CIVITAS
Sustainable and smart mobility for all
2030

CIVITAS indicators

Congestion – Version 3 (TRA_FC_CG3)

DOMAIN

Transport	Environment	Energy	Society	Economy

TOPIC	**Functionality of the transport system**	
IMPACT	**Congestion** *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 HIGHER value of the indicator after the experiment compared to the BAU case.**

This indicator can be helpful also to measure the effects of traffic calming measures on private transport travel time. If used for this purpose, the value of the indicator reflecting a successful action depends case by case: it can be a lower value if the focus is on the effectiveness of measures aimed at slowing traffic; it can be a not too lower value if the desired impact is a limited reduction of speed resulting from e.g., measures aimed at increasing safety.

DESCRIPTION

This indicator is based on the average speed of cars in peak time on a sample of road sections. The indicator is based specifically on car speed because it is the most representative and, focusing on one vehicle type only avoids complexities due to the mix of different vehicle types on roads.

The unit of measurement of the indicator is **km/h**.

METHOD OF CALCULATION AND INPUTS

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

There are three alternative methods of calculation available for this indicator. The three methods distinguish for the approach used to measure speed. Approaches are of different complexity and significance.

METHOD 1	METHOD 2	METHOD 3
Speeds extracted from a transport simulation model	**Speed measured in peak time of one day**	**Speed measured in the peak day in different days**
It is based on a theoretical calculation rather than on observation.	It is based on the real conditions in a limited period.	It is based on real conditions directly in different periods.
Complexity 	Complexity 	Complexity 
Significance 	Significance 	Significance 

Method 1

Speeds extracted from a transport simulation model

Significance: **0.25**

INPUTS

The input needed to compute this indicator is:

a) A set of modelled speeds on a sample of road sections in the experiment area.

The experiment would be reflected in the modification of the modelled speed **in same road sections**. The modification would be the result of the simulation of one or more interventions directly or indirectly affecting the speed of road vehicles.

METHOD OF CALCULATION

The indicator should be computed according to the following steps:

- **Definition of the set of road sections** where measuring speed. 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.

- **Extraction of modelled car speed on each section from a transport model**.

- **Quantification of the indicator**. The indicator is the average speed computed using all sections.

EQUATIONS

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

$$\boldsymbol{CongInd} = \frac{\sum_s \boldsymbol{Speed_s}}{\boldsymbol{S}}$$

Where:

$Speed_s$ = modelled speed (in km/h) on road section *s*

S = Total number of road sections

Method 2

Speed measured in peak time of one day

Significance: **0.50**

INPUTS

The input needed to compute this indicator is:

a) A set of measured speeds of cars on a sample of road sections in the experiment area.

The experiment would be reflected in the modification of the measured speeds **in same road sections**. The modification would be the result of one or more interventions directly or indirectly affecting the speed of road vehicles.

METHOD OF CALCULATION

The indicator should be computed according to the following steps:

- **Definition of the set of road sections** where measuring speed. 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 speed monitoring system in place, the data from the system can be used, but the requirements above should be respected anyway.

- **Measurement of vehicles speed on each section**. The measurement should be made in 2 peak time hours of a working day.

- **Quantification of the indicator.** The indicator is the average of all measured speeds (all vehicles in all sections)

EQUATIONS

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

$$CongInd = \frac{\sum_s \sum_v {}_v Speed_s}{S * V_s}$$

Where:

${}_{v}Speed_{s}$ = observed speed (in km/h) of vehicle *v* on road section *s*

S = Total number of road sections

V_s = Number of vehicles for which speed is measured on road section *s*

Method 3

Speed measured in peak time in different days	Significance: **1.00** 

INPUTS

See Method 2.

METHOD OF CALCULATION

See Method 2.

The difference with respect to Method 2 is in the second step, as there are additional requirements regarding the period of the measurements, which should be repeated for at least 3 working days.

EQUATIONS

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

$$\boldsymbol{CongInd} = \frac{\sum_s \sum_d \sum_v {}^{d}_{v}\boldsymbol{Speed_s}}{\boldsymbol{S} * \boldsymbol{D} * {}^{d}\boldsymbol{V_s}}$$

Where:

${}^{d}_{v}Speed_{s}$ = observed speed (in km/h) of vehicle *v* on road section *s* in day *d*

S = Total number of road sections

D = Number of days monitored

${}^{d}V_s$ = Number of vehicles for which speed is measured on road section *s* in day *d*

ALTERNATIVE INDICATORS

Alternative indicators for measuring the same impact are **TRA_FC_CG1, TRA_FC_CG2, TRA_FC_CG4**.

The indicator described in this factsheet evaluates congestion intensity by analysing speed data from a sample of road sections, with lower speeds indicating higher congestion levels. Its input data is sourced from either simulation models or road measurements.

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_CG2 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.

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 helps filter out roads experiencing only mild congestion, focusing instead on those with more significant traffic jams. By doing so, it provides insight into the share of road sections affected by congestion above an acceptable threshold. Similar to **TRA_FC_CG3,** it relies 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_CG3**) and **TRA_FC_CG4** may be preferrable for cities where speeds are already monitored on a regular basis. In addition, it should be noted that devices used to measure speeds may also count vehicles; therefore, the input data to compute **TRA_FC_CG2** could be easily obtained while taking the measurements needed for this indicator.

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.