

Turbo Tables



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How to Register

Once you have installed your copy of Turbo Tables, there is one final step required to register your product. Each of these products is licensed as a single installation product (contact i2Gemini for more information on our Enterprise or Corporate License). This registration procedure is intended to prevent unauthorized installations of the product.

Follow the steps below to register your product after completing the basic installation:

1. Close Excel and reopen Excel to ensure the Turbo Tables product is being loaded.
2. You will be asked if you want to register
3. Click on the “Register” button
4. Click on the button that says “I have not been given a registration number” and click on the “Next” button.
5. You will be given a PC ID and a keycode – carefully copy down this information or click on the support@i2Gemini.com link to access your email account and set up an email that will contain this information
6. Click the “Back” button
7. Either call i2Gemini’s technical support line at 866-936-4436 or email us at support@i2Gemini.com with your PC ID, keycode, and serial number
8. i2Gemini will supply you with a registration number

Once you have received the registration number

9. Click on the “I have been given a registration number” button
10. Enter the registration number and click on the “Finish” button.
11. You will receive an onscreen message that your product is registered.

How to Contact Us

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[mailto: Sales@i2gemini.com](mailto:Sales@i2gemini.com)

Customer Service & Technical Support Information

If you require technical support on our product, please call us at the phone number below. Another option would be to e-mail us! We are here to help you. Hours of operation are Monday through Friday, 9:00 a.m. until 5:00 p.m. (EST).

240.547.1304 (Voice)

410.240.1721 (Fax)

[mailto :Support@i2gemini.com](mailto:Support@i2gemini.com)(Email)

Visit our Web Site

For valuable industry-related issues, product upgrade information, product demos, new releases, and much more!

www.i2Gemini.com

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Installation

System Requirements

Microsoft Windows 2000/XP/Vista

Microsoft Excel 2002 - 2007

Pentium-class Processor

10 MB disk space

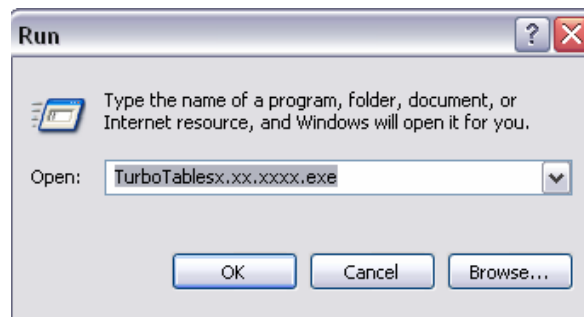
Installation Procedures

Before you install Turbo Tables, close any programs or applications that you have running on your PC.

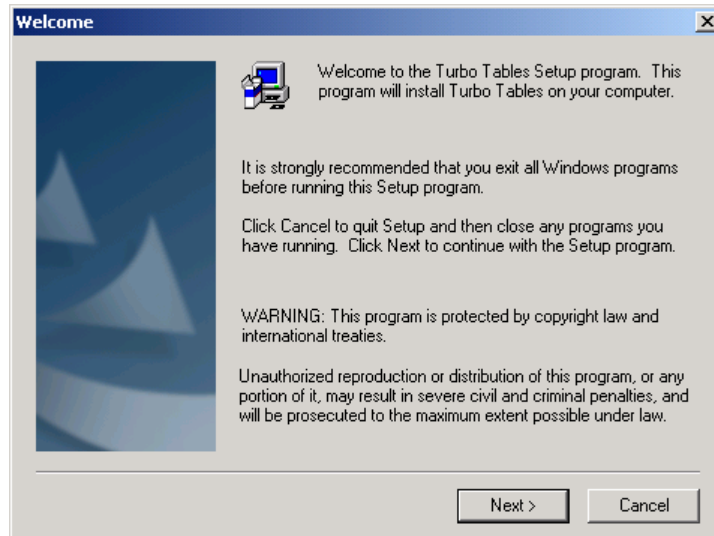
The installation disk contains 1 file, TurboTablesx.xx.xxxx.exe (where x.xx.xxxx is the version number), for installing your Turbo Tables to your hard drive. Turbo Tables cannot be run directly from the cd but will install onto your system.

Insert the Turbo Tables installation disk in your CD drive. The installation program should start automatically.

If the installation program does not start automatically then from the **Start** menu, select **Run**. Type **c:\ TurboTablesx.xx.xxxx.exe** (or substitute the appropriate letter of your CD drive instead of the c drive). Select **OK**

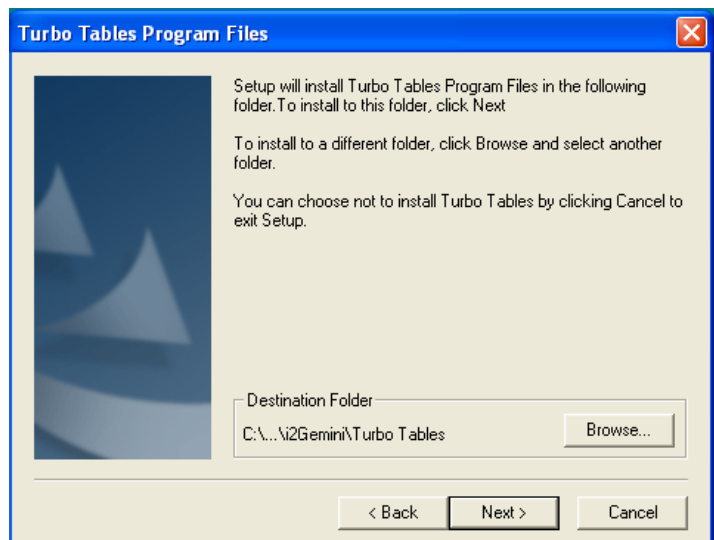


When the installation program starts, follow the prompts that appear on the screen. The installation program Welcome screen appears; please read. Click *Next*.

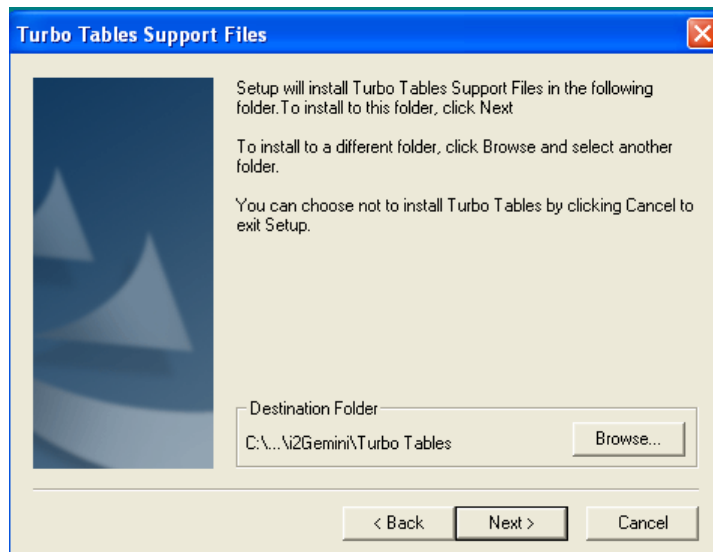


You will be prompted to enter the product serial number, accept the terms and conditions of our end user license agreement and then the following screens will display the destination of the various program and support files. You may simply continue by clicking *Next*, or use the *Browse* button to choose your own destinations however we strongly recommend that you accept the destinations offered by the installation program.

Program files



Support files



Once the installation program has all the information it requires you will be prompted to click *Next* to start the installation and begin copying files.

Files will now begin copying. When completed, you will receive a screen indicating that installation is completed.

To begin working with **Turbo Tables**, open *Microsoft Excel*

Product Overview

Turbo Tables

Turbo Tables is based on a selection of the traffic engineering programs developed by i₂Gemini, Inc.. It allows a *Microsoft Excel* user to perform a wide range of traffic engineering computations, as well as take advantage of the extensive computation and charting features of *Microsoft Excel*.

Seven Functions of *Turbo Tables*

There are seven *Turbo Tables* functions in the program:

The Seven Functions

=NLines	Computes number of trunks required from offered traffic, Grade Of Service objective
=GOS	Computes Grade Of Service from offered traffic, number of trunks
=Traffic	Computes traffic capacity from number of trunks, GOS required
=Agents	Compute number of agents from offered traffic service level required, talk time
=DelayQ	Computes proportion of calls delayed beyond particular time from offered traffic, number of agents, talk time
=ASA	Computes average speed of answer from offered traffic, number of agents, talk time

=Trunk	Computes traffic carried on specific trunk from offered traffic, trunk number, total trunks in group
--------	--

Traffic formulae

Three of the most common traffic formulae are included:

Poisson	Blocked Calls Held
Erlang-B	Blocked Calls Lost
Erlang-C	Blocked Calls Wait

Value Ranges

All functions in this package operate with the following range of values:

Offered traffic	0 to 10,000 erlangs or 0 to 360,000 CCS
Number of trunks/agents	1 to 10,000
Grade Of Service	0.1% to 99.0% or P001 to P99

There are two versions of each function, one works with Erlangs and the other with CCS.

The functions are implemented by a series of complex mathematical formulae so the speed of computation is nearly the same for 10 lines as it is for 1000. *They do not rely on lookup tables.*

Accuracy of Turbo Tables functions

The accuracy of the implementation is typically better than 0.1%. (This means that if the exact Grade Of Service (GOS) is 5.2%, the functions will at worst be between 5.1% to 5.3%).

What you'll receive

What you can expect to achieve using Turbo Tables

- Determine appropriate number of lines to telephone company's Central Office
- Determine the Grade of Service of existing line group.
- Compute traffic per trunk in a group of lines.
- Determine how much traffic can be carried by an existing group of trunks.
- Perform simple network optimizations.
- Determine the number of agents in a Call Center arrangement that meets your performance criteria.

- Produce graphs of delay distributions on a queuing system.

Erlang Function Specifications

General format

Turbo Tables functions may be used in exactly the same manner as regular =functions. You must ensure that the **TURBOTAB.XLA** add-in has been attached before you load worksheets that use TT functions (Refer to Chapter 1 - Installation). Failing to do so will cause all of your existing TT worksheets previously loaded to be replaced with ='Drive and Path where Turbo Tables resides in' Formula(x,x,x). All new worksheets will not accept formula and will display #NAME?

Specifying the formula

In many of the TT functions you will have the option to specify the traffic formula to be used. Choices will be:

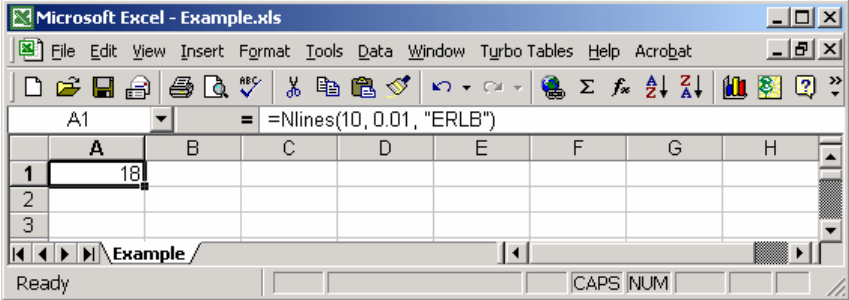
- POIS Poisson
- ERLB Erlang-B
- ERLC Erlang-C

NOTE: If this parameter is omitted, the function will assume Poisson. When you do specify a formula, it must be enclosed in double quotation marks, or it must be a reference to a cell containing a label.

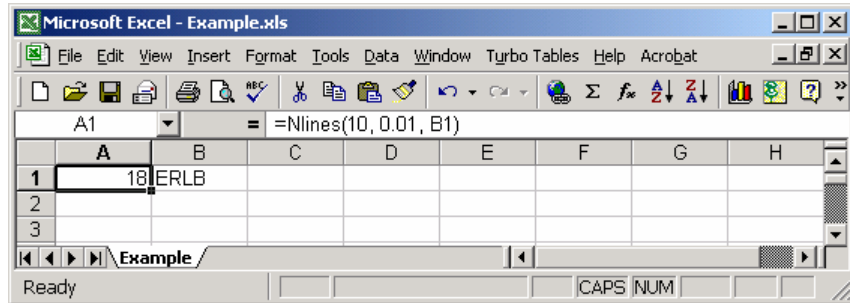
Here's what we mean

As an example, to compute the Number of Lines required to carry 10 Erlangs at a P01 Grade of Service using the Erlang-B formula, you may use either of the following approaches:

Enter `=NLines(10,0.01, "ERLB")` and your result will appear in A1.



Or, you could create a cell containing the label defining the formula you wish to use, and then enter **=NLines(10,0.01,B1)**.



NOTE: The formula name must be four characters - using either upper or lower case.

Receiving an Error message

Error Message

If the parameters are in the wrong range, the cell containing the TT function will return a short message:

Message Meaning

A<0	Offered Traffic must be zero or greater
A>1000	The functions only operate with values up to 1000 Erlangs
B<0	The Grade of Service objective must be between 0 and 1
B>1	The Grade of Service objective must be between 0 and 1
C<0	Conversation Time must be greater than zero
ERR	Insufficient parameters or wrong type
Form	Wrong spelling of traffic formula or not a label
N<0	The number of lines or agents must be zero or greater
N>1000	The Number of Lines or Agents must be below 1000
SL<0	Service Level proportion must be between 0 and 1
SL>1	Service Level proportion must be between 0 and 1
ST<0	Service Level Time must be zero or greater
T<0	Time parameters must be zero or greater
#NAME?	Misspelled =function

Number of Lines Required

The Number of Lines Required function computes the Number of Lines (or Agents for Erlang-C) required to provide a Grade of Service equal or better than a specified level.

=NLines(Offered_traffic, GOS_required, [formula])

Parameter	Definition
NLines	Between 0 and 1000
Offered_traffic	In Erlangs between 0 and 10,000
GOS_required	As a proportion between .001 and .999
Formula	"POIS" or "ERLB" or "ERLC" (<i>"POIS" assumed if parameter is missing</i>)

Example

If you have the following parameters:

- Offered Traffic of 2.5 Erlangs
- required Grade of Service of P01 (%)
- Poisson formula

You would enter the following data:

- =NLines(2.5,.01,"POIS")

Your result will be 8, which indicates that 8 lines will meet or exceed the required Grade of Service.

Grade of Service

The Grade of Service function computes the Grade of Service relevant to the specified formula, and it is based on the Offered Traffic and Number of Lines or Agents.

The Grade of Service is Blocking for Poisson and Erlang-B; it is Probability of Delay for Erlang-C.

=GOS(Offered_traffic, Number_lines, [Formula])

GOS	Between 0.0000 and 1.0000
Offered_traffic	In Erlangs between 0 and 10,000
Number_lines	Between 0 and 10,000
Formula	"POIS" or "ERLB" or "ERLC" (<i>"POIS" assumed if parameter is missing</i>)

Example

If you have the following parameters:

- Offered Traffic of 2.5 Erlangs
- 8 Trunks
- Use Poisson formula

You would enter the following data:

- =GOS(2.5,8,"POIS")

Your result will be a value of 0042 or 0.42%

Traffic capacity of a Trunk or Agent Group

This function computes the Offered Traffic, which for a given Number of Lines, experiences a given Grade of Service.

=Traffic(Number_lines, GOS_required, [formula])

Parameter	Definition
Traffic	In Erlangs between 0 and 10,000
Number_lines	Between 0 and 10,000
GOS_required	a proportion between .001 and .999
Formula	"POIS" or "ERLB" or "ERLC" (<i>"POIS" assumed if parameter is missing</i>)

Example

If you have the following parameters:

- 8 trunks
- required Grade of Service of P05 (5%)
- use the Poisson formula

You would enter the following data:

- =Traffic(8,.05,"POIS")

The result is 3.981, which means that an Offered Traffic of 3.981 Erlangs will have a Grade of Service of 5% with the Poisson formula.

Number of Agents to meet Service Level Objective

This function computes the Number of Agents required to achieve a required Service Level based on Erlang-C. It is expressed as follows:

x% of calls to be answered within y seconds

Parameter	Definition
Number_agents	Between 0 and 10,000
Offered_traffic	In Erlangs between 0 and 10,000
SL_proportion	A proportion between .001 and .999 indicating percentage of calls you wish to answer within a specified Service Level time.
SL_time ¹	Time you set for your Service Level time.
Talk_time ¹	Average time spent by an agent talking on an incoming call.

Example

If you have the following parameters:

- Service Level of 80% of calls being answered within 30 seconds
- Offered Traffic of 5.5 Erlangs
- Average Talk Time of 180 seconds

You would enter the following data:

- =Agents(5.5,0.8,30,180)

The result will be 8, which means you will need 8 agents to achieve (or better serve) your desired Service Level.

Proportion of Calls Delayed beyond a given time

This function computes the proportion of calls which are delayed beyond a given time based on the Erlang-C formula.

=DelayQ(Offered_traffic, Number_agents, test_time, [Talk_time])

Parameter	Definition
DelayQ	A proportion between 0 and 1 indicating percentage of calls that are delayed beyond the Test_time.
Offered_traffic	In Erlangs between 0 and 10,000
Number_agents	Between 0 and 10,000

¹Talk Time, Service Level Time and Test Time must all be expressed in the same units e.g all in seconds or all in minutes. If Talk Time is omitted, it is assumed to be 1.

Test_time ¹	Time you set for the delay calculation.
Talk_time ¹	Average time spent by an agent talking on an incoming call.

Example

If you have the following parameters:

- Offered Traffic of 5.5 Erlangs
- 9 Agents
- Average Talk Time of 180 seconds

You would enter the following data:

- =DelayQ(5.5,9,30,180)

The result will be 0.927, which means that 92.7% of Offered Calls will be answered within 30 seconds.

Average Speed of Answer

The ASA function computes the Average Speed of Answer based on the Erlang-C formula

=ASA(Offered_traffic, Number_agents, [Talk_time, [Delay_Flag]])

Parameter	Definition
ASA	average speed of answer <i>in same units as Talk_time</i>
Offered_traffic	In Erlangs between 0 and 10,000
Number_agents	Between 0 and 10,000
Talk_time ¹	Average time spent by an agent talking on an incoming call.
Delay_Flag ¹	If this is 1, the function will compute the ASA for delayed calls only. If it is zero or absent, the function will compute the ASA for all calls.

Example

If you have the following parameters:

- Offered Traffic of 5.5 Erlangs
- 9 Agents
- Average Talk Time of 180 Seconds

You would enter the following data:

- =ASA(5.5,9,180)

The result would be 6.7 seconds for all calls. The average for delayed calls only (delay flag set to 1) is 51.4 seconds.

Be Aware!

These queuing functions are all based on the Erlang-C formula. This formula *assumes* the following:

- there are sufficient incoming trunks, so there will be no 'busies'
- callers do not abandon their calls before they are answered
- agents do not have any post-talk work time

The general result is that Erlang-C generally overestimates the Number of Agents Required. If you are dealing with a situation of heavy loads and frequent busies, you should consider our ***Hills-B Optimizer Pro*** software.

Traffic Engineering Review

Erlang Functions Guide

Function	Notes
=NLines(A,B,[F])	Number of lines that achieve required GOS
=GOS(A,N,[F])	Grade Of Service in range 0.0000 to 1.0000
=Traffic(N,B,[F])	Traffic capacity in erlangs
=Trunk(A,M,[F,N])	Traffic carried on specific trunk in erlangs
=Agents(A,SP,ST,[C])	Number of agents required using Erlang-C
=DelayQ(A,N,T,[C])	Proportion of calls delayed using Erlang-C
=ASA(A,N,[C])	Average speed of answer using Erlang-C

NOTE: Parameters in brackets like [F] are optional and may be omitted.

Parameter	Definition
A	Offered traffic in Erlangs - in range 0 to 10,000
B	GOS objective - in range .001 to .999
N	Number of trunks [ERLB,POIS] Number of agents [ERLC].
F	Formula to be used POIS, ERLB or ERLC. The formula must be a reference label of POIS, ERLB or ERLC. If it is entered into the function directly it must be enclosed in quotation marks. Any combination of upper and lower case may be used for the four characters.
M	Trunk number for traffic per trunk function.
SP,ST	Service Level is expressed as <i>SP%</i> of calls answered in <i>ST</i> seconds. Where Service Level Proportion - in range 0 to 1; Service Level Time from zero upwards
T	Test Time for computation of proportion of calls delayed beyond this time.
C	Talk Time used in Erlang-C functions.

Talk Time, Service Level Time and Test Time must all be expressed in the same units, e.g. all in seconds or all in minutes. If Talk Time is omitted, it is assumed to be 1

CCS Functions Guide

Function	Notes
=NLinesC(A,B,[F])	Number of lines that achieve required GOS
=GOSC(A,N,[F])	Grade Of Service in range 0.0000 to 1.0000
=TrafficC(N,B,[F])	Traffic capacity in CCS
=TrunkC(A,M,[F,N])	Traffic carried on specific trunk in CCS
=AgentsC(A,SP,ST,[C])	Number of agents required using Erlang-C
=DelayQC(A,N,T,[C])	Proportion of calls delayed using Erlang-C
=ASAC(A,N,[C])	Average speed of answer using Erlang-C

NOTE: Parameters in brackets like [F] are optional and may be omitted.

Parameter	Definition
A	Offered traffic in CCS - in range 0 to 360,000
B	GOS objective - in range .001 to .999
N	Number of trunks [POIS or ERLB] Number of Agents [ERLC]
F	Formula to be used POIS, ERLB or ERLC The formula must be a reference label of POIS or ERLB or ERLC. If it is entered into the function directly it must be enclosed in quotation marks. Any combination of upper and lower case may be used for the four characters.
M	Trunk number for traffic per trunk function.
SP,ST	Service Level is expressed as <i>SP% of calls answered in ST seconds.</i> Where Service Level Proportion - in range 0 to 1 Service Level Time from zero upwards
T	Test Time for computation of proportion of calls delayed beyond this time
C	Talk Time used in Erlang-C functions

Talk Time, Service Level Time and Test Time must all be expressed in the same units, (all in seconds or all in minutes). If *Talk Time* is omitted, it is assumed to be 1.

Traffic Formulae Review

There are a wide variety of different traffic formulae. The characteristics they have in common are:

- Offered Traffic,
- Number of Lines (or Agents)
- Grade Of Service

The major difference between the formulae is what is assumed to happen when a call is blocked. Each formula has its own area of applicability. The most common formulae and their assumptions are explained below.

Most Common Formulae

Poisson

For many years Poisson was the most popular formula in North America. This formula is based on the not-very-realistic assumption that somehow a blocked call waits around for the duration of the average conversation time, and if a trunk becomes available during this time, the call is carried on that trunk for the balance of the conversation time.

Though not the perfect formula, it was adopted because it took in some account of the retries of a blocked call.

(Note: Some of the blocked traffic is carried so the overflow is less than the product of the offered traffic and blocking.)

Erlang B

The Erlang-B formula assumes that a blocked call is lost and never reappears. This is not a very good model for sizing Central Office trunks, as it does not take into account the all-important retries.

Erlang-B's main application is in Automatic Route Advance networks. When this type of network finds that all trunks in one group are busy, it immediately offers the call to an alternative trunk group.

As far as the first trunk group is concerned, the assumptions of the Erlang-B formula are satisfied because as far as Erlang-B is concerned, the blocked call never reappears - the alternative trunk group carries the blocked call.

Erlang C

The Erlang-C formula assumes that blocked calls go into a queue with an infinite number of waiting places. All calls will eventually be served, but after a greater or lesser delay.

Since all calls are served according to this formula, the offered traffic (in Erlangs) must be less than 99% of the number of trunks; otherwise, the average delay time of people in queue will become excessively large.

The probability of blocking is independent of the average conversation time, but the average delay is directly proportional to the conversation time.

Measuring Offered Traffic

Erlang and CCS traffic defined

The **TT** functions contain two versions, Erlangs and CCSs.

Offered Traffic is defined as the volume of traffic in the particular hour that is offered to a group of trunks or agents. This traffic is measured in either hours of usage or in 100-second increments.

When measured in hours per hour, the unit is called **Erlangs**. When measured in 100 second increments, it is called **CCS**. Since there are 3600 seconds in one hour, there are 36 100-units in an hour.

Erlang

If you have the offered traffic in terms of:

- calls per hour
- minutes per call

you may convert it to Erlangs by:

$$\text{Traffic in Erlangs} = \frac{\text{Calls per Hour} \times \text{Mins per Call}}{60}$$

CCS

If you know the traffic

- hours per month (Day time)
- days per month
- busy hour proportion,

you can compute the busy hour traffic:

$$\text{Traffic in Erlangs} = \frac{\text{Hours per month} \times \text{Busy hour proportion}}{\text{Days per month}}$$

Number of Lines or Agents

With Erlang-B or Poisson the number in the traffic formula is the number of lines in a group of trunks. With Erlang-C it is the number of agents in a group, the number of trunks is assumed infinite.

Grade of Service

Most common, Probability of Blocking

There are many different ways of expressing Grade of Service. The most common is *Probability of Blocking* - the probability that a call finds all trunks busy at the instant the call arises. Blocking is frequently expressed in the P format, such as P05, which means a probability of .05 or 5% of a call finding all trunks busy.

For a system without queuing, Grade of Service normally refers to the probability of a caller getting a busy signal when he or she makes a call to a CO line or other type of service.

Call vs. Time Blocking

Call Blocking versus Time Blocking

Technically, Grade of Service is the *Call Blocking* probability. If your switch gives Peg counts, the measured Grade of Service will be the ratio of Blocked Calls to Call Attempts.

There is another measure of Grade of Service, which is *Time Blocking*. Time Blocking is the proportion of time that all trunks in a group are busy.

The Time Blocking may be computed from a traffic report that gives a count of *All Trunks Busy Seconds* (ATBS). It will be the number of such seconds divided by the number of seconds in the observation period. For instance if, in a 1-hour period the ATBS count was 54, the time blocking probability was

$$\frac{54}{3600} = 0.015 \text{ (or 1.5\%)}$$

NOTE: It is important to realize that the Time Blocking and Call Blocking probabilities are sometimes very different. The difference occurs because of callers' retry behavior.

Differences between Call and Time Blocking

As a simple example, consider the situation where the Call Blocking is 0.10 (i.e. the trunks are blocked 10% of the time). As we all know, when a caller is given a busy signal on dialing 9 for an outside line, the immediate impulse of most callers is to try again.

In all probability they will try again within a short period of time, and in many cases the congestion that they encountered the first time will still be there. In our example, if 50 % of the blocked callers do call again once within a short period, they will all receive busies.

If there were 100 first-call attempts in the hour, the Peg counts will record a total of 105 Call Attempts (the original 100 plus 5 repeat attempts of the 10 blocked calls), and 15 busy counts. Based on the Peg counts, the Call Blocking is:

$$\frac{15}{105} = 0.143 \text{ (or 14.3\%)}$$

This is considerably higher than the 10.0% Time Blocking. The difference gets higher the higher the blocking.

You need to note the following:

- Erlang-B and Erlang-C traffic tables give the Time Blocking
- Poisson gives you the Call Blocking
- Poisson only approximates the effect of Retries
- Erlang-B ignores Retries

Which Grade of Service to use

In a blocked system, such as a CO trunk group where there is no overflow, the opinions differ as to the "best" Grade of Service. For most applications communication managers find that P01 Grade of Service is good or very good, P02 to P05 is often adequate, and P10 or higher is terrible.

Managers using the Erlang-B formula usually design to a lower (i.e. better) Grade of Service. Middle-of-the-road managers use P02, good is P005 (0.5% or 1 per two hundred calls) and poor is P05.

Interestingly enough, the number of lines chosen is almost the same as the number chosen with Poisson and their objectives.

How to measure Grade of Service

The most important thing to realize with traffic is that it is a very volatile commodity. By this we mean that the number of simultaneous calls varies considerably from moment to moment.

Therefore, measuring just a small sample is very dangerous. Traffic theory can tell you very little about one particular hour alone. In all cases, the Grade of Service is a number ranging from 0 to 1.000. So, if you wish to enter a Grade of Service of P01 (meaning 1 in 100 calls being blocked), you would enter .01 or 1% into the spreadsheet

CCS Function Specifications

General format

Turbo Tables functions may be used in exactly the same manner as regular =functions. You must ensure that the **TURBOTAB.XLA** add-in has been attached before you load worksheets that use Turbo Tables functions (if needed please refer to Chapter 1 - Installation. Failing to do so will cause all of your existing Turbo Tables worksheets loaded to be replaced with ='Drive and Path where Turbo Tables resides in' Formula(x,x,x). All new worksheets will not accept the formula and will display #NAME?

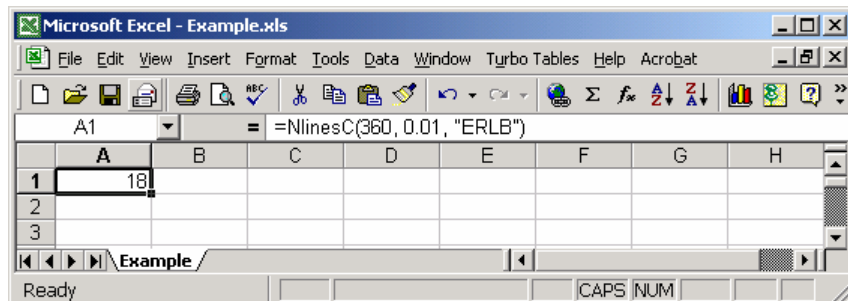
Specifying the formula

In many of the Turbo Tables functions you may specify the traffic formula to be used. Your choices are:

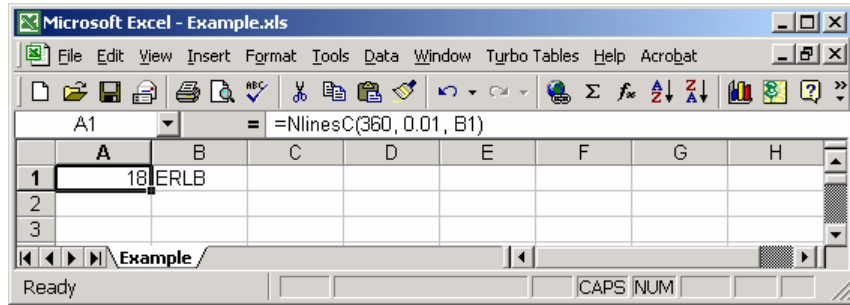
POIS	Poisson
ERLB	Erlang-B
ERLC	Erlang-C

If the parameter is omitted, the function will assume Poisson. If you specify the function, it must be enclosed in double quotation marks or be referenced in a cell containing a label.

For instance to compute the number of lines required to carry 360 CCS at a P01 Grade of Service using the Erlang-B formula, you may use either of the following examples below:



Or, create a cell containing the label defining the formula to be used:



NOTE: The formula name must be four characters (upper or lower case).

Error Message

If the parameters are in the wrong range, the cell containing the Turbo Tables function will return a short message:

Message	Meaning
A<0	Offered traffic must be zero or greater
A>36000	The function only operates with values up to 36000 CCS
B<0	The Grade Of Service objective must be between 0 and 1
B>1	The Grade Of Service objective must be between 0 and 1
C<0	Conversation Time must be greater than zero
ERR	Insufficient parameters or wrong type
Form	Wrong spelling of formula or not a label
N<0	The number of lines or agents must be zero or greater
N>1000	The number of lines or agents must be below 1000
SP<0	Service Level Proportion must be between 0 and 1
SP>1	Service Level Proportion must be between 0 and 1
ST<0	Service Level Time must be zero or greater
T<0	Time parameters must be zero or greater
*****	Offered traffic greater than number of agents in for Erlang-C

Number of Lines required

This function computes the Number of Lines (or agents for Erlang-C) required to provide a Grade of Service equal to or better (i.e. smaller) than a specified level.

=NLinesC(Offered_traffic, GOS_required, [Formula])

Parameter	Definition
NLinesC	Between 0 and 1000
Offered_traffic	In CCS between 0 and 360,000
GOS_required	As a proportion between .001 and .999
Formula	"POIS" or "ERLB" or "ERLC" (<i>"POIS" assumed if parameter is missing</i>)

Example

If you have the following parameters:

- Offered Traffic of 90 CCS
- required Grade of Service of P01 (1%)
- use the Poisson formula

You will enter the following data:

- =NLinesC(90,.01,"POIS")

The result will be a value of 8, which indicates that 8 lines will meet or exceed the required Grade of Service.

Grade of Service

This function computes the Grade of Service relevant to the specified formula, based on the Offered Traffic and Number of Lines or Agents.

The Grade of Service is Blocking for Poisson and Erlang-B; it is Probability of Delay for Erlang-C.

=GOSC(Offered_traffic, Number_lines, [Formula])

Parameter	Definition
GOSC	Between 0.0000 and 1.0000
Offered_traffic	In CCS between 0 and 360,000
Number_lines	Between 0 and 1000
Formula	"POIS" or "ERLB" or "ERLC" (<i>"POIS" assumed if parameter is missing</i>)

Example

If you have the following parameters:

- Offered Traffic of 90 CCS
- 8 Trunks
- use the Poisson formula

You will enter the following data:

- =GOSC(90,.01,"POIS")

The result will be 0042 or 0.42%

Traffic Capacity of a trunk or agent group

Computes the Offered Traffic that, for a given number of lines, experiences a given Grade of Service.

=TrafficC(Number_lines, GOS_required, [Formula])

Parameter	Definition
TrafficC	In CCS between 0 and 360,000
Number_lines	Between 0 and 10,000
GOS_required	A proportion between .001 and .999
Formula	"POIS" or "ERLB" or "ERLC" (<i>"POIS" assumed if parameter is missing</i>)

Example

If you have the following parameters:

- 8 Trunks
- Grade of Service of P05 (5%)
- use the Poisson formula

You will enter the following data:

- =TrafficC(90,.05,"POIS")

The result will be 143.3, which means an Offered Traffic of 143.3 CCS will have a Grade of Service of 5% using the Poisson formula.

Number of Agents to meet Service Level Objective

Computes Number of Agents required to achieve a required Service Level based on Erlang-C. The Service Level is expressed as:

x% of calls to be answered within y seconds

Parameter	Definition
Number_agents	Between 0 and 10,000
Offered_traffic	In CCS between 0 and 360,000
SL_proportion	A proportion between .001 and .999 indicating percentage of calls you wish to answer within a specified Service Level time
SL_time ¹	Time you set for your Service Level time
Talk_time ¹	Average time spent by an agent talking on an incoming call

Example

If you have the following parameters:

- a Service Level of 80% of calls being answered within 30 seconds
- Offered traffic of 198 CCS
- Average Talk Time of 180 seconds

You will enter the following data:

- =AgentsC(198,0.8,30,180)

The result will be 8, indicating that you will need 8 Agents to achieve or better your desired Service Level.

¹Talk Time, Service Level Time and Test Time must all be expressed in the same units e.g all in seconds or all in minutes. If Talk Time is omitted, it is assumed to be 1.

Proportion of Calls Delayed beyond a given time

Computes the proportion of calls that are delayed beyond a given time based on the Erlang-C formula.

=DelayQC(Offered_traffic, Number_agents, Test_time,[Talk_time])

Parameter	Definition
DelayQC	A proportion between 0 and 1 indicating percentage of calls that are delayed beyond the Test_time
Offered_traffic	In CCS between 0 and 360,000
Number_agents	Between 0 and 10,000
Test_time ¹	Time you set for the delay calculation
Talk_time ¹	Average time spent by an agent talking on an incoming call

Example

If you have the following parameters:

- Offered Traffic of 198 CCS
- 9 Agents
- Service Level expressed based on 30 seconds
- Average Talk Time of 180 seconds

You will enter the following data:

- =DelayQC(198,9,30,180)

The result will be 0.927, indicating that 92.7% of your calls will be answered within 30 seconds.

Average Speed of Answer

Computes the Average Speed of Answer based on Erlang-C formula.

=ASAC(Offered_traffic, Number_agents,[Talk_time,[Delay_Flag]])

Parameter	Definition
ASAC	Average speed of answer <i>in same units as Talk Time</i>
Offered_traffic	In CCS between 0 and 360,000
Number_agents	Between 0 and 10,000
Talk_time ¹	Average time spent by an agent talking on an incoming call
Delay_Flag1	If this is 1, the function will compute the ASA for delayed calls only. If it is zero or absent, the function will compute the ASA for all calls.

Example

If you have the following parameters:

- Offered Traffic of 198 CCS
- 9 Agents
- Average Talk Time of 180 Seconds

You will enter the following data:

- =ASAC(198,9,180)

The result will be 6.7, indicating that the ASA will be 6.7 seconds for all calls.

Be Aware!

These queuing functions are all based on the Erlang-C formula. This formula *assumes* the following:

- there are sufficient incoming trunks, so there will be no 'busies'
- callers do not abandon their calls before they are answered
- agents do not have any post-talk work time

The general result is that Erlang-C generally overestimates the Number of Agents Required. If you are dealing with a situation of heavy loads and frequent busies, you should consider our *Hills-B Optimizer Pro* software.

Turbo Tables Functions

Functions and Samples

All **TT** functions have two versions, the first using Erlangs and the other using CCS. You may utilize whichever you are most familiar. Both are installed into your worksheet, and using both is an option as well.

Below you will find some examples of utilizing the **TT** functions.

Compute Number of Lines using Erlang version

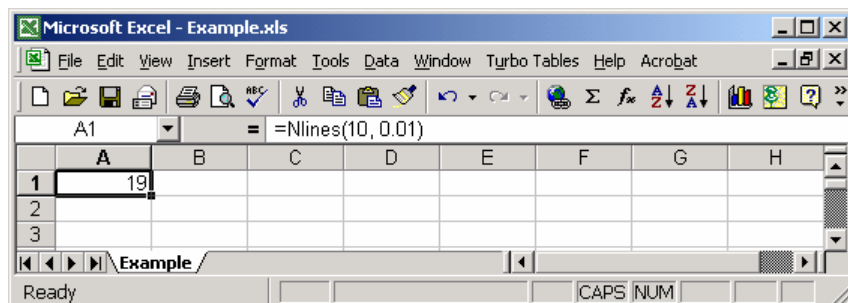
This result tells us that we need 19 lines to achieve a service level of 1%.

To compute the number of lines required to carry 10 Erlangs at a P01 Grade of Service, enter **=NLINES (10,.01)**. This result tells us that we need 19 lines to achieve a service level of 1%.

*Number of Lines Sample
Using Erlang*

NOTE:

- P01 is entered as .01 or 1%.
- You may enter the characters NLINES in any combination of upper and lower case, and it will always be stored as NLines.
- The =NLines function assumes you wish to use the Poisson formula if one is not specified.

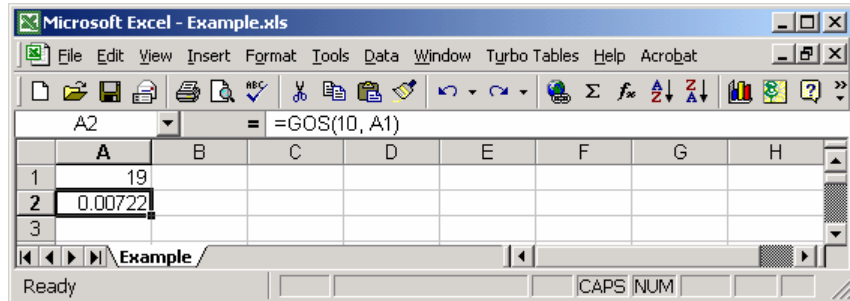


Compute Number of Lines using CCS version

If you prefer using CCS, enter `=NLinesC(360,.01)`, and the result will be the same as above.

Compute Grade of Service using Erlang

To compute the actual Service Level, in Cell A2 enter `=GOS(10,A1)`. The results tell us that 19 lines will achieve a Grade of Service of .00722 or 0.72%.

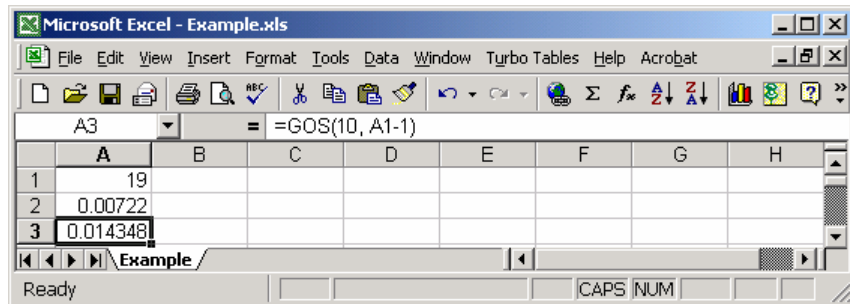


	A	B	C	D	E	F	G	H
1	19							
2	=GOS(10, A1)							
3								

Compute Grade of Service using CCS

Those who use the CCS version will enter in Cell A2, `=GOSC(360,A1)`, and the results will be the same as above.

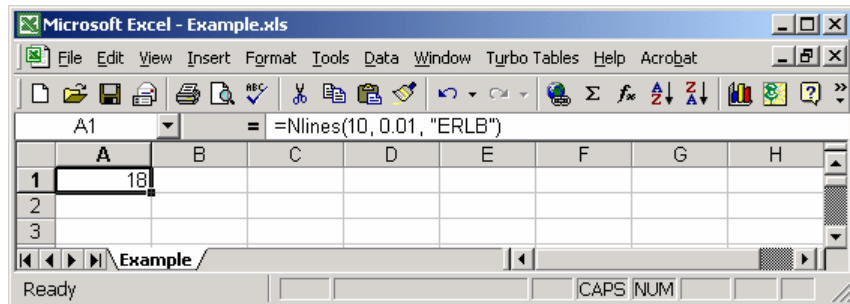
Let's take another example of the Grade of Service. In the sample below we show one less than the required Number of Lines. Enter in Cell A3, `=GOS(10,A1-1)`. The result shows us that one less than the required Number of Lines achieves a Grade of Service of only .014348 or 1.43%.



	A	B	C	D	E	F	G	H
1	19							
2	0.00722							
3	=GOS(10, A1-1)							

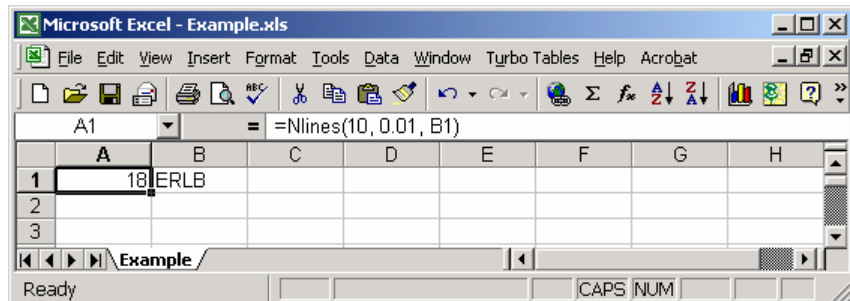
Number of Lines based on the Erlang B formula

You may use either Erlang-B or Erlang-C traffic formulae in place of the Poisson formula. To compute the Number of Lines required to carry 10 Erlangs at a P01 Grade of Service under the Erlang-B traffic formula, enter **=NLines(10,.01,"ERLB")** in Cell A1.



Alternatively, you could create a cell containing the label defining the formula to be used as follows:

Enter **ERLB** in Cell B1, and enter **=NLines(10,.01,B1)**. See sample below:



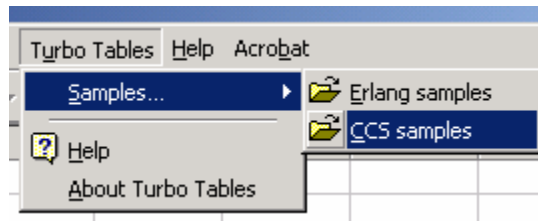
Erlang or CCS - the choice is yours

Choosing between Erlang and CCS

This User's Manual contains many different examples of the use of these functions sampled above. In order to simplify the presentation, some chapters are dedicated to either the Erlang or the CCS version of the functions. Read the one with which you feel the most comfortable.

If you have no preference, we recommend the Erlang version.

Sample worksheets



You can open either of the two sample worksheets by selecting 'Samples...' from the Turbo Tables menu command which is located on the main Excel worksheet menu bar.

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