

Agent shrinkage calculations for T-Calc(PhoneCalc) and T-Plan Version 2.0

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Abstract

This document describes the framework, terminology, and detailed calculations used for agent shrinkage in the Mitan PhoneCalc Suite. Also described is the method of estimating agent attendance and FTE requirements without recourse to detailed shift planning.

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1 Introduction

Agent shrinkage means the various time overheads that prevent all of an agents time for which they are employed being available for actually taking calls. (This document talks in terms of phone calls, but this should be understood to mean also emails, faxes, correspondence, and so on.) The calculations for shrinkage are in one sense obvious, but it is necessary to have a structure for the calculations, and to define some terminology. The structure and terminology described in this document are used in the Mitan programs such as the PhoneCalc Suite programs.

1.1 Purposes of the calculations

Call-centre planning typically uses forecasting and queueing theory to calculate how many agents will be needed to take calls during each interval of a day. Shrinkage factors then need to be taken into account in order to answer the following questions.

1.1.1 How many agents need to be assigned in a particular interval?

Queueing theory, such as Erlang-C or Mitan-C or other models, can be applied to a single interval to tell us how many agents are needed so that, on average, the service-level targets will be met. These calculations usually assume that an agent is available for calls the whole time they are assigned to call-taking. In practice agents may be permitted ¹ to be away from the phone for a few minutes each assigned hour, for comfort breaks or to get a coffee. This "unaccounted time" factor needs to be incorporated into the queueing-theory models used ², and this has been done in the Mitan implementations of a range of queueing-theory models.

1.1.2 How many agents need to be scheduled to attend on a particular day?

A significant part of an agents time may be taken up with team meetings, coaching, breaks and so on, so that an agent will be able to deliver only a certain amount of time for call-taking. We therefore need to take account of shrinkage to convert the call-taking time required into the number of agents required on a particular day. A further complication is the matching of agent shift times to the call-taking demand pattern. For day-to-day planning a call-centre will normally use sophisticated WFM³ packages to plan actual shift patterns for agents. For budgeting and exploratory planning, the calculations described in this document provide a useful and quick way of answering this question without the need for the sometimes cumbersome⁴ WFM software to be used.

1.1.3 How many agents need to be employed?

For budget calculations about how much it will cost each year to provide a service, the agent attendance requirements for each day need to be aggregated and the other overhead factors such as vacation and absence, induction of new agents due to attrition, need to be factored in.

1.2 Shrinkage categories

Shrinkage can broadly be divided into the following five categories, which are explained in more detail below.

- Employment, such as induction training
- Yearly, such as vacation
- Daily, such as meal breaks
- Overfit, unproductive time due to mismatching of shift and demand patterns
- On-phone, or "unaccounted" time, assigned agents not in fact available for calls.

¹In some countries it is a requirement under employment laws that such an allowance is made.

²The unaccounted time must be an integral factor of the mathematics of the queueing models because of the complex and non-linear behaviour of queueing systems.

³Work-Force Management

⁴Cumbersome because of the level of detail and personnel information that WFM needs to take into account.

1.3 Levels of shrinkage

The chart shown in Figure 2 illustrates the levels of shrinkage. At the left we start with Employed time represented as 100%. As we progress to the right, various time overheads are deducted, until in the right-hand column the yellow area represents the percentage of an agents time that is actually available for handling calls. (This includes the time spent waiting for calls). The various overheads are grouped so that shrinkage can be represented as several levels, which are explained below.

- Employed: the total time for which an agent is employed, expressed as days accounted.
- Qualified: employed time less annualised induction training.
- Rostered: days scheduled to attend primarily for the purpose of handling calls.
- Attended: rostered time less absence for illness and similar factors.
- Assigned: time assigned to the phones, which is attended time less daily overheads.
- Available: assigned time less an allowance per assigned hour for miscellaneous short breaks.

1.4 Shrinkage ratios

Ratios of different categories of agent time are displayed in the shrinkage panel of the PhoneCalc Suite shrinkage calculator, which is shown in Figure 4. The user can fix and category as the basis for the ratios. In the example shown, in order to have one agent hour available (that is actually available for call-handling, meaning talk time, wrap-time, or ready for a call) requires 1.7 hours of rostered time, or 2.14 hours of employed time. These figures depend, of course, on the particular input values used to produce the illustration.

1.5 Other considerations

Accounted time

The starting point for shrinkage calculations is the total amount of time for which an agent is employed. This is specified by the accounted days, which is the nominal working days per year for an agent, together with the average daily shift length, in hours. These overall values should include all the shrinkage components listed below, since those components will be deducted from the total accounted time to arrive at the amount of time an agent is actually available for handling calls.

Paid or non-paid time

Some shrinkage factors are paid agent time, while some, such as meal breaks, are unpaid. Depending on the purpose of the calculations you are doing, you may wish to work with just paid time or all the agent time. For budgeting calculations it may be that only paid time is of interest, since the essential question is likely to be how much it will cost to provide the required amount of agent time assigned to call-taking. For more general management purposes all of the agent time may be of interest. If only paid time is of interest, then unpaid shrinkage factors should be set to zero.

2 Components of shrinkage

This section defined all the input parameters for the shrinkage calculations. Each parameter is given a variable name, with a suffix that specifies the units in which the parameter is measured. Names are of the form $(abc)_{sfx}$. The "abc" is the actual name of the variable, intended to be descriptive. The "sfx" is a suffix which specifies the units in which the value is expressed. This form makes the variable names fairly long, but is intended to avoid ambiguity.

2.1 Employment shrinkage

A newly-recruited agent will normally undergo some kind of induction training, as distinct from in-service training on new products or services. Employment shrinkage is specified by the number of days of induction training required, and the average length of employment for an agent. Induction shrinkage will be converted to days per agent-year.

Table 1: Employment shrinkage variables

| Description | Variable |
|---|---------------------------------------|
| Average length of employment for an agent | $(\text{employment})_{\text{months}}$ |
| Length of induction | $(\text{induction})_{\text{days}}$ |

2.2 Yearly shrinkage

Yearly shrinkage covers those items that are conveniently measured in whole days per year, and are listed in the Table 2. The values of yearly shrinkage parameters are controlled on the upper input panel of the shrinkage display, as shown in Figure

Table 2: Yearly shrinkage components and variables

| Yearly shrinkage component | Description | Variable |
|----------------------------|--|--|
| Accounted | The number of days per year to be accounted for. | $(\text{accounted year})_{\text{days/year}}$ |
| Training | Regular training on new products, systems, or procedures. | $(\text{training})_{\text{days/year}}$ |
| Vacation | Annual vacation entitlement. | $(\text{vacation})_{\text{days/year}}$ |
| Public Holidays | Public holidays in addition to annual vacation. | $(\text{public hols})_{\text{days/year}}$ |
| Other non-roster | Days for other, unspecified, activities. | $(\text{other non-rostered})_{\text{days/year}}$ |
| Absenteeism | Unplanned absence for illness and so on. Absenteeism is expressed as a percentage chance that an agent will be absent on a roster day, or as a number of days. | $(\% \text{absent})$ or $(\text{absent})_{\text{days/year}}$ |

2.3 Daily shrinkage

Daily shrinkage is those items that apply to a rostered day, where a rostered day is a day on which the agent is scheduled to be in the call centre primarily for the purpose of answering calls (not training, for example). The items are listed in Table 3.

Table 3: Daily shrinkage components and variables

| Daily shrinkage component | Description | Variable |
|----------------------------|---|--|
| Average shift | The length of an average shift. | $(\text{average shift})_{\text{mins/day}}$ |
| Meals | Meal breaks | $(\text{meals})_{\text{mins/day}}$ |
| Breaks | Breaks other than meal breaks. | $(\text{breaks})_{\text{mins/day}}$ |
| Team meetings and coaching | Time required per agent per day for team meetings and coaching sessions | $(\text{team/coach})_{\text{mins/day}}$ |
| Non-phone tasks | Time assigned to non-phone tasks. | $(\text{non-phone})_{\text{mins/day}}$ |

2.4 Overfit

Overfit is the inefficiency that results from a mismatch between the workload demand pattern for agent time, and the agent shift patterns. It may be necessary to schedule more agents to attend the call centre than the simple calculation of assigned time and assigned-time-per-agent-day would suggest. Detailed planning using a WFM package could be used to calculate the overfit for each day, but the parameters used here can provide good estimates without recourse to a full shift-planning algorithm. The parameters used are listed in Table 4.

Table 4: Overfit parameters

| Overfit parameter | Description | Variable |
|---------------------------|---|--|
| Specified overfit | A fixed percentage overfit specified by the user. | $(\% \text{specified overfit})$ |
| Round-up attending agents | Calculated attending agents required is rounded up to an integer. | $(\text{round-up overfit})_{\text{boolean}}$ |
| Factor in peak agents | Ensure attending agents \geq peak assigned agents. | $(\text{peak overfit})_{\text{boolean}}$ |

Specified overfit

The shift plan for agents may not be able to match the assigned agents in an interval to the number required for performance targets. It may be necessary to assign a greater number of agent-hours than the demand curve actually requires. The shift-overfit parameter says how much greater the actual assigned hours will be compared to the required agent hours. Specified overfit is a percentage increase in the number of agents scheduled to attend. The effect is very similar to "non-phone tasks" element of daily shrinkage, except that it is specified as a percentage rather than time. It can be argued that shift overfit time could be used for things like team meetings and coaching⁵, and should therefore be set to zero.

Round-up agents

The calculated number of agents attending is, in general, a fractional value. This option will ensure that the number of agents is always an integer value.

Use peak agents

In deciding how many agents need to be scheduled for attendance on a particular day, the peak number of agents can, optionally, be taken into account. For example, the number of agent-hours that needs to be assigned to call-taking might be deliverable from 32 agents attending. But the peak requirement in the busiest interval might be, say, 35 agents. It may therefore be necessary to plan for 35 agents attending, rather than 32, so that the peak requirement can be met. In practice it may be possible to divert a few agents from other parts of the call-centre for the peak intervals, so that only 32 agents need be scheduled.

⁵An explicit option to recognise this is planned for future development.

2.5 Assigned shrinkage

While an agent is assigned to the phones, the agent may not be expected to account for 60 minutes per hour of their time, but may be permitted some time (for example 10 minutes) that does not have to be registered as either direct handling of calls (talk and wrap time) or ready for a call. This time may include comfort breaks, some allowance for fetching a coffee, and some time just for taking a short break from calls at the desk. This time is referred to as unaccounted or ad-hoc time, and is expressed as the number of minutes per hour allowed.

Table 5: Assigned shrinkage variables

| Description | Variable |
|---|--|
| Unaccounted time while an agent is assigned to call-taking | $(\text{unaccounted})_{\text{mins/hour}}$ |
| Breaks per hour. Used for simulation but not for queueing-theory. | $(\text{unaccounted breaks})_{\text{breaks/hour}}$ |

2.6 Levels of Shrinkage

The chart shown in Figure 1 illustrates the levels of shrinkage. At the left we start with Employed time represented as 100%. As we progress to the right, various time overheads are deducted, until in the right-hand column the yellow area represents the percentage of an agents time that is actually available for handling calls. (Some of this time will in practice be spent waiting for calls). The various overheads are grouped so that shrinkage can be represented as several levels, as explained below.

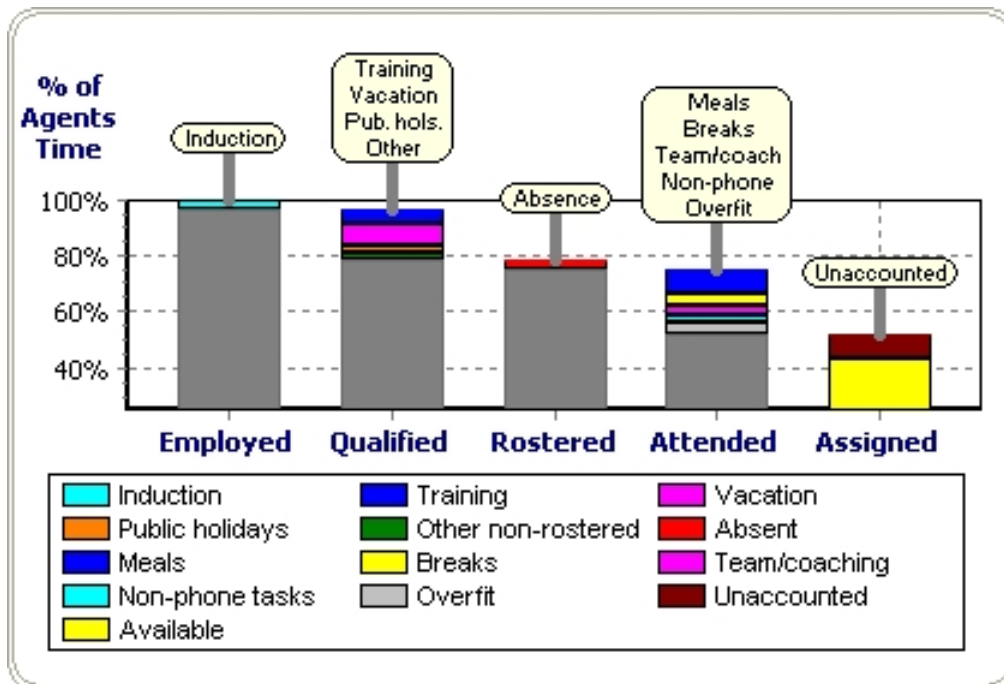


Figure 1: Shrinkage chart

Employed

This is the total time for which an agent is employed. This is expressed as days accounted, which means the number of days per year for which the agent is employed, including vacation, public holidays, absence, and other factors which mean the agent does not actually attend the call-centre, regardless of whether these factors are paid or unpaid time. This is the total number of days per year that the shrinkage calculations must account for, and might be, say, 260 days.

Qualified

A newly-recruited agent will normally undergo some induction training. How much overhead this represents will depend on the length of employment as an agent. For example the induction training may be 15 days, and the average length of employment might be 18 months. The induction training is annualised to $10=15*(12/18)$ days per year, so that the one employed agent would contribute $260-10=250$ days per year as a trained agent.

Rostered

Rostered means scheduled to attend the call-centre primarily for the purpose of handling calls. Roster time therefore excludes vacation, public holidays, other non-roster days.

Attended

Attended time is the number of days an agent is rostered, less absence. Absence for illness and so on is assumed to impact rostered time. Vacation, public holidays, training and so on, are assumed to be mandatory, so that, for example, a day of training lost through absence would have to be made up by taking a day from rostered time. Absence is expressed as a percentage chance that an agent will be absent on a rostered day. This is the same as the average percentage of rostered days on which an agent will be absent. Alternatively, the number of days of absence can be entered directly.

Assigned

An agent attending the call-centre will require time for meals, other breaks, team meetings, and coaching. Assigned time is attended time less these daily overheads.

Available

An agent assigned to call-handling might not be required to account for 60 minutes of every hour as talk time, wrap time, or ready for calls. An allowance of, say 10 minutes ad-hoc time per assigned hour may be given for comfort breaks, getting a coffee, or just taking a short respite from calls. Available time is assigned time less unaccounted time.

2.7 Shrinkage ratios

Ratios of different categories of agent time are displayed in the shrinkage panel of the PhoneCalc Suite shrinkage calculator, which is shown in Figure 2. The user can fix and category as the basis for the ratios. In the example shown, in order to have one agent hour available (that is actually available for call-handling, meaning talk time, wrap-time, or ready for a call) requires 1.7 hours of rostered time, or 2.14 hours of employed time. These figures depend, of course, on the particular input values used to produce the illustration.

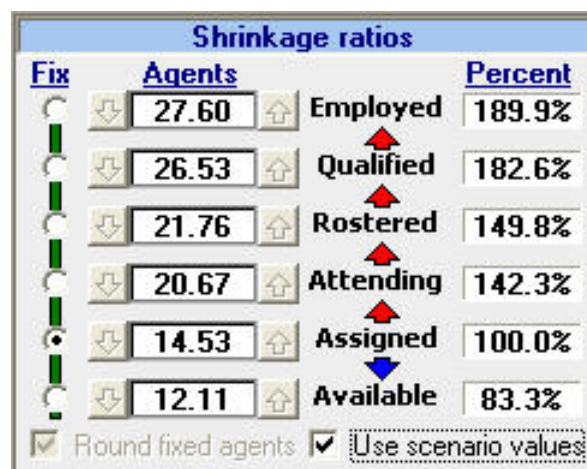


Figure 2: Shrinkage ratio display

3 Detailed shrinkage calculations

The calculations are described here starting with total accounted days and working down to time assigned to the call-taking. This establishes the ratios between different levels of agent time. In practical planning calculations, the starting point will usually be assigned time, as this will be available from applying a queueing-theory model to each interval of a day.

3.1 Annualise induction

Induction training must first be expressed as an annualised number of days.

$$(\text{annualised induction})_{\text{days per year}} = \left[\frac{12}{\text{employment}_{\text{months}}} \right] \cdot (\text{induction})_{\text{days}} \quad (1)$$

3.2 Qualified and rostered days

Now we can calculate the average number of qualified days and rostered days per agent per year, simply by deducting the yearly components.

$$(\text{qualified})_{\text{days/year}} = (\text{accounted year})_{\text{days/year}} - (\text{annualised induction})_{\text{days/year}} \quad (2)$$

$$\begin{aligned} (\text{rostered})_{\text{days/year}} = & (\text{qualified})_{\text{days/year}} - (\text{training})_{\text{days/year}} \\ & - (\text{vacation})_{\text{days/year}} \\ & - (\text{public holidays})_{\text{days/year}} \\ & - (\text{other non-rostered})_{\text{days/year}} \end{aligned} \quad (3)$$

3.3 Absent and attended days

Absenteeism is expressed as the percentage chance that an agent will be absent on a day for which they are rostered. The average number of days absent is therefore calculated as follows. Alternatively, the actual number of absent days can be specified, and the percentage absence calculated. Which mode of calculation to use is controlled by the variable

$$(\text{absentmode}) = \text{abmPct or abmDays} \quad (4)$$

so that one of the following calculations is selected.

$$(\text{absent})_{\text{daysperyear}} = \frac{(\% \text{absent})}{100} \cdot (\text{rostered})_{\text{daysperyear}} \quad \text{for abmPct} \quad (5)$$

$$(\% \text{absent}) = 100 \cdot \frac{(\text{absent})_{\text{daysperyear}}}{(\text{rostered})_{\text{daysperyear}}} \quad \text{for abmDays} \quad (6)$$

Once absent days is known then the number of attended days can be calculated.

$$(\text{attended})_{\text{daysperyear}} = (\text{rostered})_{\text{days}} - (\text{absent})_{\text{daysperyear}} \quad \text{for abmDays} \quad (7)$$

3.4 Specified overfit

A shift overfit of $x\%$ means that the total agent attended time for a day will be factor $(1 + x/100)$ greater than what would otherwise be required to enable enough agents to be assigned to call-taking in each interval of the day. A value of $x > 0$ implies that the excess hours cannot be made use of for the daily overheads, and so the overfit time must be regarded as another overhead.

$$(\text{overfit})_{\text{mins/day}} = \frac{(\text{shift overfit}\%)}{100 + (\text{shift overfit}\%)} \cdot (\text{average shift}_{\text{mins}}) \quad (8)$$

Specified overfit is added before other additional overfit is considered, and is treated essentially as another part of daily overhead.

Calculations

Without overfit the required number of agents attending is calculated as in

$$(\text{required agent attendance})_{\text{agent days}} = \frac{(\text{required agent time assigned})_{\text{mins/day}}}{(\text{assigned time per agent})_{\text{mins/day}}} \quad (9)$$

$$= \frac{(\text{required agent time assigned})_{\text{mins/day}}}{(\text{average shift})_{\text{mins/day}} - (\text{daily overheads})_{\text{mins/day}}} \quad (10)$$

We now want to find z , the specified overfit per agent per day, in minutes, that will result in an increase in attendance required of $x\%$.

$$\left(1 + \frac{x}{100}\right) \cdot (\text{required agent attendance})_{\text{agent days}} \quad (11)$$

$$= \frac{(\text{required agent time assigned})_{\text{mins/day}}}{(\text{average shift})_{\text{mins/day}} - (\text{daily overheads})_{\text{mins/day}} - z_{\text{mins/day}}} \quad (12)$$

Solving equations (10) and (12) for the value of z , it follows that:

$$(\text{specified overfit})_{\text{mins/day}} = \left(\frac{x}{100 + x}\right) \cdot \left[(\text{average shift})_{\text{mins/day}} - (\text{daily overheads})_{\text{mins/day}}\right] \quad (13)$$

3.5 Additional overfit

Basic overfit is specified by the user, and is not dependent on the workload of an actual day. Additional overfit can be specified, which takes account of the workload, in two ways.

Round agents attending

This option simply rounds up the number of agents attending (after the inclusion of basic overfit).

Factor in peak agents

In order to assign the required number of agents to call-taking during the busiest interval of the day, sufficient agents must be in attendance. This option ensures that the number of agents attending is at least the peak requirement. Depending on the call-taking demand curve, and other parameters, it may be that more than the peak number of assigned agents is required anyway, in which case factoring in the peak agents will have no effect.

Calculations

If either or both of the above options are selected, then we have an attendance requirement, N , to meet the criteria, and we wish to find the overfit, w , in minutes per day per agent that will result in N . We will calculate w ignoring specified overfit and then adjust w to allow for specified overfit. However, it is important to remember that the rounded-up number of agents must be calculated after specified overfit has been applied.

$$N = (\text{required agent attendance})_{\text{agent days}} \quad (14)$$

$$= \frac{(\text{required agent time assigned})_{\text{mins/day}}}{(\text{average shift})_{\text{mins/day}} - (\text{daily overheads})_{\text{mins/day}} - w_{\text{mins/day}}} \quad (15)$$

From (15) it follows that the required overfit is given by (16), with the proviso that overfit cannot be negative.

$$w = (\text{average shift})_{\text{mins/day}} - (\text{daily overheads})_{\text{mins/day}} - \left[\frac{(\text{required agent time assigned})_{\text{mins/day}}}{N} \right] \quad (16)$$

And now we can adjust for the specified overfit, again with the proviso that additional overfit cannot be negative.

$$(\text{additional overfit})_{\text{mins/day}} = w - (\text{specified overfit})_{\text{mins/day}} \quad (17)$$

3.6 Time assigned

Now we calculate the number of minutes per attended day that an agent is assigned to call-taking, taking into account the various daily overheads, except for unaccounted time (which is part of assigned time).

$$\begin{aligned}
 (\text{daily overheads})_{\text{mins/day}} = & + (\text{meals})_{\text{mins/day}} \\
 & + (\text{breaks})_{\text{mins/day}} \\
 & + (\text{team/coaching})_{\text{mins/day}} \\
 & + (\text{non-phone})_{\text{mins/day}}
 \end{aligned} \tag{18}$$

Assigned time is simply the shift length minus the daily overheads, and also minus the overfit, if overfit is used.

$$\begin{aligned}
 (\text{assigned})_{\text{mins/day}} = & (\text{average shift})_{\text{mins}} - (\text{daily overheads})_{\text{mins/day}} \\
 & - [(\text{specified overfit})_{\text{mins/day}} + (\text{additional overfit})_{\text{mins/day}}]
 \end{aligned} \tag{19}$$

3.7 Unaccounted and available each day

Unaccounted time is specified as minutes per hour while assigned to the phones, so now that we have calculated the time per day assigned to the phones, we can calculate the unaccounted time per day.

$$(\text{unaccounted/day})_{\text{mins}} = \left[\frac{(\text{unaccounted})_{\text{mins/hour}}}{60} \right] \cdot (\text{assigned/day})_{\text{mins}} \tag{20}$$

Now we can calculate the time available for handling calls per attended day by deducting the unaccounted time.

$$(\text{available/day})_{\text{mins}} = (\text{assigned/day})_{\text{mins}} - (\text{unaccounted/day})_{\text{mins}} \tag{21}$$

Some of the results are required as hours per day rather than minutes per day, so we convert.

$$(\text{assigned/day})_{\text{hours}} = (\text{assigned/day})_{\text{mins}}/60 \tag{22}$$

$$(\text{available/day})_{\text{hours}} = (\text{available/day})_{\text{mins}}/60 \tag{23}$$

3.8 Percentages and ratios

Percentages of a year

These are all percentages of a year, taking account of annualised induction.

$$\begin{bmatrix}
 (\% \text{induction}) \\
 (\% \text{training}) \\
 (\% \text{vacation}) \\
 (\% \text{public holidays}) \\
 (\% \text{non-rostered}) \\
 (\% \text{absent})
 \end{bmatrix} = \frac{100}{(\text{accounted/year})_{\text{days}}} \cdot \begin{bmatrix}
 (\text{annualised induction})_{\text{days}} \\
 (\text{training})_{\text{days}} \\
 (\text{vacation})_{\text{days}} \\
 (\text{public holidays})_{\text{days}} \\
 (\text{non-rostered})_{\text{days}} \\
 (\text{absent})_{\text{days}}
 \end{bmatrix} \tag{24}$$

Percentages of a day

These are percentages of an attended day.

$$\begin{bmatrix}
 (\% \text{overfit}) \\
 (\% \text{meals}) \\
 (\% \text{breaks}) \\
 (\% \text{team/coach}) \\
 (\% \text{non-phone}) \\
 (\% \text{other rostered}) \\
 (\% \text{unaccounted}) \\
 (\% \text{available})
 \end{bmatrix} = \frac{100}{(\text{shift length})_{\text{mins}}} \cdot \begin{bmatrix}
 (\text{overfit})_{\text{mins/day}} \\
 (\text{meals})_{\text{mins/day}} \\
 (\text{breaks})_{\text{mins/day}} \\
 (\text{team/coach})_{\text{mins/day}} \\
 (\text{non-phone})_{\text{mins/day}} \\
 (\text{other rostered})_{\text{mins/day}} \\
 (\text{unaccounted})_{\text{mins}} \\
 (\text{available})_{\text{mins}}
 \end{bmatrix} \tag{25}$$

Ratios

A number of shrinkage ratios are of interest.

$$(\text{ratio qualified:accounted}) = \frac{(\text{qualified})_{\text{days}}}{(\text{accounted})_{\text{days}}} \quad (26)$$

$$(\text{ratio rostered:qualified}) = \frac{(\text{rostered})_{\text{days}}}{(\text{qualified})_{\text{days}}} \quad (27)$$

$$(\text{ratio attended:rostered}) = \frac{(\text{attended})_{\text{days}}}{(\text{rostered})_{\text{days}}} \quad (28)$$

$$(\text{ratio assigned:attended}) = \frac{(\text{assigned})_{\text{days}}}{(\text{attended})_{\text{days}}} \quad (29)$$

$$(\text{ratio available:assigned}) = \frac{(\text{available})_{\text{mins/day}}}{(\text{assigned})_{\text{mins/day}}} \quad (30)$$

From the ratios above we can derive some further useful ratios.

$$(\text{ratio rostered:accounted}) = (\text{ratio rostered:qualified}) \cdot (\text{ratio qualified:accounted}) \quad (31)$$

$$(\text{ratio attended:accounted}) = (\text{ratio attended:rostered}) \cdot (\text{ratio rostered:accounted}) \quad (32)$$

$$(\text{ratio assigned:accounted}) = (\text{ratio assigned:attended}) \cdot (\text{ratio attended:accounted}) \quad (33)$$

$$(\text{ratio available:accounted}) = (\text{ratio available:assigned}) \cdot (\text{ratio assigned:accounted}) \quad (34)$$

Ratios as percentages

$$(\% \text{qualified}) = 100 \cdot (\text{ratio qualified:accounted}) \quad (35)$$

$$(\% \text{rostered}) = 100 \cdot (\text{ratio rostered:accounted}) \quad (36)$$

$$(\% \text{attended}) = 100 \cdot (\text{ratio attended:accounted}) \quad (37)$$

$$(\% \text{assigned}) = 100 \cdot (\text{ratio assigned:accounted}) \quad (38)$$

$$(\% \text{available}) = 100 \cdot (\text{ratio available:accounted}) \quad (39)$$

Converting daily percentages into yearly percentages

Daily overheads apply only to attended days, so that to get percentages of all agent time, and adjustment is required for the percentage attended time.

$$\begin{bmatrix} (\% \text{overfit of year}) \\ (\% \text{meals of year}) \\ (\% \text{breaks of year}) \\ (\% \text{team/coach of year}) \\ (\% \text{non-phone of year}) \\ (\% \text{other rostered of year}) \\ (\% \text{unaccounted of year}) \\ (\% \text{available of year}) \end{bmatrix} = (\text{ratio attended:accounted}) \cdot \begin{bmatrix} (\% \text{overfit of day}) \\ (\% \text{meals of day}) \\ (\% \text{breaks of day}) \\ (\% \text{team/coach of day}) \\ (\% \text{non-phone of day}) \\ (\% \text{other rostered of day}) \\ (\% \text{unaccounted of day}) \\ (\% \text{available of day}) \end{bmatrix} \quad (40)$$

3.9 Calculations for the shrinkage diagram

In T-Calc and T-Plan a shrinkage calculator is provided showing the 6 levels of shrinkage, as in Figure 2. The user may choose to fix any of the shrinkage levels to 100% and a specified number of agents. The calculator then works out the percentages and numbers of agents that correspond to each of the other shrinkage levels. First we calculate the Employed percentage, by applying the appropriate ratio to the 100% at the level that the user has chosen to fix, as shown in the Table 4. Note that only one of these calculations is performed, the purpose being to establish the Employed percentage that corresponds to 100% at the level the user has chosen to fix. A parallel calculation provides the number of Employed agents that corresponds to the number of agents specified by the user at the shrinkage level fixed by the user.

| Shrinkage level fixed by user | Corresponding Employed % | Corresponding Employed agents |
|-------------------------------|--|--|
| Employed | 100 | |
| Qualified | $\frac{100}{(\text{ratio qualified:accounted})}$ | $\frac{(\text{fix qualified agents})}{(\text{ratio qualified:accounted})}$ |
| Rostered | $\frac{100}{(\text{ratio rostered:accounted})}$ | $\frac{(\text{fix rostered agents})}{(\text{ratio rostered:accounted})}$ |
| Attended | $\frac{100}{(\text{ratio attended:accounted})}$ | $\frac{(\text{fix attended agents})}{(\text{ratio attended:accounted})}$ |
| Assigned | $\frac{100}{(\text{ratio assigned:accounted})}$ | $\frac{(\text{fix assigned agents})}{(\text{ratio assigned:accounted})}$ |
| Available | $\frac{100}{(\text{ratio available:accounted})}$ | $\frac{(\text{fix available agents})}{(\text{ratio available:accounted})}$ |

Now we have established the percentage and number of agents for the Employed level, and we can straightforwardly calculate the percentages and number of agents for the other shrinkage levels.

$$\begin{bmatrix} (\text{fix qualified agents}) \\ (\text{fix rostered agents}) \\ (\text{fix attended agents}) \\ (\text{fix assigned agents}) \\ (\text{fix available agents}) \end{bmatrix} = (\text{fix employed agents}) \cdot \begin{bmatrix} (\text{ratio qualified:accounted}) \\ (\text{ratio rostered:accounted}) \\ (\text{ratio attended:accounted}) \\ (\text{ratio assigned:accounted}) \\ (\text{ratio available:accounted}) \end{bmatrix} \quad (41)$$

$$\begin{bmatrix} (\text{fix qualified } \%) \\ (\text{fix rostered } \%) \\ (\text{fix attended } \%) \\ (\text{fix assigned } \%) \\ (\text{fix available } \%) \end{bmatrix} = (\text{fix employed } \%) \cdot \begin{bmatrix} (\text{ratio qualified:accounted}) \\ (\text{ratio rostered:accounted}) \\ (\text{ratio attended:accounted}) \\ (\text{ratio assigned:accounted}) \\ (\text{ratio available:accounted}) \end{bmatrix} \quad (42)$$

4 T-Calc (aka PhoneCalc) and T-Plan shrinkage calculations

4.1 Shrinkage input panels

The input panels for setting the shrinkage parameters are shown in Figure 4. These panels are part of the "Shrinkage display" which is included in both T-Calc and T-Plan, which can be accessed by clicking the button shown in Figure 3.



Figure 3: Button for accessing the shrinkage display

| Yearly factors | | Days per Year |
|---|------|---------------|
| Accounted days | | 260 |
| <input type="checkbox"/> Induction days | 15 | 10.0 |
| Employment months | 18 | |
| <input type="checkbox"/> Training | 12 | |
| <input type="checkbox"/> Vacation | 20 | |
| <input type="checkbox"/> Public Holidays | 8 | |
| <input type="checkbox"/> Other non-rostered | 5 | |
| Rostered | | 205.0 |
| <input type="checkbox"/> Absent | 5.0% | 10.3 |
| Attending | | 194.8 |

| Daily factors | | Time per Day |
|--|-------|--------------|
| Average shift | | 08:30 |
| <input type="checkbox"/> Meals | 01:00 | |
| <input type="checkbox"/> Breaks | 0:30 | |
| <input type="checkbox"/> Team/coach | 0:20 | |
| <input type="checkbox"/> Non-phone | 0:20 | |
| <input type="checkbox"/> Overfit | | 0:27 |
| Assigned to phones | | 5:53 |
| mins per hour | | |
| <input type="checkbox"/> Unaccounted | 10 | 0:59 |
| <input type="checkbox"/> Available for calls | | 4:54 |

| Overfit options | |
|-------------------------------------|------------------------|
| <input checked="" type="checkbox"/> | Round agents attending |
| <input checked="" type="checkbox"/> | Factor in peak agents |
| <input checked="" type="checkbox"/> | Basic overfit |
| | 5% |

Figure 4: Shrinkage input panels

4.2 T-Calc(PhoneCalc) with Interval scenario

For an Interval scenario the only shrinkage component used is unaccounted time, which the queueing-theory algorithms can, optionally, take into account. Other shrinkage parameters are used only within the shrinkage display itself. As well as on the shrinkage display itself, unaccounted time can be controlled from the shrinkage panel on the summary display, as shown in Figure 5. If the Unaccounted check box is un-checked, then the queueing models ignore unaccounted time. Unaccounted time is displayed in the Occupancy chart, as shown in Figure 6 and in the agent group as in Figure 7.



Figure 5: T-Calc shrinkage panel for Interval scenario

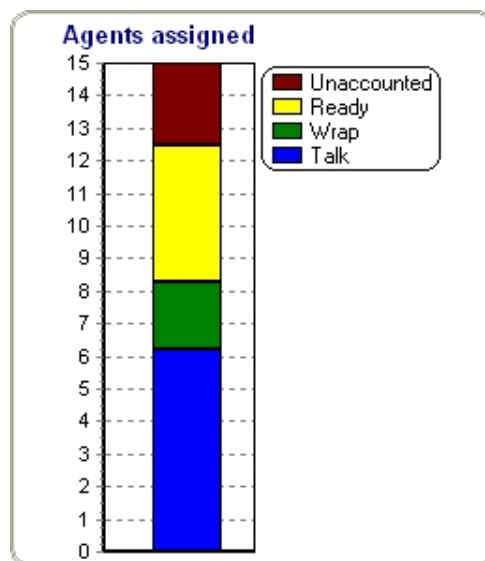


Figure 6: T-Calc occupancy chart for Interval scenario

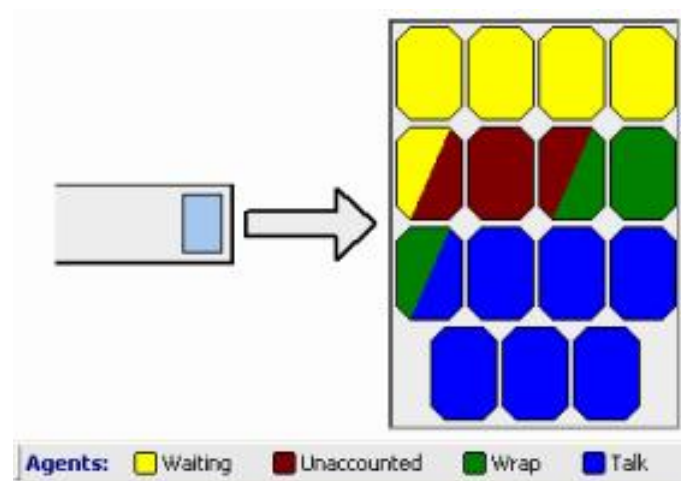


Figure 7: T-Calc agent group for an Interval scenario

4.3 T-Calc(PhoneCalc) with a Day scenario

For a Day scenario, the agent calculations will use the parameters from the Daily factors panel and the Overfit options as shown in Figure 4. Unaccounted time, daily overheads, and overfit are shown in the occupancy chart, Figure 8, and in the agent group, Figure 9.

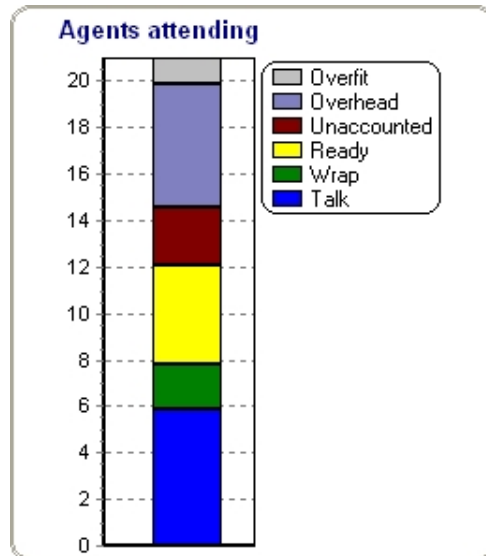


Figure 8: T-Calc occupancy chart for Day scenario

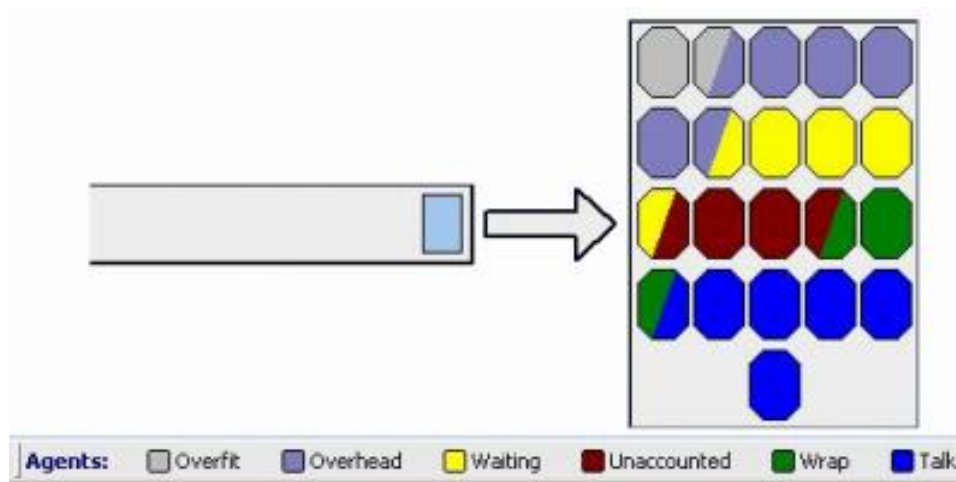


Figure 9: T-Calc agent group for an Day scenario

4.4 T-Plan

For T-Plan the agent requirements are calculated separately for each day, in a similar way as for a Day-scenario in T-Calc. Once the number of agents required to attend on each day has been calculated, we can calculate the total number of agent attendance days needed. Yearly overheads can then be added to get annualised totals for budgeting purposes/

4.4.1 Interval totals

Interval totals are displayed as assigned agents, as shown in Figure 10, with only unaccounted time displayed.

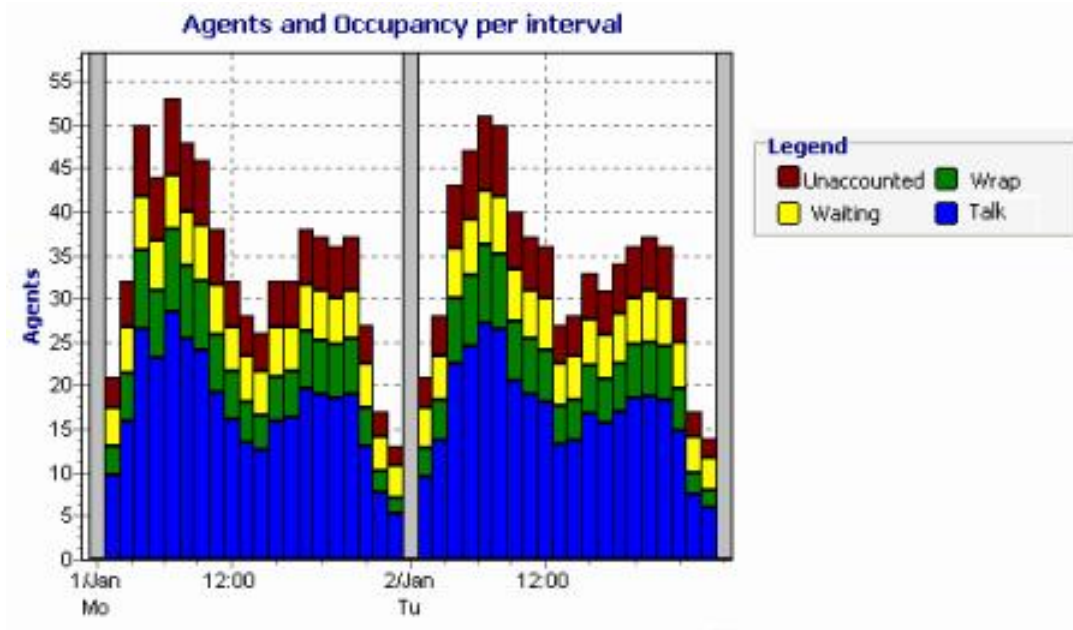


Figure 10: T-Plan interval totals chart for assigned agents

4.4.2 Daily totals

The daily totals display for agents is shown in Figures 11 and 12, for assigned and attending agents respectively.

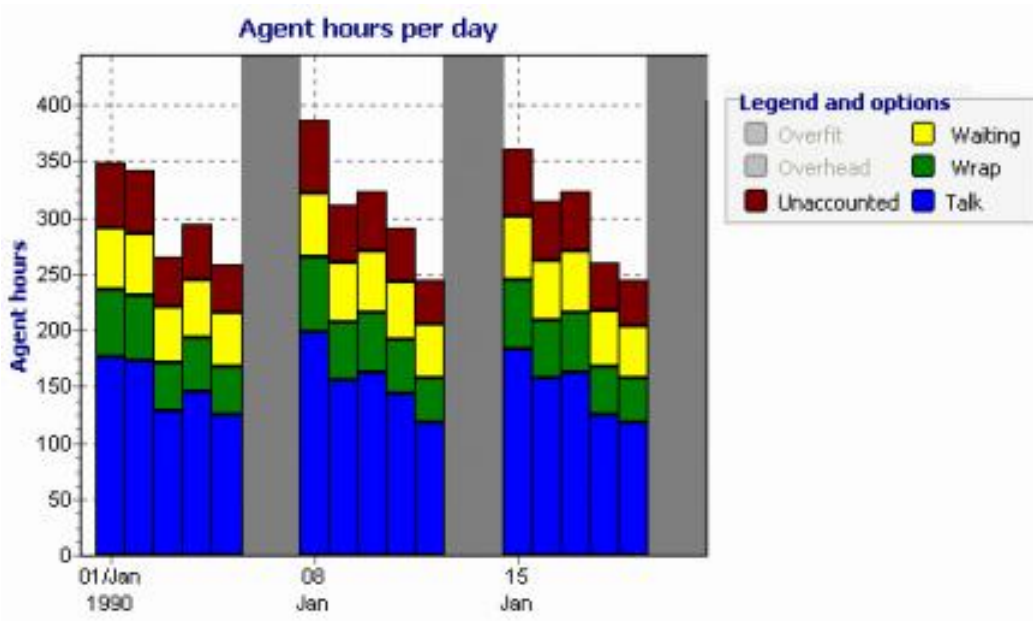


Figure 11: T-Plan daily totals chart for assigned agents

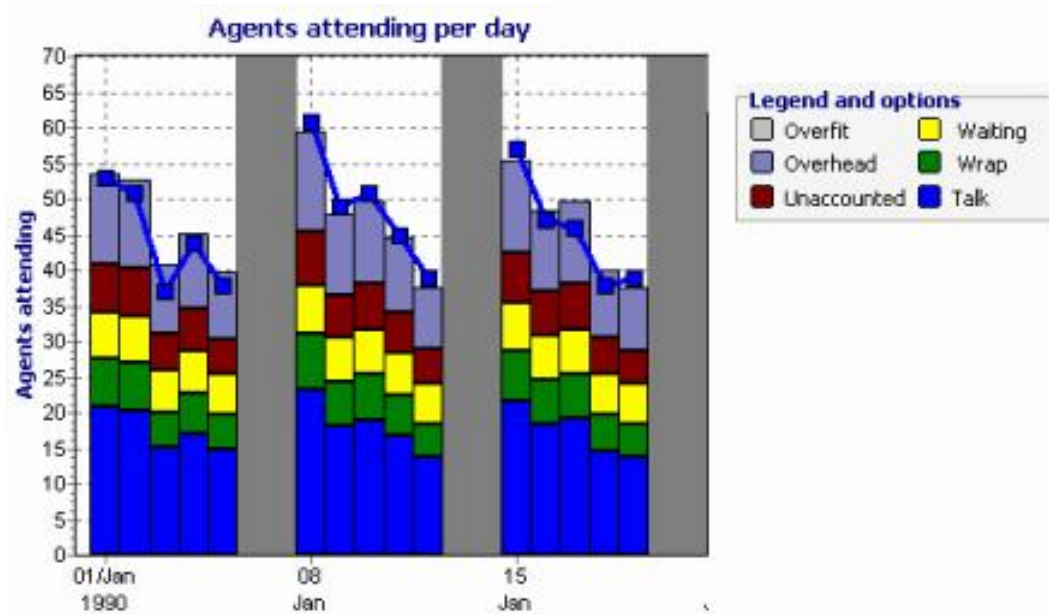


Figure 12: T-Plan daily totals chart for attending agents

4.4.3 Weekly totals

Weekly totals are displayed in the same way as daily totals, either assigned agents or attending agents.

4.4.4 Budget

The budget display in T-Plan is accessed by clicking the button shown in Figure 13. The budget display is shown in Figure 14. From the days represented in the current file, the average number of attended days, and other statistics, for each selected day of the week is calculated. A "standard week" is a week with each day of the week having the average values. A "standard year" is then calculated, assuming 365 days per year, and therefore containing (365/7) standard weeks. This can be modified by the option to deduct public holidays. The number of public holidays is taken from the "Yearly factors" panel of the shrinkage display.

$$(\text{weeks per year}) = \frac{365}{7} \quad \text{without deduction} \quad (43)$$

$$= \frac{365}{7} - \frac{(\text{public holidays per year})}{(\text{days-of-week selected})} \quad \text{with deduction} \quad (44)$$

Once the total days-attended for the standard year has been calculated, the yearly shrinkage factors can be added. From this the number of employed agents needed to support the workload over the year can be calculated, along with the total number of days absence.



Figure 13: T-Plan button for accessing the budget display

| Day-of-Week | Number of days | | | Average normal day | | | | |
|----------------------|----------------|---------|---------|--------------------|------------------|-----------------|-------------------------------------|-----------------|
| | Normal | Unusual | Omitted | Number | Calls Talk hours | Wrap hours | Agents Assigned hours Attended days | |
| Monday | 15 | | | 3,814 | 190.7 | 63.6 | 373.0 | 57.4 |
| Tuesday | 15 | | | 3,292 | 164.6 | 54.9 | 328.4 | 50.5 |
| Wednesday | 14 | | | 2,975 | 148.8 | 49.6 | 300.7 | 46.3 |
| Thursday | 14 | | | 2,953 | 147.6 | 49.2 | 298.5 | 45.9 |
| Friday | 14 | | | 2,524 | 126.2 | 42.1 | 260.8 | 40.1 |
| Saturday | | | | | | | | |
| Sunday | | | | | | | | |
| Totals | 72 | | | | | | | |
| Standard week | | | | 15,558 | 777.9 | 259.3 | 1,561.4 | 240.2 |
| Standard year | | | | 811,263 | 40,563.1 | 13,521.0 | 81,417.6 | 12,525.8 |

| | | | | | |
|---|-------------|---|--------------|----------------------------|--------------|
| Standard year | | Agent statistics for standard year | | Planned performance | |
| Weeks per year | 52.1 | Employed agents required | 64.0 | Service level | 82.7% |
| <input type="checkbox"/> Deduct public holidays | | Absent days | 659.3 | Not answered | |

Figure 14: T-Plan budget display