

Access and Connection



transport choice

Overview



Indicator name	Mode share		
Indicator number	1	Indicator type	Core
Objective	To measure the proportion of sustainable travel mode usage by transport customers.		
Application guidance	<p>Providing sustainable transport systems is a key indicator of sustainable cities and communities. Sustainable modes - walking, cycling and public transport - serve people of all ages and abilities. When key destinations are appropriately serviced by multiple modes and frequent and reliable services are provided, sustainable modes can be made the easy and natural choice for all users.</p> <p>This indicator will support practitioners to understand how customers that reside or work in particular areas choose to travel (area-based analysis), or the breakdown of modal choice on discrete parts or links of the transport network (link-based analysis). Based on the outcome of the assessment, practitioners can determine the proportion of users that choose to walk, cycle or utilise public transport to complete their journeys for the present time and estimated or modelled for a point in the future.</p> <p>Practitioners can use the <i>sustainable mode share on existing links</i> metric to measure the breakdown of mode choice for all customers that travel down a set link in the network, including one or more portions of a road, a rail line, a ferry route etc.</p> <p>Practitioners can use the <i>sustainable mode share on existing area</i> metric to measure the breakdown of mode choice for a set area in which people reside or depart from, or by the area where people travel to or arrive in at the end of their journey.</p> <p>Practitioners can use the <i>sustainable mode share on existing option or future consideration</i> metric to measure the breakdown of mode choice based on the modal split model.</p>		

Metric



- Sustainable mode share on existing links
- Sustainable mode share on existing area
- Sustainable mode share on existing option or future consideration

Recommendation



N/A

Related indicators



Access and Connection

- 3 Cycling accessibility
- 4 Public transport accessibility
- 6 Bus and strategic freight reliability



Comfort and Safety

- 23 Road safety
- 25 Safe speed for environment



Character and Form

- 32 Street space for pedestrians



Metric – Sustainable mode share on existing links

Metric unit	Percentage (%)
Description	To measure the current proportion of sustainable mode share on a network link
Spatial coverage	Applicable to all NSW
Spatial application	This metric is most suitable for link-based analysis based on the road network

Calculation methodology

Set observers

1. Collect link-based datasets for current conditions by recording observations at desired locations along a transport corridor or across a wider network

Define and undertake survey

2. Collect observation datasets utilising either permanent or temporary (ad-hoc) survey methods. Survey methods include: personal roadside interview or questionnaire, manual video observation or AVI (automatic vehicle identification), infrared, ultrasonic, VIPS (video image processing system), microwave and millimetre radar, bluetooth, piezo-electric, loop detectors, passive acoustic, WIM (weigh in motion), hybrid system technologies, and public transport ticketing systems (OPAL).

Note: Ad-hoc field surveys can be undertaken regularly or occasionally over a short period of time (less than five years), based on project needs. The time periods of data analysis should cover the peak and off-peak traffic hours suggested by Austroads (2007 and 2016).

3. Define the time period for survey(s)
4. Collect counts for all modes that transit the transport link in question using selected survey methods and defined time period from Steps 2 and 3

Note: According to Austroads (2007 and 2016) traffic volume by modes data during weekdays is recorded and reported in three time periods: AM Peak (06:00 to 10:00), PM Peak (15:00 to 19:00) and Off peak (10:00 to 15:00) for each direction for strategic planning purposes. For more detailed planning purposes, the report should use the peak periods of 07:00 to 09:00, 10:00 to 15:00 and 17:00 to 19:00. This is also to recognise that in Sydney, not all of State roads have long congested peak periods so that shorter time periods may be required for a more detailed planning analysis. On weekends, mode share is reported for Saturday and Sunday between 10:00 to 15:00. Reporting of mode share during public holidays and school holidays should be included. For a detailed analysis, hourly based observations can also be derived.

Calculate sustainable mode share

5. Calculate the percentage of sustainable mode share by combining the counts for people using all sustainable modes (walking, cycling, and public transport) as a proportion of the total count for all modes

Note: Counts are to be undertaken for people and not vehicles

Data representation

6. Assign colour based on the classification below

Unit: Percentage of sustainable trips (%)

From place of work



From usual place of residence





Metric – Sustainable mode share on existing links (Cont.)

Assumption

- Link-based analysis is conducted if the study or project area involves transport infrastructure segment, link, route, corridor and linear network (ie. trident-shaped network)
- All counts included in mode share calculations should be of users/customers, and not vehicles (ie. the total number of people in private vehicles and the number of people on buses etc)
- Count data is available for all modes that are in use along the identified link(s)
- Unless otherwise known, private vehicle occupancy should be assumed to be 1.3 people per vehicle
- Links can be reported on discretely or aggregated up to form larger links, categorised by link type, or to represent links within a defined geographic
- In some situations, a combination of link-based and area-based methods can be used to determine the difference in travel choice between the local population or workforce and other people that transit through the area on different network links
- Planned and unplanned incident data should be reviewed to identify when prolonged incidents such as roadworks or other incidents impact on a significant proportion of a link for an extended period
- January performance is impacted by public and school holidays and does not reflect what may be considered 'normal' operations. Traffic volumes change in school holiday periods and this should be considered when reviewing quarterly and annual reports.

Limitation



- Data for each mode may not always be available
- Funding availability may limit the size of the surveyed areas and the level of detail of data being collected.

Data source

- Manual collection of data from field surveys (ie. field observation, questionnaires or interviews, vehicle classification surveys, etc.)
 - Published data (ie. OPAL, SCATS) can supplement manual collection data
 - Permanent automatic detection systems and ticketing systems.
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Metric – Sustainable mode share on existing area

Metric unit	Percentage (%)
Description	To measure the current and/or past proportion of sustainable mode share at a geographic level
Spatial coverage	Applicable to all NSW
Spatial application	This metric is most suitable for area-based analysis based on SA2
Calculation methodology	<p>Obtain and define Journey to Work (JTW) data</p> <ol style="list-style-type: none">1. Obtain Journey to Work (JTW) data from the Australian Bureau of Statistics (ABS)2. Select the dataset (UR or PoW) that best suits the needs of the project or design (see assumptions) <p>Calculate percentage of sustainable trips</p> <ol style="list-style-type: none">3. Combine the following fields to determine the proportion of the combined total of all modes:<ul style="list-style-type: none">• UR_Share_PT (UR share Public Transport)• UR_AT_Share (UR share Active Transport) or PoW_PT (PoW Public Transport)• PoW_AT (PoW Active Transport) <p>Obtain supplementary data</p> <ol style="list-style-type: none">4. Collect any relevant secondary data, including the TfNSW Household Travel Survey (HTS) and Journey to Work (JTW) dataset (Greater Sydney only)5. Select relevant 'Mode_Label' values (Bus, Train, Walk Only) and sum the associated 'PCT_OF_SA3_WEIGHTED TRIPS' values <p><i>Note: Mode share values are pre-calculated as a proportion of all trips, so they will not need to be divided by the total of all trips</i></p> <p>Data representation</p> <ol style="list-style-type: none">6. Assign colour based on the classification below <p>Unit: Percentage of sustainable trips (%)</p> <p>From place of work</p>  <p>From usual place of residence</p> 
Assumption	<ul style="list-style-type: none">• Area-based analysis is conducted when the scope of study or project area includes an area, such as mesh block, travel zone, local government area, district or city levels• All counts included in mode share calculations should be of users/customers, and not vehicles (ie. the total number of people in private vehicles and the number of people on buses etc)• Census (population and housing) and Journey to Work data are updated every four years• TfNSW Household Travel Survey (HTS) and Journey to Work (JTW) data is updated on an annual basis• JTW data should be applied at an SA2 spatial unit, or greater. Where JTW data is not available, HTS should be utilised. HTS data should be applied at an SA3 spatial unit, or greater



Metric – Sustainable mode share on existing area (Cont.)

Assumption

- In some situations, a combination of link-based and area-based methods can be used to determine the difference in travel choice between the local population or workforce and other people that transit through the area on different network links
- Planned and unplanned incident data should be reviewed to identify when prolonged incidents such as roadworks or other incidents impact on a significant proportion of a link for an extended period
- January performance is impacted by public and school holidays and does not reflect what may be considered 'normal' operations. Traffic volumes change in school holiday periods and this should be considered when reviewing quarterly and annual reports.
- According to Austroads (2007) traffic volume by modes data during weekdays is recorded and reported in three time periods: AM Peak (06:00 to 10:00), PM Peak (15:00 to 19:00) and Off peak (10:00 to 15:00) for each direction for strategic planning purposes. For more detailed planning purposes, the report should use the peak periods of 07:00 to 09:00, 10:00 to 15:00 and 17:00 to 19:00. This is also to recognise that in Sydney, not all of State roads have long congested peak periods so that shorter time periods may be required for a more detailed planning analysis. On weekends, mode share is reported for Saturday and Sunday between 10:00 to 15:00. Reporting of mode share during public holidays and school holidays should be included. For a detailed analysis, hourly based observations can also be derived.

Limitation

- HTS data is only available for the Greater Sydney area
- Census (population and housing) and Journey to Work data are available for all NSW

Data source

- Manual collection of data from field surveys (ie. field observation, questionnaires or interviews, etc.)
 - Published data (ie. Journey to Work, Household Travel Survey) can supplement manual collection data
 - ABS Journey to Work (2016): opendata.transport.nsw.gov.au/dataset/journey-work-jtw-2016
 - TfNSW Household Travel Survey: transport.nsw.gov.au/data-and-research/passenger-travel/surveys/household-travel-survey-hts
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Metric – Sustainable mode share on existing option or future consideration

Metric unit	Percentage (%)
Description	To measure the current and/or future (including current options for development) proportion of sustainable mode share using the modal split model
Spatial coverage	Applicable to all NSW
Spatial application	This metric is suitable for either link-based or area-based analysis

Calculation methodology

Note about Modal Split Model

Estimated or modelled mode share values can be calculated for both links and areas, and at various time intervals, by using the modal split model. There are various types of modal split model. One of the commonly used modal split models is the Binomial or Multinomial Logit Model. Refer to Ortuzar and Willumsen (2011) for a more detail explanation of modal split models that can be employed for future mode choice analysis.

The logit model is based on the economic utility function. The utility function is a set of mathematical equations that is used to measure the preference of transport customers over a number of transport modes. Modes are considered to be more preferable to the competitive modes if the modes in question have more favourable features, such as faster and cheaper performances. In general, modes with higher performance levels will have higher utility levels than the other modes for customers.

Estimate future mode share

To estimate/model future mode share for links/areas, the following formula proposed by Khisty and Lall (2003) should be used:

$$P_i = \frac{e^{V(i)}}{\sum_{s=1}^n e^{V(s)}}$$

Where:

- P_i = probability of using mode i
- $V(i)$ = utility of mode i
- $V(s)$ = utility of mode s
- N = number of modes in consideration

The utility function can be derived using the following expression from Rogers (2008):

$$V_m = \beta_m + \sum \alpha_j Z_{mj} + \varepsilon$$

Where:

- V_m = total utility provided by mode option m
- β_m = mode specific parameter which states the relative attractiveness of various modes to those within the market segment in question.
- Z_{mj} = set of travel attributes of mode m, such as travel cost and travel time
- α_j = model parameter which is to be defined by calibration from travel survey data (Ortuzar and Willumsen, 2011, pp.217-218)
- ε = stochastic term to allow for the incorporation of the unspecifiable portion of mode utility that is assumed to be random. This term indicates the variability in individual utilities around the average utility of those within the market segment.

Note: The utility function for an area, such as a precinct or a city, is unique and it should be derived by a specific transport study.



Metric – Sustainable mode share on existing option or future consideration (Cont.)

Calculation methodology

Data representation

Assign colour based on the classification below

Unit: Percentage of sustainable trips (%)

From place of work



From usual place of residence



Assumption

- Modal split model is employed to estimate a mode share percentage for the existing condition with option development and for future conditions
- The synthetic model of existing condition needs to be calibrated and validated before being used for estimating mode share percentage for both the existing condition with option development and the future condition
- Modal split model employs either the binomial logit model or multinomial logit model, depending on the issues being tackled
- All counts included in mode share calculations should be of users/customers, and not vehicles (ie. the total number of people in private vehicles and the number of people on buses etc)
- No major changes in the land-use structure, transport network configuration, social and economic conditions and/or planning policies during the future planning periods
- In some situations, a combination of link-based and area-based methods can be used to determine the difference in travel choice between the local population or workforce and other people that transit through the area on different network links
- Mode share data obtained from the synthetic models, JTW and HTS data should be calibrated and validated using field survey results to reflect the real mode share condition

Limitation

The applicability of the model depends on data availability, such as vehicle cost, public transport fares, travel time data, etc

Data Source

- NSW Government, public transport fares and travel time data: transportnsw.info
- TfNSW, Cost of Vehicle Operations (updated annually)

Reference



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- Austroads, Guide to Traffic Management Part 3: Transport Study and Analysis Methods AGTM03-20 (2020): austroads.com.au/publications/traffic-management/agtm03
- Khisty, J.C. and Lall, K. Transportation Engineering – An Introduction, Third Edition, Prentice Hall, Upper Saddle River, New Jersey, USA, 2003
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