth, St, Sydney, NSW, 2000

After waiting up to 10 minutes, the calculation will be complete.

100 % complete

The spreadsheet will then display the results for the specific project site location.

ABS GCCSA Region	Greater Sydney
ABS GCCSA Population	4,391,680
Public Transport Population Catchment	1,047,221
Percentage Achieved	23.8%
Points	**3 / 3**
Car Parking Accessibility Index	Accessibility Rating 3
Browser link for map	C:\X/179 Elizabeth Street, Sydney, NSW, 2000.htm

For this specific project site location, the results include:

Category	Description
Population Number	1,047,221 people can access the site by public transport within 45 minutes, during morning peak hour.
Points	Three points achieved.
Car Parking Accessibility Index	Accessibility Rating 3 – highly accessible. This is to be used to determine the Compliance Requirements for the 'Reduced Car Parking Provision' criterion.
Browser link for map	C:\X/179 Elizabeth Street, Sydney, NSW, 2000.html – this will be specific to each user's computer. This link can be used to access the graphical display (see 3.2.2)

The graphical display (see Figure 7) shows the compliant SA2's, those that contain people that can reach the project site location within 45 minutes using public transport during morning peak hour.

The graphic can also be used to see trends (overlay seen in green) in the origin of the people accessing the site, and the key public transport corridors that allow them to access the site within the time allotment.

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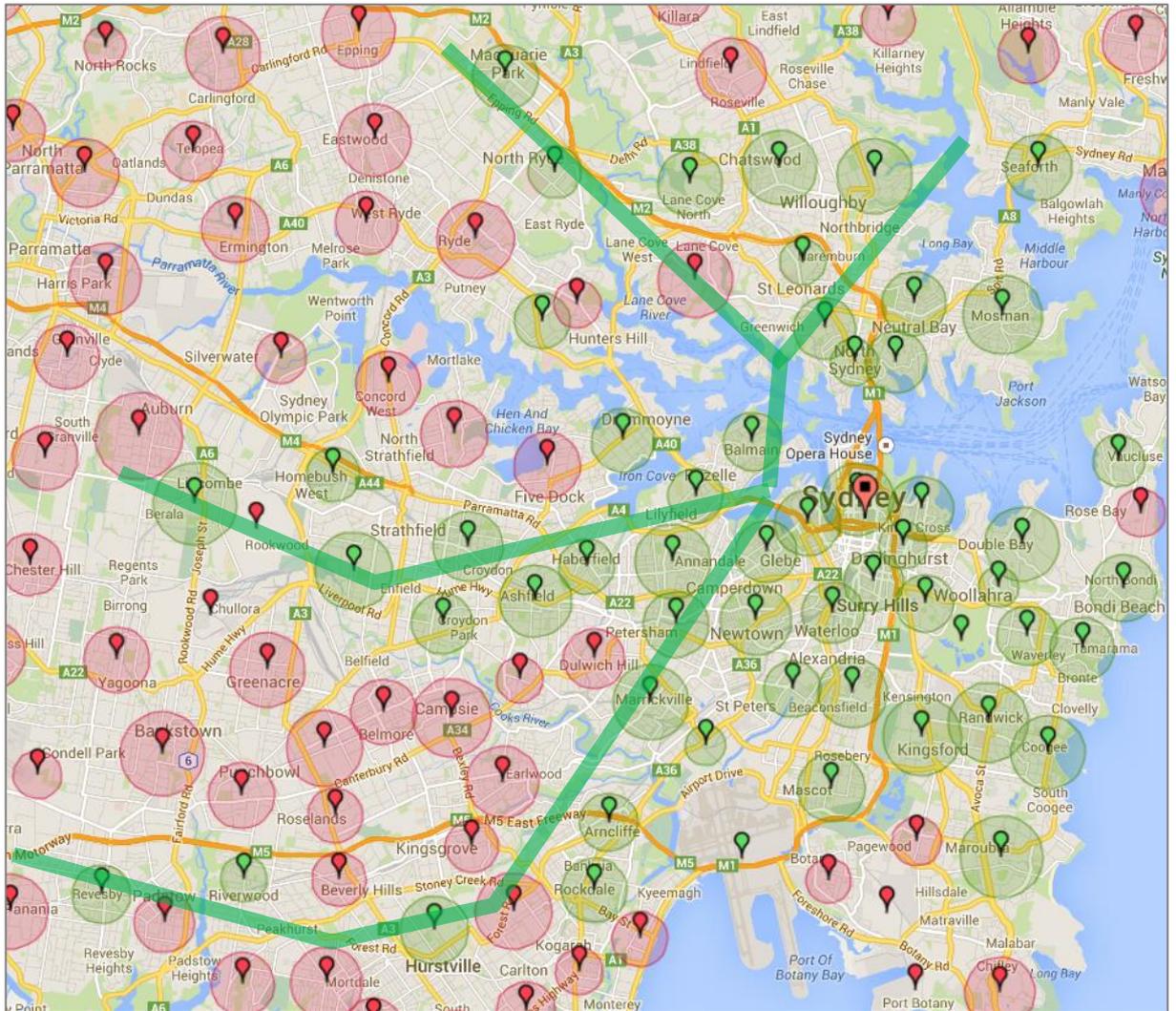
Figure 7: Graphical display of results for 179 Elizabeth Street, Sydney, NSW, 2000

Example 2

Street address: 1 Nicholson St, Melbourne, VIC, 3000.

Once the project address has been inserted according to Section 3.1, press the "Calculate" button.

Address   1, Nicholson, st, Melbourne, vic, 3000

After waiting up to 10 minutes, the calculation will be complete.

100 % complete

The spreadsheet will then display the results for the specific project site location.

ABS GCCSA Region	Greater Melbourne
ABS GCCSA Population	3,999,968
Public Transport Population Catchment	797,488
Percentage Achieved	19.9%
Points	**3 / 3**
Car Parking Accessibility Index	Accessibility Rating 3
Browser link for map	No outputs or mapping available for Victorian addresses

For this specific project site location, the results include:

Category	Description
Population Number	797,488 people can access the site by public transport within 45 minutes, during morning peak hour.
Points	Three points achieved.
Car Parking Accessibility Index	Accessibility Rating 3 – highly accessible. This is to be used to determine the Compliance Requirements for the 'Reduced Car Parking Provision' criterion.
Browser link for map	No outputs or mapping available for Victorian addresses (see 3.3)

APPENDIX B: HOW THE SCORE IS CALCULATED

The 'Public Transport Population Catchment' is calculated using an isochrone destination-based accessibility measure. In simple terms, this is the number of residents that are within a 45 minute "effective time" of the destination, in this case the project under assessment.

A destination-based accessibility measure requires one destination, but multiple origins. In this case, the origins are the centroids of all of the SA2s within a 30 kilometre radius of the building under assessment. By entering an address or coordinates in the "Inputs" sheet of the 'Access by Public Transport' calculator and pressing the "Calculate" button, the "Outputs" sheet will sort the SA2s by their distance from the project under assessment. The coordinates of each SA2 centroid may be found in columns J and K of the "Outputs" spreadsheet in WGS 84 decimal degrees. Each SA2 is then assigned the population of that SA2 according to the 2011 Census. If the applicant can prove that the current population is higher than the 2011 Census, they may provide evidence to the GBCA to increase their score.

The 'Public Transport Population Catchment' is simply the total population of all SA2s that have their centroid within 45 minutes effective time from the destination, arriving at 8:30am on the closest weekday morning to when the calculation is run.

Effective time is calculated using a logsum. The four best options are received from Google Transit. The time assigned to each of these options is the total walk time, wait/transfer time and the in-vehicle time (these three times are included in the Google Transit result, or in columns F to I in the "Outputs" worksheet) plus the "dead time", which is defined as the difference between 8:30am and the actual arrival time – for example if the service arrives at 8:29am, there is one minute of dead time.

The calculation for effective time is as follows:

$$-1 \times \ln\left(\sum_{n=1}^{n=4}(e^{-0.9 \times t_n})\right)$$

Where 't' is the time taken for each of the four options, including the time returned by Google Transit (this includes all walk, wait/transfer and in vehicle time) plus the dead time.