



**stats sa**

Department:  
Statistics South Africa  
**REPUBLIC OF SOUTH AFRICA**

## **METHODOLOGICAL NOTE:**

Seasonal adjustment of land transport



## **Methodological note on the seasonal adjustment of land transport**

This document provides a brief explanation of the seasonal adjustment of land transport estimates.

Monthly and quarterly time series are often characterised by considerable seasonal variations, which might 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 or length-of-quarter, trading day, leap year and Easter effects.**

X-12-ARIMA is a seasonal adjustment program developed at the United States Census Bureau. It incorporates regression techniques and also ARIMA modelling to improve estimation of the different time series. Further information is available at the following link:

<https://www.census.gov/topics/research/seasonal-adjustment.html>.

The period used in identifying the parameters for the land transport estimates was January 2008 to February 2021 (indirect seasonal adjustment was applied by adjusting the subcomponents and then aggregating them to the total).

The parameters will be revised every one year to two years, or as necessary.

Table 1, on page 2, shows metadata for the individual components for land transport. For each component the following are given in the table below: decomposition scheme, ARIMA model, presence of seasonality, Easter, length-of-month and trading effects, Henderson and seasonal moving average filters, and outliers.

**Table 1: Metadata for land transport time series for the period January 1998 to February 2021**

	Decomposition scheme	ARIMA model	Presence of seasonality	Presence of Easter effect	Presence of length-of-month and trading day effects	Henderson filter	Seasonal moving average filter	Outliers (AO, TC, LS)
<b>Payload for rail freight transportation</b>	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	Not present	23	3x5	TCAPR2020 TCMAY2010 AOJUN2011 TCJAN2021
<b>Income for rail freight transportation</b>	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	Not present	13	3x5	TCAPR2020 AOMAY2020 AOMAY2010
<b>Payload for road freight transportation</b>	Multiplicative	(0,1,1)(0,1,1)	Present	Present	TDNOLPYEAR	13	3x5	TCAPR2020
<b>Income for road freight transportation</b>	Multiplicative	(0,1,1)(0,1,1)	Present	Present	TDNOLPYEAR	13	3x5	TCAPR2020
<b>Passenger journeys for rail passenger transportation</b>	Multiplicative	(0,1,1)(0,1,1)	Present	Present	Not present	13	3x5	AOAPR2020 AOMAY2020 AOJUN2020 AOJUL2020 AOAUG2020 AOSEP2020 AOOCT2020 AONOV2020 AODEC2020 AOJAN2021 AOFEB2021
<b>Income for rail passenger transportation</b>	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	Not present	13	3x5	
<b>Passenger journeys for road passenger transportation</b>	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	Not present	13	3x5	
<b>Income for road passenger transportation</b>	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	LPYEAR	13	3x5	

## 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** – A 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 (TD)** – 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 (LOM)** – 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 of 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.