# How the installation of grilles and re-roofing of a building in Dorset have allowed greater horseshoe bats (*Rhinolophus ferrumequinum*) to emerge earlier

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## Introduction

It is well known that vegetative cover close to the entrances of the roosts of both greater and lesser horseshoe bats allows them to leave sites in relative security from predators. As the light level is lower, they can also leave earlier than if they had to cross open ground. However, little conclusive evidence of this has yet been published.

Since 1994 continual observations have been made on the time and numbers of greater horseshoe bats *(Rhinolphus ferrumequinum)* emerging from The Old Kitchens, Bryanston, Dorset at dusk.

At the start of observations only 70% of the building at the north end was roofed over. In 2006/07 the final 30% was roofed over as part of a major re-roofing (enhancement) programme. A few months prior to this re-roofing, grilles were installed in the eastern elevation wall. This was to allow bats an alternative exit point should they be deterred by the access left for them under the eaves of the proposed roof. Once the re-roofing was completed and the bats had become used to using the grilles, a significant difference was noted in the emergence time of the first bat. This paper is a report of these findings and observations.

## A brief history of the colony

Bats have been studied at The Old Kitchens since the 1950s. Michael Blackmore, Andrew Watson, Henry Arnold and Bob Stebbings are just a few of those who have worked there. Andrew Watson [Pers Comm] said he had seen 'many hundreds' of greater horseshoe bats using the small brick built building to the south of the main building but it was too difficult to get access into the loft. His main study site was the loft of the larger building, and this location is the focus of the observations and records contained in this paper.

The Old Kitchens was always considered a satellite roost from the major greater horseshoe colony located in outbuildings at Creech Grange, near Corfe. Dorset (Fig 1). However, the Corfe site was effectively destroyed as a nursery after the roof timbers were sprayed with Lindane (also known as gamma-HCH) to eradicate a serious infestation of death watch beetle *(Xestobium rufovillosum).* The Old Kitchens at Bryanston now houses the major remaining part of Dorset's nursery colony of greater horseshoe bats. During the winter, it also provides a range of habitats suitable for other bat species, including lesser horseshoe, brown and grey long-eared, whiskered, Natterer's, Bechstein's, Daubenton's, barbastelle, serotine, common and soprano pipistrelle.

***Figure 1.*** *Creech Grange. Outbuildings here contained the majority of greater horseshoe bats in Dorset until it was destroyed by chemicals.*


## General description of the site and The Old Kitchens

The building is the sole remaining domestic section of a country mansion built in the late 1800's by Henry William Portman Esq. It has had a variety of uses over the years: during the Second World War it was used as a billet for American soldiers and after this it was Bryanston 'Old boys' Club. In the 1960s it was used as a handicraft workshop by the school's 'potter'.

The original construction was a brick-built stone-faced building under a traditional hardwood cut roof of four hips (Fig 2). Its longitudinal axis is almost exactly north-south and its dimensions are approximately 31m x 10m. The western elevation is built into a cutting in a steep chalk hillside and, although the building is nearly 6m tall on the east elevation, the roof level on the west elevation is only 1m above the ground. Centrally on the eastern elevation of the roof was a portico that fronted a duo-pitch, twin-valley roof. It is unclear if the original roof covering was slate or natural stone. Adjacent buildings, such as the stables would suggest that it was slate, but a stone tile discovered on site may suggest otherwise. There is a small brick-built building to the south, but just four or five feet of wall remained above ground at the time I started visiting the site. To the north-east, and adjoining the main building, was the remains of a small single story outbuilding, consisting of just four walls and a partially collapsed asbestos roof (not shown). This has recently been rebuilt. The majority of the house was pulled down towards the end of the 19th century; the domestic quarters are the only remaining section left standing.

### Internal features

Very little of the original internal features of The Old Kitchen's building remain. The first floor has been removed and there are a series of interconnected rooms on the ground floor that are open to the loft floor some 6 metres above. During the winter of 1989-90 a small tunnel approximately 10m in length was excavated under the chimney on the north-western elevation, to offer the bats a greater range of winter roosting opportunities. In the winter of 1997 a second, much longer tunnel was excavated near the south-west corner of the building.

Between the chimneys on the west elevation is a small tunnel approximately 600mm in diameter leading to a redundant underground water reservoir.

**Condition of the building**

By the mid 1970s, The Old Kitchens building was in a serious state of disrepair; lead flashings had been stolen from the hips and ridge, and the western elevation was in such a poor condition that corrugated iron sheets had been installed. Slates on the remaining elevations were continually slipping and falling from the roof. Bob Stebbings [Pers Comm] was making continual temporary repairs to the site and eventually he persuaded the Nature Conservancy Council (now Natural England) to replace the roof and generally improve and secure the site for the bats.

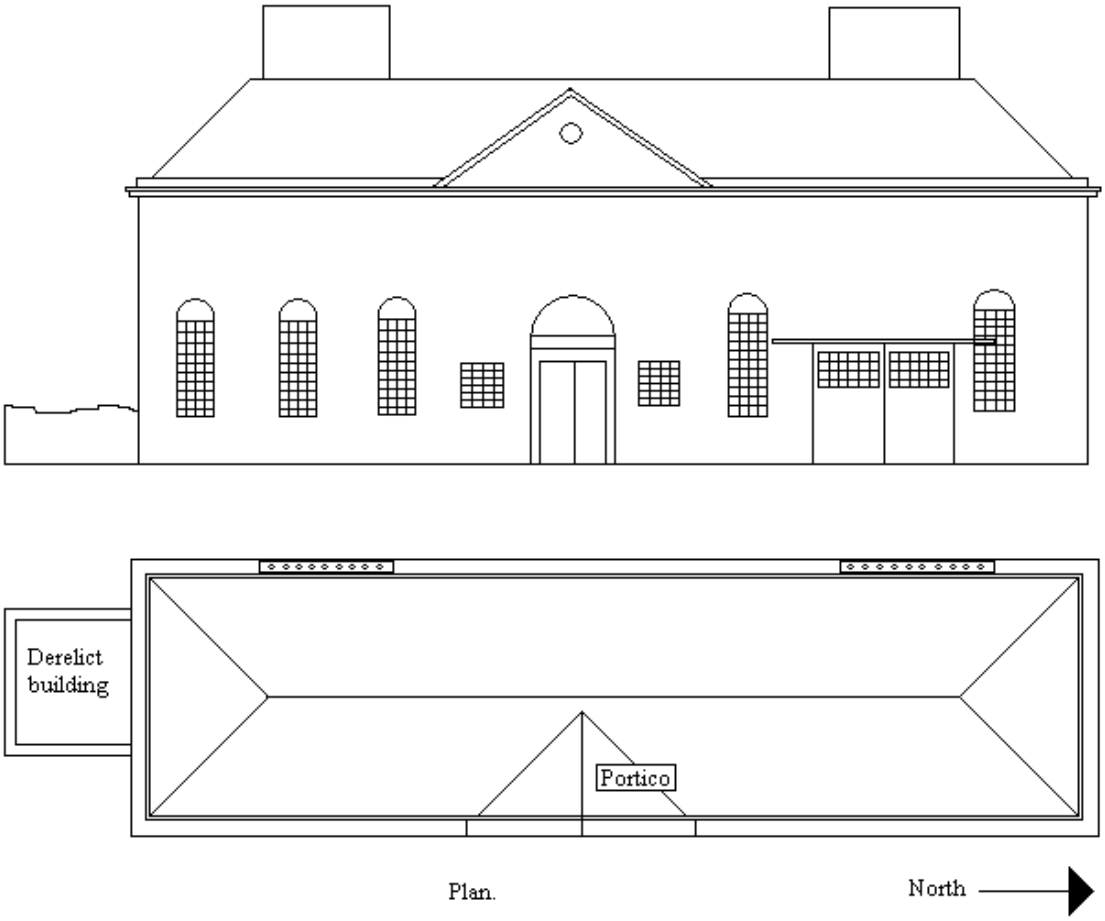


***Figure 2.*** *The original building's roof configuration showing the four hips and portico.*

**The re-roofing and building works in the 1970/80s**

The original four-hipped roof was replaced with a much simpler gable-to-gable duo-pitched roof in the late 1970s. The new roof only covered about 70% of the original building, the remaining section on the southern elevation was left open – basically three walls approximately 6m high. Because the building contained dry rot *(Serpula lacrymans)* all the internal timbers were removed and, as chemicals could not be used for fear of poisoning the bats, the new roof was

replaced with a simple steel framed 'agricultural' roof built on top of a reinforced concrete ring-beam. The roof covering was asbestos/cement sheets. Repairs to the building at the same time included blocking up the windows to stop disturbance from casual visitors and removing the duo-pitch roof behind the portico on the east elevation (Fig 3). A new access point for the bats was created in the newly constructed south-facing gable wall that supported the new roof. It led directly into the new loft.

However, the new asbestos roof compromised the thermal qualities of the original slate roof as it had a 450mm gap between the outer covering and the wood-lined interior of the loft. This gap acted as a buffer from the little solar heating the asbestos sheets generated and, although initially they tried to overcome the reflective properties of the light coloured asbestos sheet by covering them with cow manure, it failed. After the first summer when no bats successfully bred in the loft, artificial heating in the form of greenhouse heating bars were installed. These were not altogether successful in terms of reliability and an innovative system using an industrial electric blanket was installed inside an insulated area approximately 1m³. The bats have bred successfully ever since.

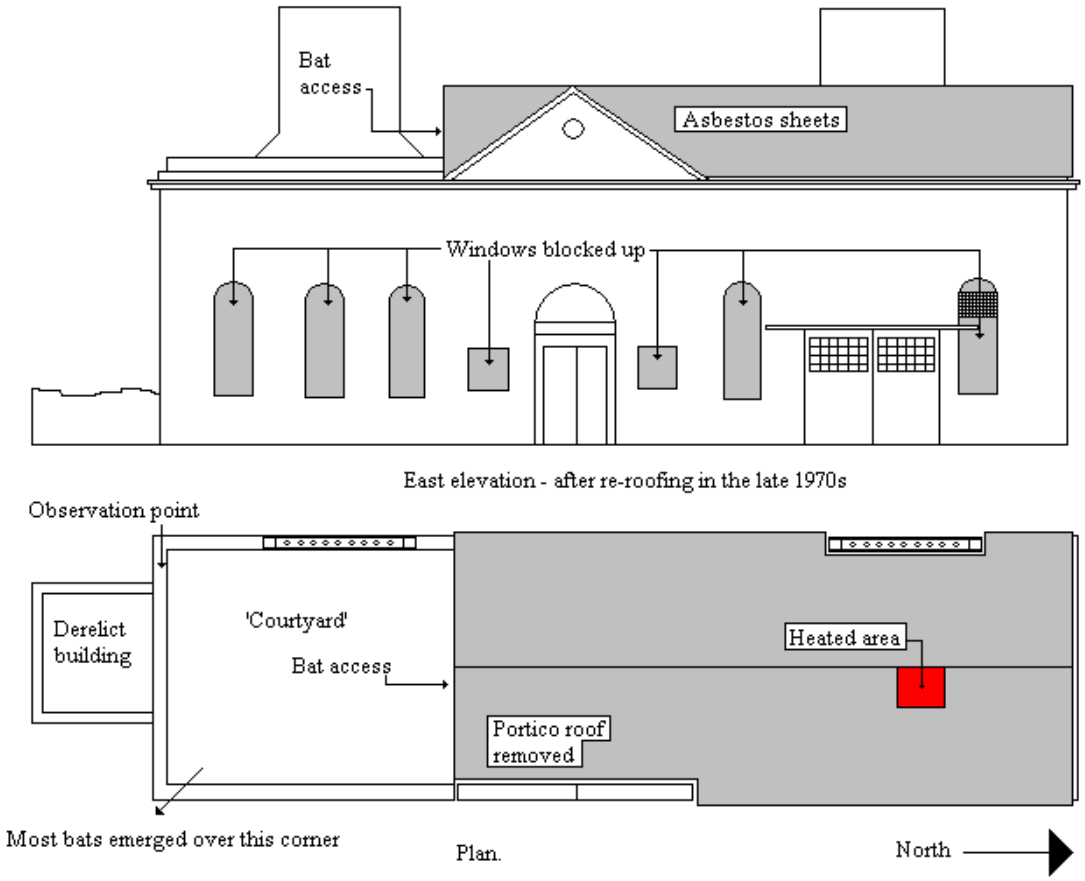


***Figure 3.*** *The late 1970s asbestos and steel 'agricultural' roof. Only 70% of the original building was re-roofed at this time. The bats emerged through a window positioned slightly off-centre of the new gable wall on the southern elevation, approximately 7m above the ground. The asbestos sheets were replaced with natural slate in 2002.*

## The Vincent Wildlife Trust's involvement

The Vincent Wildlife Trust purchased the building from Bryanston School in 1994 and set about a programme of works to enhance and improve the bats' roosting opportunities and improve security. The asbestos roof was replaced with natural slate to improve solar heating and to also create a greater range of temperatures in the loft. Prior to this, the bats spent the vast majority of time roosting in the small heated area shown in Figure 2. The electrical wiring was also replaced and improved. In 2005 two grilles were installed in the eastern elevation walls to allow bats to emerge at a lower level than they could previously, which had been over the top of the 6m high walls. It also allowed them to emerge into dense vegetation. Security doors were fitted inside the grilles in case the bats did not use them and the building needed to be secured (Fig 4).

***Figure 4.*** *One of the two grilles in the eastern elevation wall – prior to re-roofing*

During the winter of 2005/2006 the final 30% of the building was roofed over with a hip-end (Fig 5) and this forms the basis for my observations into how it has affected the greater horseshoe bats emergence times.

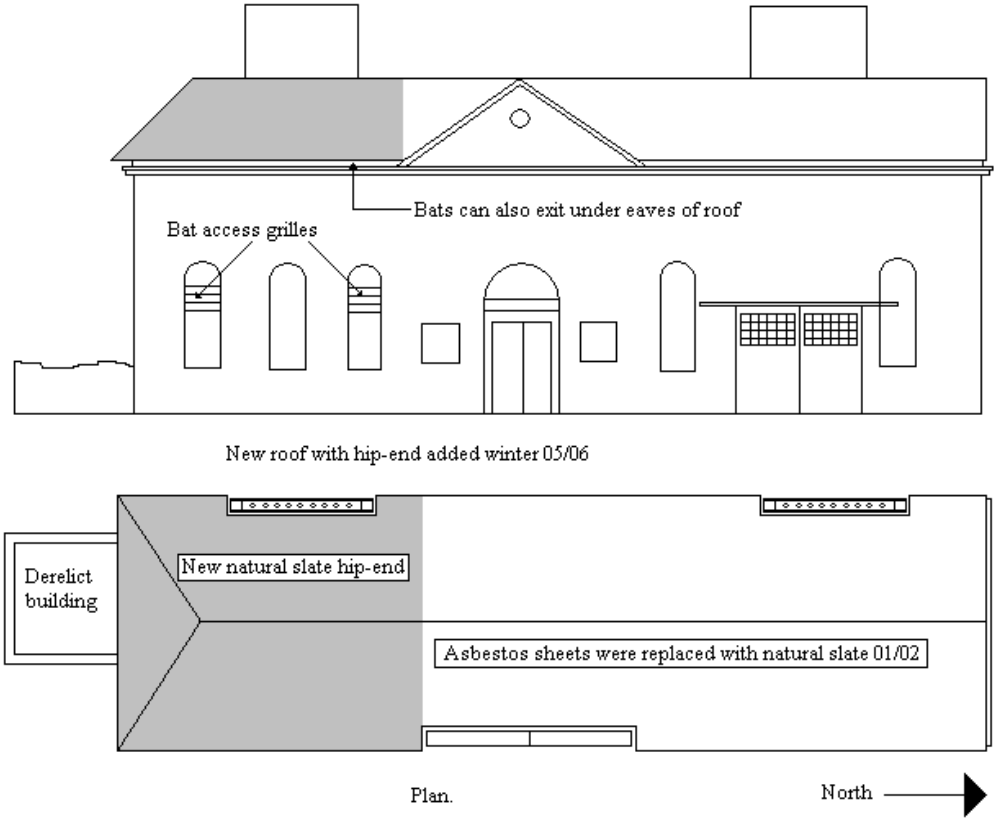


***Figure 5.*** *The final section of roofing at the southern end.*

## Observation and recording of greater horseshoe bats

Between 1994 and 2005 emerging bats were observed from a position on the south-western corner of the building, on top of a wall approximately 1.5m wide (see Fig 3). The building was set into a hillside and at this location the wall was at ground level. In front of (and below) the observer were the three remaining un-roofed walls and the new southern gable wall of the re-roofed original building. This unroofed section is referred to as 'The Courtyard'– a paved area surrounded by four walls. A 600mm x 450mm window approximately 7m off the ground was positioned just off-centre in this elevation. Bats were observed emerging (and entering) this window, and from two doors at lower ground level inside the courtyard. As with all horseshoe bats, a period of light sampling took place and typically included bats emerging into the courtyard and then back into the building.

As the light faded, bats became more active and used the courtyard in what can best describe as a 'wall-of-death'. Bats were observed flying around and around inside the walls, getting higher and higher and eventually exiting over the south-eastern corner before diving into the vegetation adjacent to the building. The time of the first 'exiting' bat was recorded at every observance.

Once the final section of the building was re-roofed (Fig 6) it was impossible to use the original observation position and the bats had to be counted from inside the woodland, approximately 10m to the south of the building. Once the bats exited the building, most of them spent at least a couple of minutes in the vegetation close-by before flying off into the woodland. The time at

which the first bat emerged was taken as it flew over the Courtyard wall (prior to the new roof being fitted) and when the first bat exited the building following the roofing work.

The result of the roofing work was that the bats emerged significantly earlier ($\chi^2 = 36.16$ $p<0.001$).

***Figure 6.*** *The final hip-end section on the southern elevation*

| | Average emergence time of the first bat in minutes after sunset ***before*** re-roofing: | Average emergence time of the first bat in minutes after sunset ***after*** re-roofing: | |
|---|---|---|---|
| MAY | 35.1 | 19.5 | Earlier by 15.6 minutes |
| JUNE | 37.9 | 23.5 | Earlier by 14.4 minutes |
| JULY | 35.8 | 19.0 | Earlier by 16.8 minutes |
| **Average** | **36.3** | **20.6** | **Earlier by 15.7 minutes** |

***Table 1.*** *Summary of the average time, on a monthly basis, of the first bat exiting the building after sunset, **before** and **after** re-roofing.*

## Conclusion

The roof over the courtyard has made this section of the building darker and allows the bats to fly safely in this area earlier in the evening. The grilles fitted into the east elevation wall also allow the bats to emerge into the dense/dark vegetation to the east. Prior to these alterations, the bats waited until it was darker before initially entering the courtyard then exiting over the courtyard wall.

Observations and recordings show that before the final re-roofing and the fitting of the grilles the first bat exited the building on average 36 minutes after sunset. After the alterations the first bat now exits the site on average 20 minutes after sunset, some 16 minutes earlier. During the shortest nights of the year this may represent up to 5% of the total night's feeding time, particularly advantageous with more insects flying during the early part of the evening. Although I have never observed avian predators on site, allowing bats direct access into cover will also lessen the chance of being 'taken'.

Appendix 1. Dataset used to calculate average emergence times of first emerging bat.

***Table 2*** *Minutes after sunset the first bat exited the building*

| MAY | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 03/05 | - | - | - | - | - | - | - | - | 22 | - | - | - | RE-ROOFING AND GRILLE S FITTED | - | 22 | - |
| 06/05 | - | 26 | - | - | | - | - | - | - | - | - | - | | - | - | - |
| 07/05 | - | - | - | - | - | - | - | - | 43 | - | - | - | | - | - | - |
| 08/05 | - | - | - | - | - | - | 44 | - | - | - | - | - | | - | - | - |
| 09/05 | - | - | - | - | 42 | 30 | - | - | - | - | 34 | - | | - | - | - |
| 10/05 | - | - | - | - | - | - | - | 19 | - | - | - | - | | - | - | - |
| 11/05 | - | - | - | - | - | - | - | - | - | 39 | - | - | | - | - | - |
| 12/05 | 20 | - | - | - | - | - | - | - | - | - | - | - | | - | - | - |
| 15/05 | - | 36 | - | - | - | - | - | - | - | - | - | - | | - | - | - |
| 16/05 | - | - | - | - | 45 | - | - | - | 41 | - | - | - | | - | - | - |
| 17/05 | - | - | - | - | - | - | - | - | - | - | 40 | - | | - | - | - |
| 18/05 | - | 38 | - | 39 | - | - | - | 34 | - | - | - | - | | - | - | - |
| 19/05 | 35 | - | - | - | - | - | - | - | - | - | - | - | | - | - | 21 |
| 21/05 | - | 27 | - | - | 39 | - | - | - | - | 33 | - | 31 | | - | - | - |
| 23/05 | - | - | - | - | - | - | - | 41 | - | - | - | - | | - | - | - |
| 24/05 | - | - | - | - | - | - | - | - | - | - | 35 | - | | - | - | - |
| 25/05 | 32 | 40 | - | - | - | - | - | - | - | - | - | - | | - | - | - |
| 26/05 | 39 | - | - | - | 42 | - | - | - | - | 59 | - | - | | - | - | - |
| 27/05 | - | - | - | - | - | - | - | - | 40 | - | - | - | | - | - | 15 |
| 29/05 | - | - | - | - | - | - | - | 34 | - | - | - | 36 | | - | - | - |
| 30/05 | - | 34 | 33 | - | - | - | - | - | - | - | - | - | | - | 20 | - |

| JUNE | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02/06 | - | - | - | - | - | - | 30 | - | - | - | - | - | RE-ROOFING AND GRILLES FITTED | - | - | - |
| 03/06 | - | - | - | - | - | - | - | 34 | - | - | - | - | | - | - | - |
| 04/06 | - | 46 | - | - | - | - | - | - | 33 | - | - | - | | 23 | - | 26 |
| 05/06 | - | 36 | - | - | - | - | - | - | - | - | 43 | - | | - | - | - |
| 08/06 | - | - | - | - | - | - | - | - | 39 | - | - | - | | - | - | - |
| 09/06 | - | - | 42 | - | - | - | - | - | - | - | - | 38 | | - | - | - |
| 10/06 | - | - | - | - | - | - | 38 | - | - | - | - | - | | - | - | - |
| 11/06 | - | - | - | - | - | - | - | 32 | - | 39 | - | - | | 27 | - | - |
| 12/06 | - | - | - | - | - | 36 | - | - | - | - | - | - | | | - | 25 |
| 14/06 | - | - | - | - | 37 | - | - | - | - | - | - | - | | | 15 | - |
| 15/06 | - | - | - | 37 | - | - | - | - | - | 40 | 44 | - | | | - | |
| 16/06 | - | - | - | - | - | - | - | - | 39 | - | - | - | | | - | 22 |
| 17/06 | - | 25 | - | - | - | - | - | 51 | - | - | - | - | | | - | - |
| 18/06 | - | - | - | - | - | - | 45 | - | - | - | - | - | | - | - | - |
| 19/06 | - | - | - | - | - | - | - | - | - | - | - | 42 | | 11 | - | - |
| 20/06 | - | - | - | 33 | - | 33 | - | - | - | - | - | - | | - | - | - |
| 21/06 | - | - | - | - | 45 | - | - | - | - | - | - | - | | - | - | - |
| 22/06 | - | 33 | - | 38 | - | - | - | - | 39 | - | - | - | | 24 | - | - |
| 23/06 | - | - | - | - | - | - | - | - | - | - | 27 | - | | - | - | - |
| 24/06 | - | - | - | - | - | - | 35 | 43 | - | - | - | - | | - | - | - |
| 25/06 | - | - | - | - | - | - | - | - | - | 39 | - | - | | - | -9 | 26 |
| 26/06 | - | - | - | - | - | - | - | - | - | - | - | 36 | | 28 | - | - |
| 27/06 | 39 | - | - | - | - | - | - | - | - | - | 41 | - | | - | - | - |
| 28/06 | - | 47 | - | - | - | - | - | - | - | - | - | 36 | | - | - | - |
| **LONGEST DAY – SHORTEST NIGHT** | | | | | | | | | | | | | | **LD - SN** | | |
| 29/06 | - | - | 42 | 37 | - | 32 | - | - | 31 | - | - | - | | - | 17 | - |
| 30/06 | - | - | - | - | - | - | 40 | - | - | - | - | - | | - | - | - |

| JULY | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | RE-ROOFING AND GRILLES FITTED | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01/07 | - | 39 | - | - | - | - | - | 41 | - | - | - | - | | - | 17 | - |
| 02/07 | - | - | - | - | - | - | - | - | - | 37 | - | - | | 22 | - | - |
| 03/07 | 40 | - | - | - | - | 36 | - | - | - | - | - | - | | - | - | - |
| 04/07 | - | - | - | 37 | - | - | - | - | - | - | 39 | 35 | | - | - | - |
| 05/07 | - | - | - | - | 38 | - | - | - | - | - | - | - | | - | - | - |
| 06/07 | - | - | 36 | 34 | - | - | - | - | - | 35 | - | - | | - | - | - |
| 07/07 | - | - | - | - | - | - | - | - | 31 | - | - | 34 | | 19 | - | - |
| 08/07 | 39 | 39 | - | - | - | - | - | 31 | - | - | - | - | | - | - | - |
| 09/07 | - | - | - | 39 | - | - | - | - | - | - | - | - | | - | - | 31 |
| 10/07 | 36 | - | - | - | - | - | - | - | - | - | - | - | | 3 | - | - |
| 11/07 | - | - | 39 | - | - | - | - | - | - | 38 | 32 | - | | - | 22 | - |
| 12/07 | - | - | - | - | 33 | - | - | - | 35 | - | - | 38 | | 20 | - | 18 |
| 13/07 | - | - | - | - | - | - | - | 39 | - | - | - | - | | - | - | - |
| 14/07 | - | - | - | - | - | - | 41 | - | 39 | - | - | - | | - | - | - |
| 15/07 | - | 38 | - | - | - | - | 35 | - | - | - | - | - | | - | - | - |
| 16/07 | 39 | - | - | - | - | - | - | - | - | - | - | - | | - | - | - |
| 17/07 | - | - | - | - | - | - | - | - | - | - | - | - | | 16 | - | - |
| 18/07 | - | - | - | - | - | - | 38 | - | - | - | 29 | - | | - | 23 | - |
| 19/07 | - | - | - | - | 35 | - | - | 29 | - | - | - | - | | - | - | 14 |
| 20/07 | - | - | 36 | 32 | - | - | - | - | - | - | - | - | | - | - | - |
| 21/07 | - | - | - | - | - | - | - | - | 37 | - | - | 37 | | - | - | - |
| 22/07 | - | - | - | - | - | - | - | - | - | - | - | - | | - | 8 | 13 |
| 23/07 | - | 33 | - | - | - | - | 35 | - | - | 34 | - | - | | - | - | - |
| 25/07 | - | - | - | 36 | | - | - | - | - | - | - | - | | - | - | - |
| 26/07 | - | - | - | - | 26 | - | - | - | - | - | - | - | | - | - | - |
| 27/07 | 30 | - | - | - | - | - | 31 | - | - | - | - | - | | - | - | - |
| 28/07 | - | - | - | - | - | - | - | - | 33 | - | - | - | | - | 32 | - |
| 29/07 | - | - | - | - | - | - | - | - | - | - | 29 | - | | - | - | - |
| 30/07 | - | - | - | - | - | - | - | - | - | - | - | - | | 19 | - | - |
| 31/07 | 60 | 38 | - | - | - | - | - | - | - | - | - | - | | - | - | - |