CIVITAS
Sustainable and smart mobility for all
2030

CIVITAS indicators

Use of multimodal hubs (TRA_MM_PI3)

DOMAIN

Transport	Environment	Energy	Society	Economy

TOPIC	**Multimodality**	
IMPACT	**Physical integration of transport modes** *Improving the use of multimodal trip solutions*	**TRA_MM**

Category

Key indicator	**Supplementary indicator**	State indicator

CONTEXT AND RELEVANCE

Physical integration of transport modes refers to the co-location and seamless connection of different transportation systems to facilitate easy transfers. This concept aims to create a cohesive network where various modes of transport, such as buses, trains, and bicycles, are interconnected. By physically integrating transport modes, cities ensure that passengers have easy access to multiple forms of transportation from a single location. For example, locating a bus terminal in proximity to a train station facilitates train-to-bus connections and vice versa.

Facilitating easy transfers is essential for the widespread adoption of public and active transportation modes. Each mode serves a specific purpose: trains are ideal for intercity travel, while buses are often used for neighbourhood-level movements due to differences in speed and stop spacing. Active modes, such as walking and cycling, help users cover the last mile. By enabling seamless connections between modes, users can reach their desired destinations in a time-efficient manner by combining the most suitable transportation options. Encouraging more users to opt for public and active transportation options reduces the number of car trips in urban areas, resulting in lower emissions, better air quality, increased road safety, and more efficient use of public space.

This indicator provides a measure of the usage of multimodal hubs serving the experiment area. Hubs can include public transport stops close to train (or light rail) stations, bike sharing bays close to public transport stops and Park&Ride facilities (for interchanges between private car and public transport). **This is a relevant indicator when the policy action is aimed at improving the physical integration between different modes of transport. A successful action is reflected in a HIGHER value of the indicator.**

DESCRIPTION

The indicator is a ratio between the number of passengers changing mode at one intermodal hub and the population of the experiment area.

Even if a certain share of users of multimodal hubs are visitors of the experiment area, rather than its inhabitants, the indicator is computed dividing by the population in order to make the value of the indicator comparable between experiment areas of different size.

Being a share, it is **dimensionless**.

METHOD OF CALCULATION AND INPUTS

The indicator is calculated as the ratio between the number of individuals changing transport mode at one multimodal hub and the population of the experiment area.

The number of individuals changing mode should be quantified by means of direct counts and on-site interviews. Should Park&Ride facilities exist, the number of passengers changing mode at these facilities can be estimated using one of the methods described for the indicator TRA_MM_PI2. The method described below applies to other types of multimodal hubs, which generally serve non-multimodal users as well (e.g., shared bikes can be collected at a station bike-sharing bay even by someone not arriving by train).

Method 1

Direct counts and on-site interviews	Significance: **0.75** 

METHOD OF CALCULATION

The indicator is computed **endogenously** within the supporting tool, building on the provided inputs, according to the following steps:

- **Calculation of the average number of individuals changing mode at each multimodal hub**. Based on data collected from counts and interviews
- **If Park&Ride facilities exist:**
  - **Calculation of the average daily number of cars arriving at Park&Ride facilities.** The calculation is simply the total number of cars collected divided by the number of days which the collected data refers to.
  - **Estimation of the average number of passengers per car in each Park&Ride facility**. Since cars and passengers are counted simultaneously in each facility, the average number of passengers per car is just the ratio between the number of counted passengers and the number of counted cars.
  - **Estimation of the average daily number of passengers interchanging at each Park&Ride facility.** The estimation is made multiplying, for each facility, the number of cars by the average car occupancy factor.
  - **Estimation of the average daily number of passengers interchanging at Park&Ride facilities.** It is the sum of estimated passengers over all facilities.
- **Estimation of the average daily number of passengers interchanging at all multimodal hubs.** It is the sum of estimated daily passengers at Park&Ride facilities and other hubs.
- **Estimation of the indicator** as ratio between the average number of daily passengers interchanging and the population of the experiment area.

INPUTS

The following inputs **should be provided to the supporting tool** to compute the indicator:

a) ${}^{h}_{z}PckpPass$. **Number of individuals picking up a shared individual mode (e.g., bike, scooter)** at hub *h* in sampled day *z*. This data should be obtained by **organising counts in all the multimodal hubs.** Counts should be carried out in 3 working days and 1 weekend day, indicatively from 8:00 to 22:00 (hours can be adapted to local conditions and habits, but the whole day should be covered).

b) ${}^{h}_{z}PckpChSh$. **Share of individuals picking up a shared individual mode (e.g., bike, scooter)** at hub *h* **after having used another mode** in sampled day *z*. This data should be obtained by **organising interviews in all the multimodal hubs in the same days when counts are made.** The interviews should be a very simple one, just asking to a random sample of individuals picking up a transport means if they arrived

there by using a different mode of transport (i.e., not walking). At least one individual out of 3 should be interviewed.

c) ${}^{h}_{z}BrdPass$. **Number of individuals boarding public transport** at hub *h* in sampled day *z.* This data should be obtained by **organising counts in all the multimodal hubs.** Counts should be carried out in 3 working days and 1 weekend day, indicatively from 8:00 to 22:00 (hours can be adapted to local conditions and habits, but the whole day should be covered).

d) ${}^{h}_{z}BrdChSh$. **Share of individuals boarding public transport** at hub *h* **after having used another mode** in sampled day *z*. This data should be obtained by **organising interviews in all the multimodal hubs in the same days when counts are made.** The interviews should be a very simple one, just asking to a random sample of individuals waiting for public transport if they arrived there by using a different mode of transport (i.e., not walking). At least one individual out of 5 should be interviewed.

<u>If Park&Ride facilities exist:</u>

e) ${}^{k}_{t}P\&RCars$. **Number of cars arriving at Park&Ride facility *k* in the period of time *t*.** This data should be collected from the operators managing the Park&Ride facilities serving the experiment area. The data should be collected for each facility for a **minimum period of 30 days.**

f) ${}_{t}Days$. **the number of days** for which the data is collected from the operators.

g) ${}^{k}_{z}P\&RCntCars$. **Number of cars arriving at Park&Ride facility *k* counted in a sampled period of time *z*.** This data should be obtained by **organising counts in all the Park&Ride facilities.** The sampled period of time should be extended at least for:

   a. 2 morning peak hours (e.g., 7-9) in 3 working days
   b. 4 morning hours (e.g., 8-12) in 1 weekend day

Ideally, the counting should be carried out in the same days in all Park&Ride facilities, but it is acceptable if the fieldwork occurs in different days, provided that the they are close to each other (e.g. within a couple of weeks).

h) ${}^{k}_{z}P\&RBrdPass$. **Number of individuals boarding public transport at Park&Ride facility *k* counted in the sampled period of time *z*.** This data should be obtained **organising counts in all the Park&Ride facilities** in the same days and times when cars are counted (i.e., in each facility, cars arriving, and passengers boarding should be counted simultaneously). It is advisable to shift the count of passengers some minutes onwards (e.g., starting at 7:05 or 7:10 until 9:05 or 9:10) as individuals need some time to reach public transport stops from parking areas.

i) Pop. **Population of the experiment area.** It is provided by municipality statistics

The experiment would be reflected in the indicator by changing the number of individuals picking up a transport means at multimodal hubs and/or the share of those arriving at hubs by another mode of transport and/or the number of cars arriving at Park&Ride facilities and/or the number of Park&Ride facilities (which in the before-experiment and BAU conditions could also be zero). The population of the experiment area should remain unchanged.

EQUATIONS

The equations applied **within the supporting tool** to compute the indicator are the followings (some of the equations might not be relevant for a specific experiment area; the tool would just provide zero if there are no inputs for a given equation):

Calculation of the average daily number of individuals interchanging ad intermodal hubs picking up a shared individual mode (e.g., bike, scooter):

$$DayPckpCh = \sum_{h} \frac{\sum_{z}\left({}^{h}_{z}PckpPass * {}^{h}_{z}PckpChSh\right)}{4}$$

Calculation of the average daily number of individuals interchanging ad intermodal hubs boarding on public transport:

$$DayBrdCh = \sum_{h} \frac{\sum_{z}\left({}^{h}_{z}BrdPass * {}^{h}_{z}BrdChSh\right)}{4}$$

Calculation of the average daily number of cars arriving at each Park&Ride facility:

$${}^{k}DayP\&RCars = \frac{{}^{k}_{t}P\&RCars}{{}_{t}Days}$$

Estimation of the average number of passengers per car in each Park&Ride facility:

$${}^{k}CarOccFact = \frac{\sum_{z} {}^{k}_{z}P\&RBrdPass}{\sum_{z} {}^{k}_{z}P\&RCntCars}$$

Estimation of the average daily number of passengers arriving at each Park&Ride facility:

$${}^{k}DayP\&RPass = {}^{k}DayP\&RCars * {}^{k}CarOccFact$$

Estimation of the average daily number of passengers interchanging at Park&Ride facilities.

$$DayP\&RPass = \sum_{k} {}^{k}DayP\&RPass$$

Estimation of the average daily number of passengers interchanging at multimodal hubs per inhabitant (**indicator value**):

$$\boldsymbol{HubsIntrchngPass = \frac{DayPckpCh + DayBrdCh + DayP\&RPass}{Pop}}$$

ALTERNATIVE INDICATORS

This indicator measures the number of passengers switching transport modes at a given multimodal hub. In contrast, indicator **TRA_MM_PI1** quantifies the number of different transport modes available at a selected hub. While the latter offers a simpler approach to data collection and computation, it is less meaningful, as it assesses the mere availability of multimodal options rather than their actual usage.

For a targeted assessment of the physical integration between private cars and public transport, indicator **TRA_MM_PI2** measures the usage of Park&Ride stations.