

## **METHODOLOGICAL NOTE:**

Seasonal adjustment of selected building statistics of the private sector as reported by local government institutions

**May 2017 to April 2018**

## **Methodological note on the seasonal adjustment of selected building statistics of the private sector as reported by local government institutions ('building statistics')**

This document provides a brief explanation of the seasonal adjustment of building statistics, at both current and constant prices.

Monthly and quarterly time series are often characterised by considerable seasonal variation, which may complicate their interpretation. Such time series are therefore subjected to a process of seasonal adjustment in order to remove the effects of these seasonal fluctuations.

### **Statistics South Africa (Stats SA) uses X-12-ARIMA to estimate trend, seasonal and irregular components as well as length of month (LOM), trading day (TD) and Easter effects.**

The time series for building statistics show TD without a leap year effect (TDNOLPYEAR) and Easter effects. Adjustment was done for these effects as shown in Table 1.

X-12-ARIMA is a seasonal adjustment program developed at the United States Bureau of Census. The program is based on the Bureau's X11 algorithm. It incorporates regression techniques and also ARIMA modelling to improve estimation of the different time series components. Indirect seasonal adjustment was applied for total building statistics while the indirect approach was adopted for the three main components. To improve the quality of the seasonal adjustment process, the span used in identifying the parameters for the building statistics time series at current and constant prices was split into three intervals:

- January 1981 to June 1994;
- July 1994 to June 2006; and
- July 2006 to March 2017.

The identified parameters will be fixed for a period of one year and revised on an annual basis.

Table 1 shows metadata for the individual components for building statistics at both constant and current prices. For each component the following is given in the tables below: decomposition scheme, ARIMA model, presence of seasonality, Easter, trading day and length of month effects, Henderson and seasonal moving average filters and outliers.

**Table 1: Metadata for building statistics (July 2006 to March 2017)**

Variable	Description	Decomposition scheme	ARIMA model	Presence of seasonality	Presence of Easter effect	Presence of TD or LOM effect	Henderson filter	Seasonal moving average filter	Outliers (AO, LS, TC)*
<b>Building plans passed (current prices)</b>									
G0010003	Residential buildings	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	13	3x5	None
G0020003	Non-residential buildings	Multiplicative	(0,1,1)(0,0,0)	Not present	Not present	Not present	23	3x9	None
G0030003	Additions and alterations	Multiplicative	(1,0,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	23	3x5	AOJAN2008 AOAPR2009 TCSEP2010
<b>Building plans passed (constant prices)</b>									
G0110003	Residential buildings	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	13	3x5	None
G0120003	Non-residential buildings	Multiplicative	(1,0,1)(0,0,0)	Not present	Not present	Not present	23	3x9	None
G0130003	Additions and alterations	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(15)	TDNOLPYEAR	13	3x5	AOJAN2008 AOAPR2009 TCSEP2010
<b>Buildings completed (current prices)</b>									
V0010003	Residential buildings	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	Not present	23	3x9	AOJAN2001 AOJUL2003 AONOV2004
V0020003	Non-residential buildings	Multiplicative	(0,1,1)(0,0,1)	Not present	Not present	Not present	23	3x5	None
V0030003	Additions and alterations	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(15)	Not present	23	3x9	None
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V0120003	Non-residential buildings	Multiplicative	(0,1,1)(0,0,1)	Not present	Not present	Not present	23	3x5	None
V0130003	Additions and alterations	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(15)	Not present	23	3x9	None

\* Note if an outlier is mentioned, it is still part of the data due to there being sufficient reasons available for the values that were identified as outliers.

## Definitions:

**Additive decomposition** – An additive decomposition is appropriate if the magnitude of the seasonal fluctuations does not vary with the level of the series. Under the additive decomposition scheme, the original series (Y) is expressed as  $Y = T + TD + S + I$ , where T = trend, TD = trading day effect, S = seasonal component and I = irregular component.

**Multiplicative decomposition** – The multiplicative decomposition is usually appropriate for series of positive values where the size of the seasonal oscillations increases with the level of the series. The original series (Y) is expressed as  $Y = T * TD * S * I$ .

**Additive Outlier (AO)** – This refers to unusually high or low singular values in the time series.

**Level Shift (LS)** – This refers to an abrupt but sustained change in the level of the time series.

**Transitory Changes (TC)** – This refers to a series of outliers with transitory effects on the level of the series.

**Easter effect** – The Easter holidays may regularly affect economic activity before, during or after the holiday period. Unlike other public holidays which occur on the same date each year, the dates for Easter are not fixed and may occur in March or April. Such an effect, if it is present, is known as the Easter effect.

**Trading day effect** – An effect associated with the composition of the calendar. For example, different months have different numbers of working days and also the number of specific days of the week can occur in differing frequency in the same month over different years. Days of the week can have different levels of activity.

**Length of month effect** – An effect arising from the fact that some months are longer than others e.g. 28, 29, 30 or 31 days.

**Seasonal adjustment approaches** – In seasonal adjustment, the direct approach refers to the adjustment of a total (aggregate or unadjusted components), and the indirect approach is the aggregation of seasonally adjusted components to obtain a total.

**Trend component** – An estimate of the local level of the series derived from the surrounding recent (a year or two) observations. The trend is generally fairly smooth and includes movements and cycles longer than a year.

**Seasonal component** – An estimate of effects that are reasonably stable in terms of annual timing, direction and magnitude. Possible causes include natural factors (the weather), administrative measures (starting and ending dates of the school year) and social / cultural / religious traditions (fixed holidays such as Christmas).

**Irregular component** – An estimate of any effect not included in the trend-cycle or the seasonal effects (or in estimated trading-day or holiday effects). Its values are unpredictable with regard to timing, impact and duration. It can arise from sampling error, non-sampling error, unseasonal weather patterns, natural disasters, strikes, etc.

**Parameters** – This refers to the decomposition scheme, ARIMA model, seasonal moving average and Henderson filters, outliers and trading-day, Easter and length-of-month regressors.