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Sustainable urban mobility: a new urban grouping framework can help inform city planners

While cities worldwide are expanding so is the significant carbon dioxide footprint of urban transport. Consequently, there is an urgent need for sustainable urban mobility solutions. A thorough analysis of the variables and dynamics of urban mobility in cities can aid in planning sustainable mobility policy. This study used a new system of classification by type (typologisation) relevant to urban mobility in global cities, with data from 331 cities in 124 countries covering 40% of the global urban population (as of 2016).

Efficient and effective urban transport solutions in the EU can bring gains in many policy areas, including energy dependency, air pollution, climate change and employment. In 2019, the EU outlined the European Green Deal, with an overall goal of climate neutrality in Europe by 2050, including a 90% reduction in emissions from transport, as well as a zero-pollution ambition and action plan on air, water and soil¹. The revised [National Emissions Ceiling Directive](#)² sets targets for lowering emissions of air pollutants by 2030, and the EU Urban Mobility Package³ — the main policy basis when it comes to sustainable urban mobility — was published in 2013 (currently in evaluation).

Urban typologies can provide a method for understanding the dynamics of cities, which vary widely in mobility behaviour. Contemporary typologies relevant for sustainable urban mobility analyses are scant and small in scope. This research, however, covers a large proportion of global cities and uses data from 2008 to 2016.

Open source data, spanning 331 cities in 124 countries, was used to create the new typologisation. The data ranged from no earlier than 2008 and was spread across the world to ensure a global and national representative sample. The data collected consisted of 64 indicators across six urban dimensions: mobility; economy; environment; social development; urban form; and geography.

Where urban data were unavailable at a city level, urban average values at the country level were used. Network data was taken from [OpenStreetmap](#).

A statistical technique known as exploratory factor analysis (EFA) was carried out to reduce the data to a smaller set of summary variables. After this, the fitness of each model was analysed using statistical and visual techniques, and nine urban variables were identified. A statistical 'hierarchical clustering technique' was then used to group broadly similar data into a cluster, which helped to identify 12 typologies. For the purpose of this study a 'city' was defined as a town with a population of at least 750 000.

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Sustainable urban mobility: a new urban grouping framework can help inform city planners (*continued*)

The nine main urban variables derived from the analysis were: **metro (present rail/metro network)**; **bus rapid transit (BRT) (present bus network)**; **bikeshare (availability/demand)**; **development (wealthy, high cost of living)**; **sustainability**; **population**; **congestion**; **sprawl**; and **network density** (density of city streets). Clusters of these variables are the 'dimensions' (general descriptors) on which the 12 urban typologies are based.

The 12 typologies identified were grouped into opposing pairs: **auto** (innovative and sprawl), **bus transit** (dense and sprawl), **congested** (boomer and emerging), **hybrid** (giant and moderate), **metrobike** (emerging and giant), **mass transit** (heavyweight and moderate).

The **auto** cities are marked by a history of car-driven development with the **auto innovative** typology marked by extensive **mass-transit** systems such as Boston, USA, and Toronto, Canada. **Auto sprawl** is less dense but with high car ownership and highest CO2 emissions with lowest mass transit share, such as Abu Dhabi, UAE.

Bus transit dense cities have high bus usage and are often highly populated with good mass transit, such as Mexico City. **Bus transit sprawl** cities are less dense with greater sprawl and high bus use. **Congested boomer** cities have high scores for population and congestion, compared to other typologies. Boomer cities also score highly in population growth and density, including cities such as Delhi, India and Manila, Philippines. **Congested emerging** cities have low carbon dioxide emissions per person, as they have low levels of industrialisation and wealth, with much of the population using public transit.

Metrobike giant and **metrobike emerging** cities are heavily populated urban areas in China where bikeshares are readily available. **Metrobike** cities have the highest sustainability scores. While the **giant** typology is categorised by having higher scores on congestion, population, metro and development, such as Shanghai and Beijing, the **emerging** cities score highest in bikeshare overall and include Ningbo and Shenyang. **Hybrid giant** and **Hybrid moderate cities** are dense, growing cities with average scores across all urban variables.

Mass transit heavyweight cities have the highest metro score and second highest development scores — public transit is fairly high in this category but carbon dioxide is the third highest; examples include London and Paris. **Mass transit moderate** has the second highest bus-transit scores and bikeshare scores across all typologies and includes Antwerp and Brussels, Belgium, and Helsinki, Finland.

The urban typologies can be used in large-scale simulations using prototypes of different city types to gain insights into sustainable future policy pathways. These typologies enable researchers and planners to understand urban travel behaviour; with each typology capturing distinctive outcomes, providing a testbed for sustainable mobility policy implementations. It should be noted that the analysis does not comprehensively take into account air pollution but only a composite indicator of "perceived pollution of air, water and the environment". Bearing this in mind, the **mass transit heavyweight** and **moderate** cities offer valuable lessons to be learnt on sustainable mobility and could be a focus for urban planners and policymakers.



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1. A European Green Deal: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

2. National Emissions Ceilings Directive: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.344.01.0001.01.ENG&toc=OJ.L.2016.344:TOC

3. Action Plan on Urban Mobility: <https://ec.europa.eu/transport/themes/clean-transport-urban-transport/urban-mobility/urban-mobility-package>