CIVITAS
Sustainable and smart mobility for all
2030

CIVITAS indicators

Congestion – Version 6 (TRA_FC_CG6)

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

To be drafted

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 speed of vehicles on a sample of road sections compared to the theoretical free flow speed.

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 indicator is a ratio; therefore, it is **dimensionless**.

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 whole day in different days**
It is based on a theoretical calculation rather than on observation.	It is based on the real conditions but not they are not directly observed.	It is based on real conditions directly observed.
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
b) The theoretical free-flow speed on the sample roads.

The experiment would be reflected in the modification of the modelled speed **in same road sections**. The theoretical free-flow speed of the roads could also be changed. The modifications would be the result of the simulation of one or more interventions directly or indirectly affecting the speed of road vehicles or the free flow speed.

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 speed on each section and free-flow speeds from a transport model**.

- **Classification of sections** between congested and uncongested.

- **Quantification of the indicator**. The indicator is the share of sections where the modelled speed is above the 120% of free-flow speed.

EQUATIONS

The equations that should be applied to quantify the indicator are the followings:

Classification of sections:

$$CongLev_s = 1 \quad if\ Speed_s \geq FFSpeed_s * 1.2$$

$$CongLev_s = 0 \quad otherwise$$

Where:

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

$FFSpeed_s$ = Free-flow speed (in km/h) on road section *s*

Computation of the index:

$$CongInd = \frac{\sum_s CongLev_s}{S}$$

Where:

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 vehicles on a sample of road sections in the experiment area.
b) The theoretical free-flow speed on the sample roads.

The experiment would be reflected in the modification of the measured speeds **in same road sections**. The theoretical free-flow speed of the roads could also be changed. 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.
- **Calculation of average speed in each section.**
- **Classification of sections** between congested and uncongested.
- **Quantification of the indicator**. The indicator is the share of sections where the modelled speed is above the 120% of free-flow speed.

EQUATIONS

The equations that should be applied to quantify the indicator are the followings:

Calculation of average speed in each section:

$$AvSpeed_s = \frac{\sum_v {}_v Speed_s}{V_s}$$

Where:

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

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

Classification of sections:

$$CongLev_s = 1 \quad if\ AvSpeed_s \geq FFSpeed_s * 1.2$$

$$CongLev_s = 0 \quad otherwise$$

Where:

$FFSpeed_s$ = Free-flow speed (in km/h) on road section *s*

Computation of the index:

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

Where:

S = Total number of road sections

Method 3

Speed measured in the whole day 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 equations that should be applied to quantify the indicator are the followings:

Calculation of average speed in each section:

$$ {}^{d}AvSpeed_s = \frac{\sum_v {}^{d}_{v}Speed_s}{{}^{d}V} $$

Where:

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

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

Classification of sections:

$$ {}^{d}CongLev_s = 1 \quad if \ {}^{d}AvSpeed_s \geq FFSpeed_s * 1.2 $$

$$ {}^{d}CongLev_s = 0 \quad otherwise $$

Where:

$FFSpeed_s$ = Free-flow speed (in km/h) on road section *s*

Computation of the index:

$$ \boldsymbol{CongInd = \frac{\sum_d \sum_s {}^{d}CongLev_s}{S * D}} $$

Where:

S = Total number of road sections

D = Number of days monitored

ALTERNATIVE INDICATORS

To be drafted. In the discussion of pros and cons compared to other congestion indicators, it can be mentioned that:

In many cases, devices used to measure speeds can also count vehicles; therefore TRA_FC_CG4 is probably also computable

in cities where speeds are already monitored on a regular basis, the effort for computing this indicator is very limited as the most complex part is already in place.