CIVITAS
Sustainable and smart mobility for all
2030

# CIVITAS indicators

## Congestion – Version 2 (TRA_FC_CG2)

### DOMAIN

| | | | | |
|---|---|---|---|---|
| **Transport** | Environment | Energy | Society | Economy |

| | | |
|---|---|---|
| **TOPIC** | **Functionality of the transport system** | |
| **IMPACT** | **Congestion**<br>*Reducing congestion in the urban area* | **TRA_FC** |

### Category

| | | |
|---|---|---|
| **Key indicator** | Supplementary indicator | State indicator |

## CONTEXT AND RELEVANCE

Urban congestion refers to the overcrowding of vehicles on road networks, leading to slower speeds, longer trip times, and increased vehicular queuing. Congestion leads to economic losses due to wasted time and fuel, in addition to contributing to air pollution and climate change. Congestion is influenced by various factors, including population size, density, economic activities, urban planning and design, and the availability and adoption of public transportation.

This indicator provides a measure of the level of congestion in the experiment area. **It is a relevant indicator when the policy action is aimed at reducing the traffic jam and the consequent increase of travel time. A successful action is reflected in a LOWER value of the indicator after the experiment compared to the BAU case.**

## DESCRIPTION

This indicator is based on the number of motorised vehicles observed on a sample of road section. Its unit of measurement is **vehicle per lane per hour**.

## METHOD OF CALCULATION AND INPUTS

The indicator should be calculated **exogenously** on the required inputs and then coded in the supporting tool**.**

There are two alternative methods of calculation available for this indicator. The two methods distinguish for size of the traffic counts campaign used to collect the information.

| METHOD 1 | METHOD 2 |
|---|---|
| **Number of vehicles observed only in peak time for a sample day** | **Number of vehicles observed in the whole day in different days** |
| It is based on a limited set of data | It is based on a wider set of data |
| Complexity  | Complexity  |
| Significance  | Significance  |

## Method 1

**Calculation based on traffic counts in peak time for one day**

Significance: **0.50**

### INPUTS

The input needed to compute this indicator is:

a) A set of traffic counts on a sample of road sections in the experiment area.

The experiment would be reflected in the modification of the observed number of motorised vehicles **in same road sections**. The modification would be the result of one or more interventions directly or indirectly affecting the number of motorised vehicles used in the experiment area.

### METHOD OF CALCULATION

The indicator should be computed according to the following steps:

- **Definition of the set of road sections** where counting vehicles. The selection of sections should be made according to the following rules:
  - Sections should include the major roads in the experiment area.
  - If the experiment includes interventions on some specific roads, counts should be made in at least some of these roads as well as in at least some roads that could be used as alternative by motorists.
  - If part of the experiment consists of including some roads in a pedestrian area where motorised vehicles are forbidden, these roads should NOT be included in the sample.
  - If part of the experiment consists of restricting access to some roads (e.g. low emissions zone) these roads can be included in the sample, but a sufficient number of roads outside the restricted area should also be included.

  If in the experiment area there is already a traffic counting system in place, the data from the system can be used, but the requirements above should be respected anyway.

- **Measurement of the number of motorised vehicles on each section**. The measurement should be made in at least 2 peak time hours of a working day. Ideally, the measurement should provide classified counts, distinguishing at least light vehicles and heavy vehicles. Non-classified counts are, however, sufficient.

- **Quantification of the indicator**. The indicator is the average number of measured vehicles per lane and per hour computed using all sections.

### EQUATIONS

The equation that should be applied to quantify the indicator is:

$$CongInd = \frac{\sum_s \sum_h \frac{Veh_s^h}{lanes_s}}{S * H}$$

Where:

$Veh_s^h$ = Number of motorised vehicles counted in road section *s* in hour *h*

$lanes_s$ = Number of lanes of road section *s*

$S$ = Total number of road sections

$H$ = Number of hours monitored

## Method 2

**Calculation based on traffic counts in the whole day for more days**

Significance: **1.00**

### INPUTS

See Method 1.

### METHOD OF CALCULATION

See Method 1.

The difference with respect to Method 1 is in the second step, as there are additional requirements regarding the period of the counts. The measurement should be made continuously from 6 to 22 in at least 3 working days.

### EQUATIONS

The equation that should be applied to quantify the indicator is:

$$CongInd = \frac{\sum_s \sum_d \sum_h \frac{{}^dVeh_s^h}{lanes_s}}{S * D * H}$$

Where:

${}^dVeh_s^h$ = Number of motorised vehicles counted in road section *s* in hour *h* of day *d*

$lanes_s$ = Number of lanes of road section *s*

$S$ = Total number of road sections

$H$ = Number of hours monitored

$D$ = Number of days monitored

## ALTERNATIVE INDICATORS

Alternative indicators for measuring the same impact are **TRA_FC_CG1, TRA_FC_CG3, TRA_FC_CG4**.

The indicator described in this factsheet assesses traffic congestion by considering traffic counts on a sample of road sections in the experiment area. Its required inputs tend to be simple to collect using sensors or through manual collection. The interpretation of this indicator requires accounting for road capacity since high volumes of traffic on a corridor do not imply congestion if capacity is sufficient. In addition, it does not assess congestion severity, as it does not consider travel time or speed.

Meanwhile, **TRA_FC_CG1** takes as input a set of measurements of travel time by car for a sample of origin/destination pairs in the experiment area. This indicator is to be preferred when the goal is to capture the actual experience of travellers regarding travel times in the experiment area. The input data is obtained from either simulation models, online route search engines or driving tests.

**TRA_FC_CG3** evaluates congestion intensity by analysing speed data from a sample of road sections, with lower speeds indicating higher congestion levels. **TRA_FC_CG4** assesses congestion severity by measuring the proportion of road sections where observed speeds fall below the free-flow speed by a specified percentage. This metric allows to filter out roads experiencing only mild congestion, focusing instead on those with more significant traffic jams. By doing so, it provides insight into the extent of congestion across road sections that exceed an acceptable threshold. Both **TRA_FC_CG3** and **TRA_FC_CG4** rely on input data sourced from either simulation models or road measurements.

Each of the alternative indicators has multiple calculation methods, with varying significance and complexity. Methods that use measures collected from traffic simulation models or online travel planners are simpler but less significant. In contrast, methods using field measurements, especially if obtained over multiple days, are more significant and more complex to apply, given the larger efforts needed for data collection.

Data availability can affect the choice among alternative indicators. This indicator (**TRA_FC_CG2**) may be preferrable for cities where traffic counts are already taken on a regular basis. In addition, it should be noted that devices used to count vehicles may also measure speeds; therefore, the input data to also compute **TRA_FC_CG3** and **TRA_FC_CG4** could be easily obtained while taking the measurements needed for this indicator.

If classified counts distinguishing light and heavy vehicles are taken, the collected data also allows to compute the freight indicator **TRA_FR_MA1**, describing the number of motorized freight vehicles on a sample of roads.

It should also be noted that congestion is one of the three components of **TRA_FC_AC1**. This indicator combines public transport connectivity, bike connectivity and road congestion to assess overall accessibility. The online tool automatically computes **TRA_FC_AC1** if the three sub-indicators have been calculated.