

# POWER SYSTEM FREQUENCY AND TIME ERROR MONITORING

June 2012

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DOCUMENT REF: SP&C\_01

VERSION: 1.0

DATE: 27 August 2012

FINAL

## Version Release History

VERSION	DATE	BY	CHANGES
1.0	27/08/2012	Peter McEnery	Initial release

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## 2 Introduction

AEMO must use reasonable endeavours to maintain the power system frequency and time error within the limits specified in the Frequency Operating Standards determined for the Mainland and the Tasmania Region by the Reliability Panel. This document reports on the frequency and time error performance observed during June 2012 in all regions of the NEM. Regions QLD, NSW, VIC and SA are referred to as the Mainland regions throughout the report.

The Frequency Operating Standards for the Mainland regions and the Tasmania region are available on the AEMC web site<sup>1</sup>.

The “Power System Frequency and Time Deviation Monitoring Report – Reference Guide<sup>2</sup>” outlines the calculation processes used by AEMO in the preparation of the monthly Power System Frequency and Time Deviation Monitoring reports.

The analysis of the delivery of Slow Raise service, Slow Lower service, Delayed Raise service and Delayed Lower service presented in this report are based on 4-second resolution data. Unless otherwise noted, frequency data for Mainland regions is sourced from 4-second measurements in New South Wales and frequency data for Tasmania region is sourced from 4-second measurements in Tasmania. The analysis of Fast Raise service and Fast Lower service delivered is based on high-speed (50 ms or higher resolution) data from Market Participants and is only presented in this report for events where the appropriate data is available.

## 3 Operation in the Normal Operating Frequency Band

Under the Mainland Frequency Operating Standards, excluding contingency events and load events the Mainland frequency is required to be within the Normal Operating Frequency Band (49.85 Hz – 50.15 Hz) 99% of the time. During June 2012 excluding contingency events and load events the Mainland Frequency was within the range 49.85 Hz – 50.15 Hz 99.99% of the time.

Under the Tasmanian Frequency Operating Standards, under Normal Conditions the Tasmanian frequency is required to be within the Normal Operating Frequency Band (49.85 Hz – 50.15 Hz) 99% of the time. During June 2012 under Normal Conditions the Tasmanian frequency was within the range 49.85 Hz – 50.15 Hz 99.96% of the time.

All frequency excursions within the Normal Operating Frequency Excursion Band (49.75 Hz – 50.25 Hz) returned to the Normal Operating Frequency Band within the times in the Frequency Operating Standards. Table 1 summarises events in the Mainland and Tasmanian regions for the month June 2012 with frequency excursions outside the Normal Operating Frequency Excursion Band. Any events in Table 1 that are identified with frequency excursions that did not meet the Frequency Operating Standards are evaluated in Section 5 of the report.

<sup>1</sup> The Frequency Operating Standards for the Mainland and Tasmania regions are available from <http://www.aemc.gov.au/Panels-and-Committees/Reliability-Panel/Guidelines-and-standards.html>

<sup>2</sup> The Power System Frequency and Time Deviation Monitoring Report – Reference Guide is available from <http://www.aemo.com.au/Electricity/Market-and-Power-Systems/NEM-Reports/Power-System-Performance-Monitoring>

## 4 Summary of Events outside the Normal Operating Frequency Excursion Band

Table 1: Events in the Mainland and Tasmanian regions with frequency excursions outside the Normal Operating Frequency Excursion Band.

EVENT	LOW/HIGH FREQUENCY EVENT	NUMBER OF EVENTS	
		MAINLAND	TASMANIA
No contingency or load event/Normal event	LOW	0	1
	HIGH	0	1
Load Event	LOW	0	60
	HIGH	0	54
Generation Event	LOW	0	0
	HIGH	0	0
Network Event	LOW	0	0
	HIGH	0	1
Separation Event	LOW	0	0
	HIGH	0	0
Multiple Contingency Event	LOW	1	1
	HIGH	0	0

## 5 Events that did not meet the Frequency Operating Standards

In this section, details are provided of those events identified in Table 1 as not meeting the Frequency Operating Standard applicable to each event.

### 5.1 Frequency events in Mainland Regions

There were no events recorded in the Mainland Region that did not meet the Mainland Frequency Operating Standards from those identified in Table 1 during June 2012.

### 5.2 Low frequency events in Tasmania

There was one low frequency event from Table 1 recorded in Tasmania region during June 2012 that did not meet the Frequency Operating Standards. This event is listed in Table 2.

*Table 2: Low frequency events in the Tasmania region that frequency exceeded the Tasmania Frequency Operating Standards.*

DATE	EVENT	MIN FREQUENCY (HZ)	TIME OUTSIDE NORMAL OPERATING BAND (49.85 HZ - 50.15 HZ)(SECONDS)
14/06/2012 12:13:24	No Condition causing the event was identified.	49.72	632

#### 5.2.1 Event: 14/06/2012 12:13:24

For the Normal Condition low frequency event on 14 June 2012 in Tasmania, Figure 1 shows that the Tasmania region frequency exceeded the Tasmania Frequency Operating Standards, and was outside the Normal Operating Frequency Band for 632 seconds. Two Tasmanian generating units were not responding to Raise Regulation targets which contributed to the frequency excursion. The generator was contacted by AEMO and the two generating units resumed following Raise Regulation targets at 1250 hours. Compared to the enabled Slow Raise and Delayed Raise FCAS, a zero amount was delivered as shown in Figure 2. Basslink was in service but not transmitting power during this event. The frequency excursion was not sufficient to trigger switched controllers to deliver Slow or Delayed FCAS during the event. Frequency fell to a minimum of 49.72 Hz in the Tasmania region. The amount of Fast Raise services delivered was not calculated as high speed data was not requested for this event.

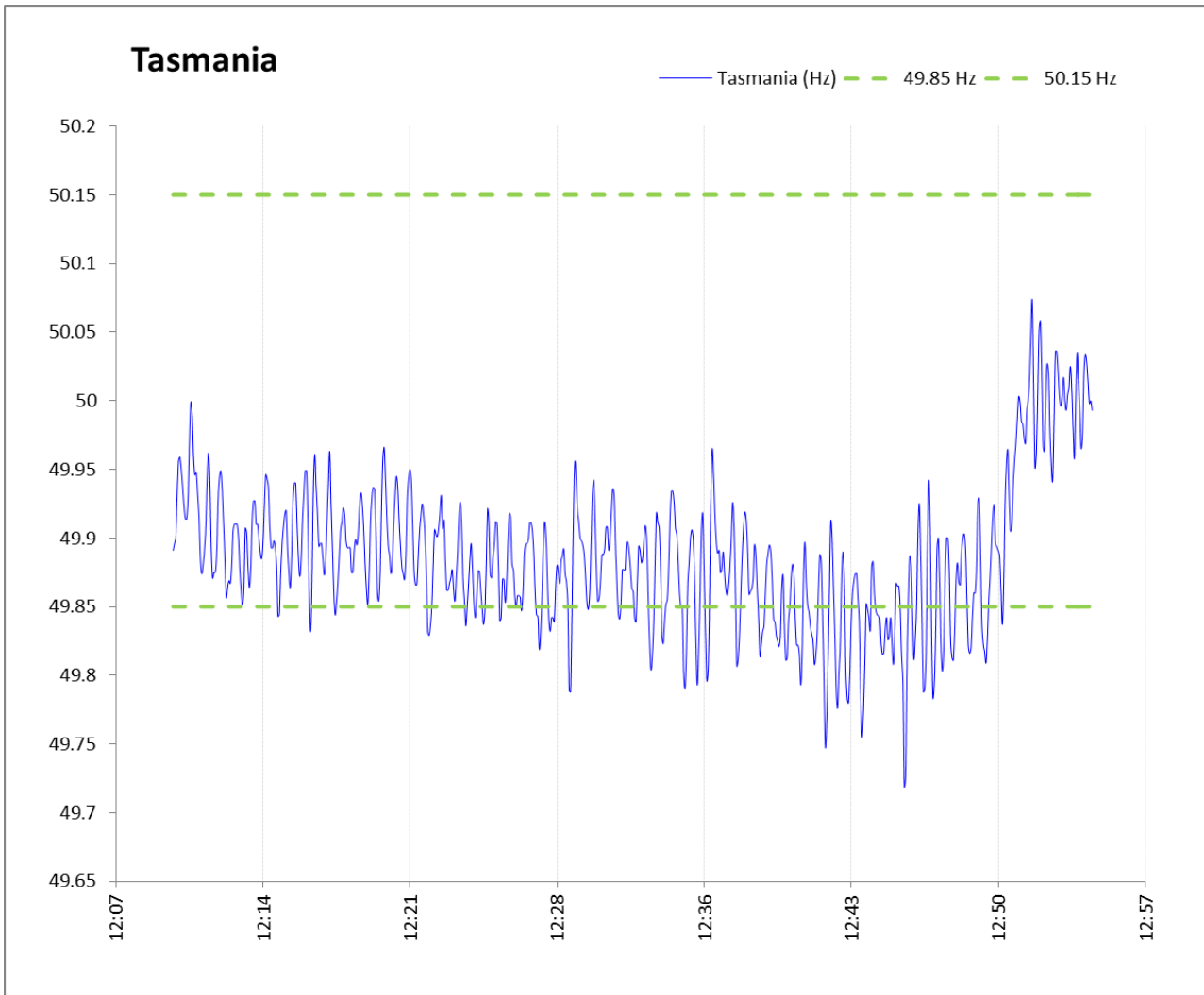


Figure 1: Low Frequency Normal Condition event in Tasmania that occurred 14/06/2012 12:13:24

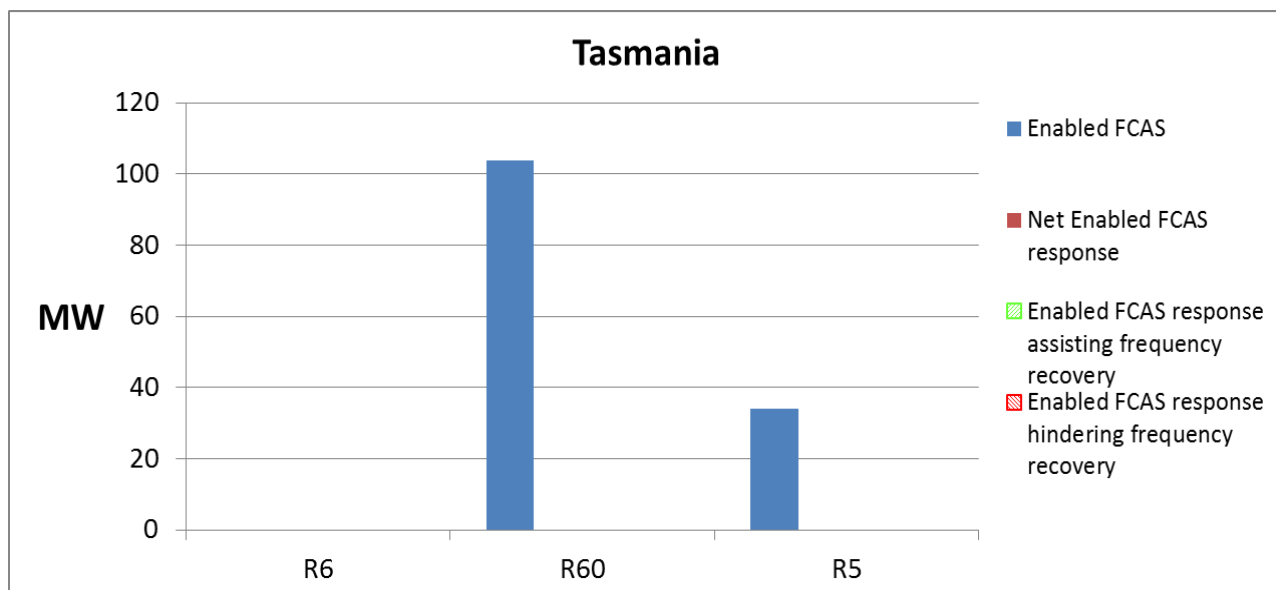


Figure 2: FCAS response to Normal Condition low frequency event that occurred 14/06/2012 12:13:24



### 5.3 High frequency events in Tasmania

There was one high frequency event in Tasmania region during June 2012 that did not meet the Frequency Operating Standards. This event is listed in Table 3.

*Table 3: High frequency events in the Tasmania region resulting in frequency exceeding the Tasmania Frequency Operating Standards.*

DATE	EVENT	MAX FREQUENCY (HZ)	TIME OUTSIDE NORMAL OPERATING BAND (49.85 HZ - 50.15 HZ)(SECONDS)
01/06/2012 15:53:24	No Condition causing the event was identified.	50.251	16

#### 5.3.1 Event: 01/06/2012 15:53:24

For the Normal Condition high frequency event on 1 June 2012 in Tasmania, Figure 3 shows that the Tasmania region frequency exceeded the Tasmania Frequency Operating Standards and was outside the Normal Operating Frequency Band for 16 seconds. One Tasmanian generating unit synchronised and dispatched to a peak of 26 MW for 193 seconds over its target of 0 MW, which contributed to the frequency excursion. Compared to the enabled Slow Lower and Delayed Lower FCAS, a zero amount was delivered as shown in Figure 4. Basslink was in service but not transmitting power during this event. The frequency excursion was not sufficient to trigger switched controllers to deliver Slow or Delayed FCAS during the event. Frequency rose to a maximum of 50.251 Hz in the Tasmania region. The amount of Fast Raise services delivered was not calculated as high speed data was not requested for this event. Figure 3 also shows a low frequency event that occurred at 1601 hours. This was an independent Basslink event that was within the Tasmanian Frequency Operating Standards.

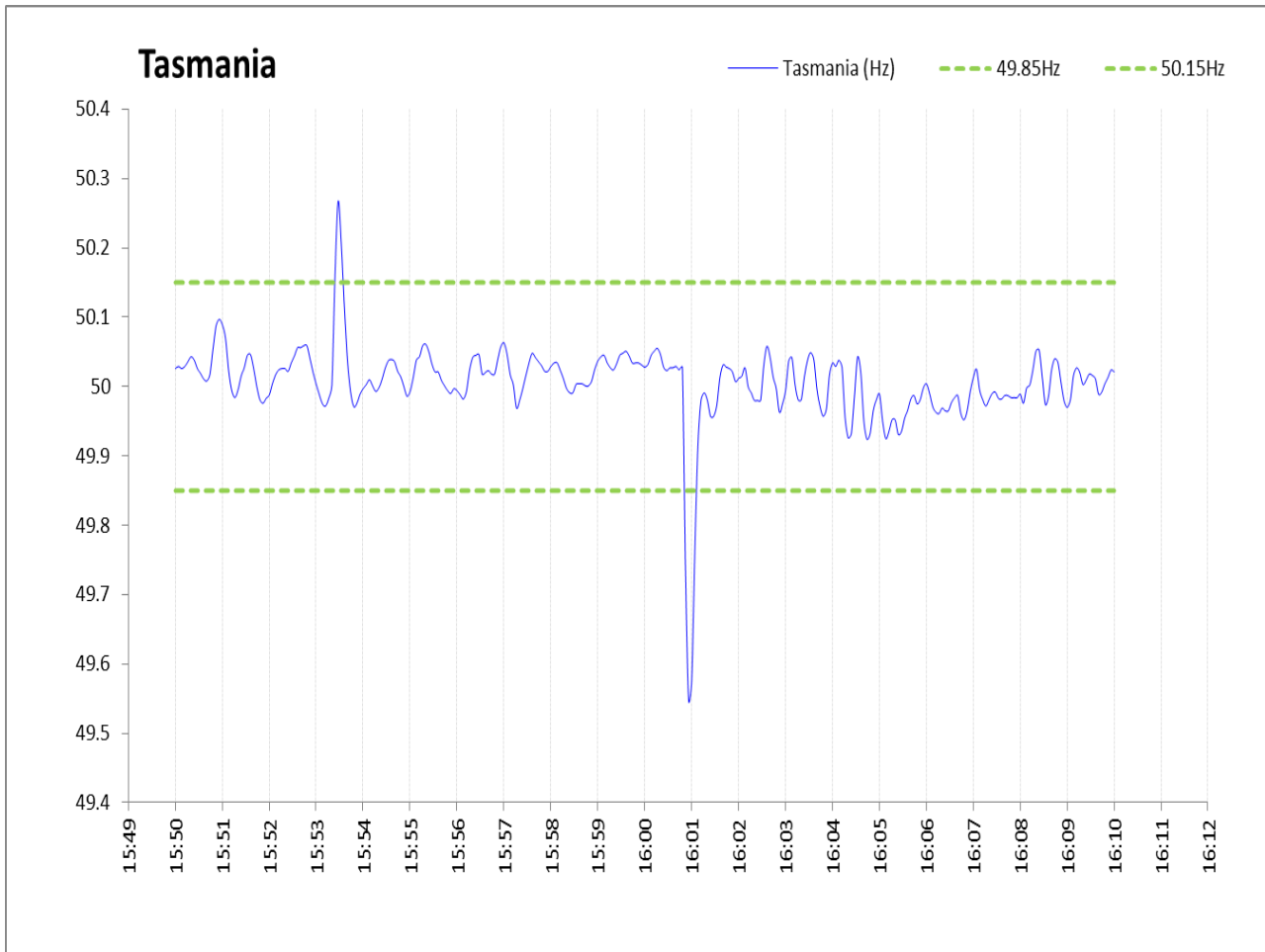


Figure 3: High frequency Normal Condition event in Tasmania that occurred 01/06/2012 15:53:24.

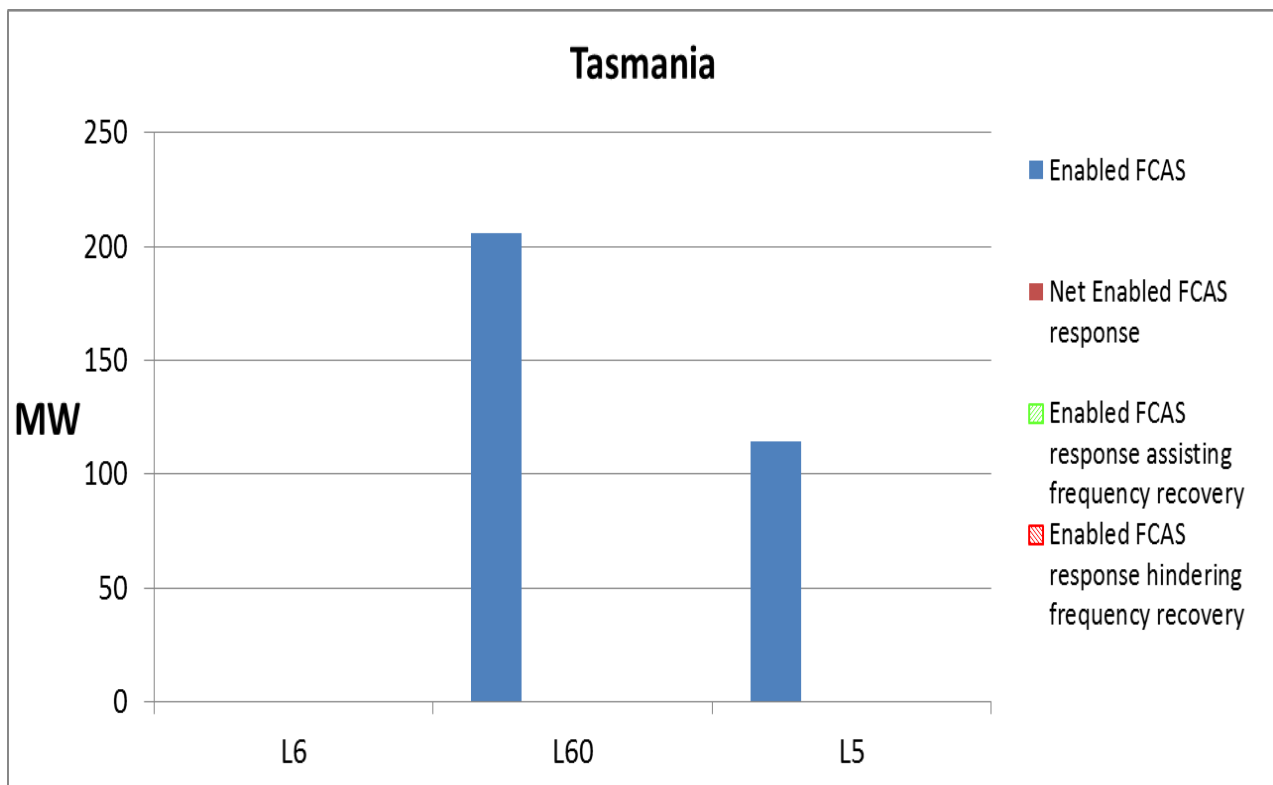


Figure 4: FCAS response to Normal Condition high frequency event that occurred 01/06/2012 15:53:24.

## 6 Multiple contingency event in Victoria 19/06/2012 20:53:48

A multiple contingency event occurred 19/06/2012 20:53:53 as a result of an earthquake in the Victorian region. Five generating units totalling approximately 2000 MW of generation and approximately 400 MW of load tripped during the event. The Frequency Operating Standards for both the Mainland and Tasmanian regions were maintained during this event. A Power System Operating Incident Report regarding this event will be made available at the following link:

<http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/Power-System-Operating-Incident-Reports>

## 7 Accumulated time error

The Frequency Operating Standards require that the accumulated time error be maintained within the range  $\pm 5$  seconds in Mainland regions and  $\pm 15$  seconds in Tasmania. For a separation event there is no requirement in the Frequency Operating Standards that time error be maintained within the ranges specified above. Constraints used to control accumulated time error are based upon measurements taken in Queensland, New South Wales and Tasmania. The range of accumulated time error recorded for these measurements in June 2012 is provided in Table 4.

Table 4: Accumulated time error ranges.

VALUE	QLD	NSW	TAS
Maximum positive error (seconds)	2.72	3.08	5.01
Maximum negative error (seconds)	-4.27	-4.43	-8.49

The distribution of time error based on the Mainland and Tasmania region measurements are provided in Figure 11 and Figure 12.

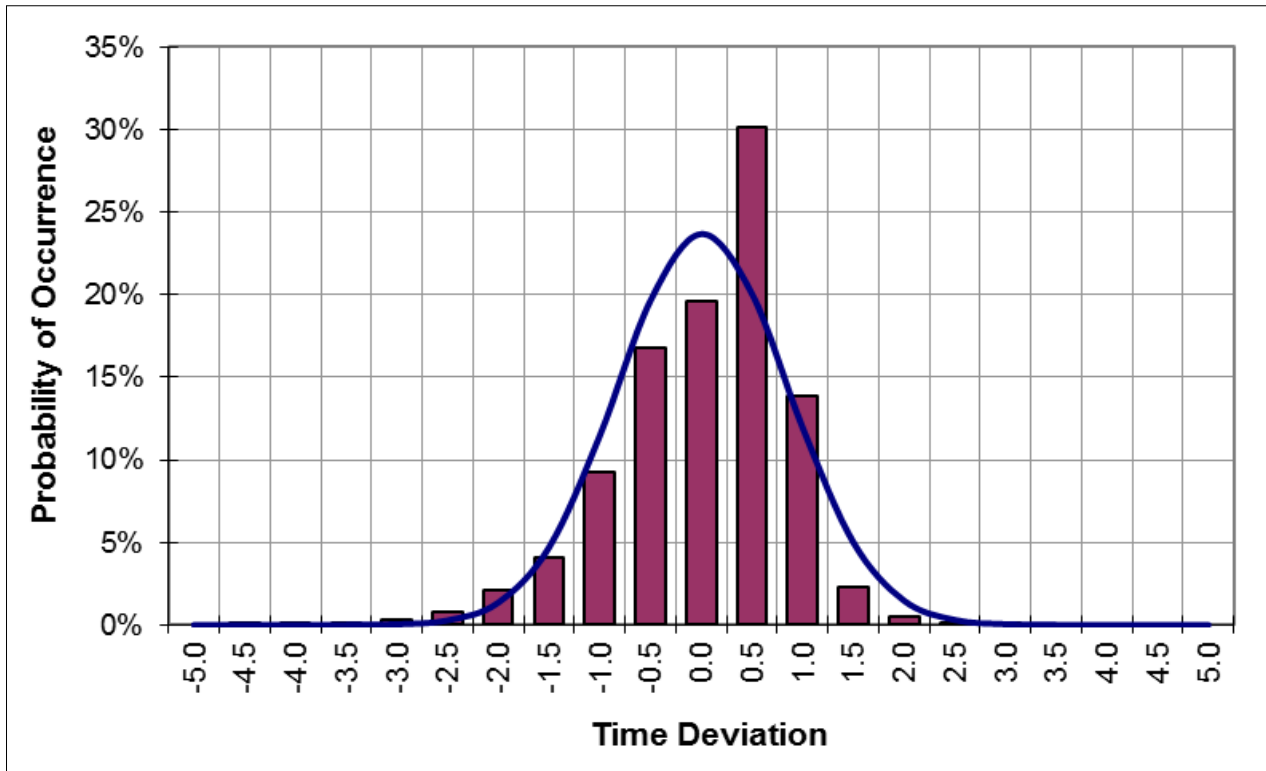


Figure 13: Mainland time error distribution for June 2012.

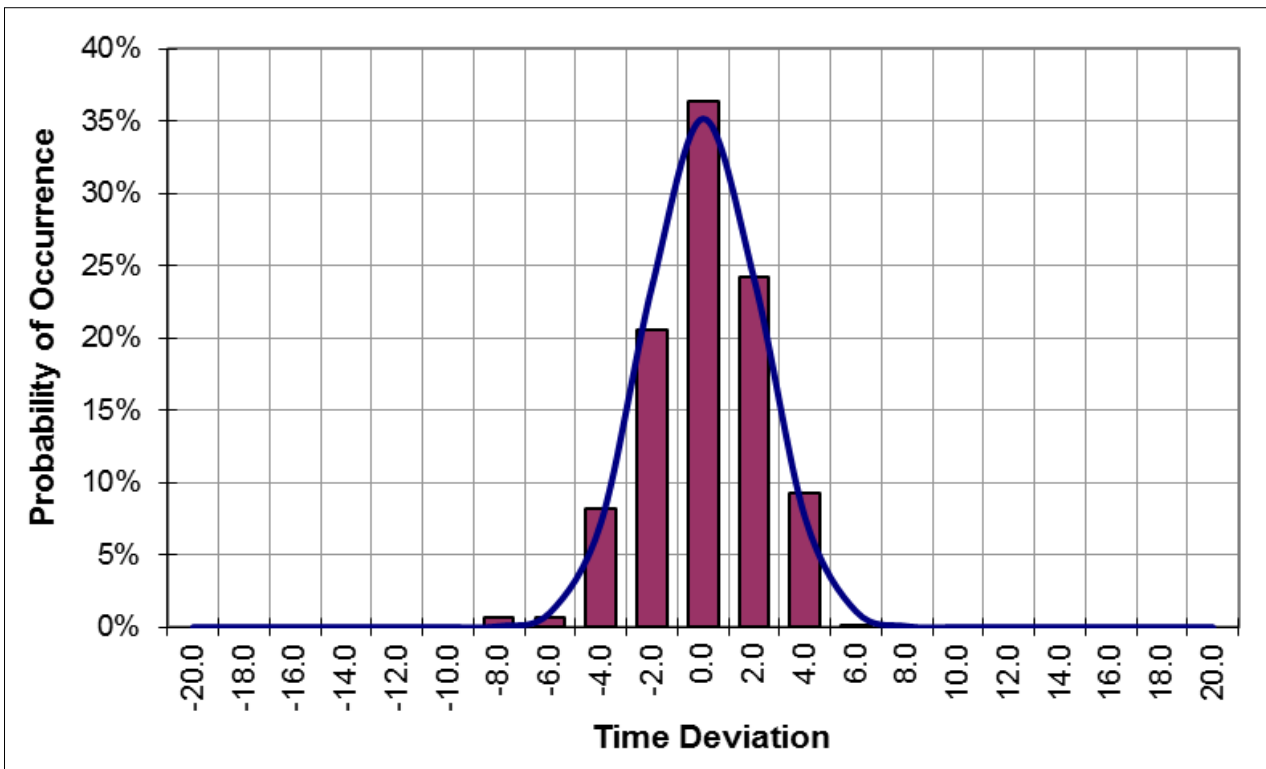


Figure 14: Tasmania time error distribution for June 2012.