Discussion Paper

Defining a minimum standard for mobility

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Background

This concept for miminum mobility standards is the state of discussions regarding lower limits of carbon budgets for mobility as part of the JPI Urban Europe project “MyFairShare”.

Glossary

Term	Definition
Individual mobility budget	Amount of transport-related CO_2 emissions (mobility credits) per person in a given time span. The sum of all individual budgets shall not exceed a maximum defined by the national carbon reduction goal and shall not jeopardise individual minimum mobility standards
Minimum mobility standard Transport emission allowance	A person’s right to mobility defined by constant travel time budgets, activity spaces and lowest available transport emission factor, represents the same level of accessibility OR focus on emission allowance only as these are to be minimised
Travel time budget	Average time per day spent on trips between locations
Activity space	Area comprising regularly visited locations of basic functionalities of everyday life
Basic functionalities of everyday life	Set of basic needs that need to be fulfilled and may require a trip to a different location (usually work, education, provision of basic supplies, recreation, social contacts)
Transport emission factors	Mode-specific emissions in grams of carbon dioxide equivalent per person kilometre

Content

1. Introductions

The transnational project “MyFairShare” examines the impact and implementation requirements of individual mobility budgets (see to achieve greenhouse gas (GHG) emission reduction goals. In the previous Austrian feasibility study “mobalance”, the main focus lay on reducing carbon emissions to mitigate the impact of climate change. The project predominantly explored the sufficiency principle to assess its potential impact on CO2 reductions through behaviour change by providing individual short-term targets and alternative options in the form of an individual mobility budget. During the involvement of different groups of stakeholders discussing the concept, the importance of “fairness” in the distribution of mobility budgets became increasingly apparent. As the concept of individual mobility budgets proposes a radical solution to achieve both climate neutral mobility and transport justice in parallel, “MyFairShare” puts particular emphasis on achieving a methodology for distributing transport carbon allowances which is perceived as fair as possible by different socio-regional groups to improve acceptance for necessary measures to reach climate goals.

During the discussion of different concepts of fairness in “MyFairShare” among the multidisciplinary research team, it became apparent that it is not only necessary to define the “upper” limits of tolerable individual carbon emissions, but also the lower limits representing an equitable right to mobility, which mobility budgets are not to fall below. This discussion paper represents the state of discussion concerning a general definition of Minimum Mobility Standards, which has also been shared with several groups of scientific and stakeholder communities to invite remarks and opinions and test its potential legitimacy as a general standard.

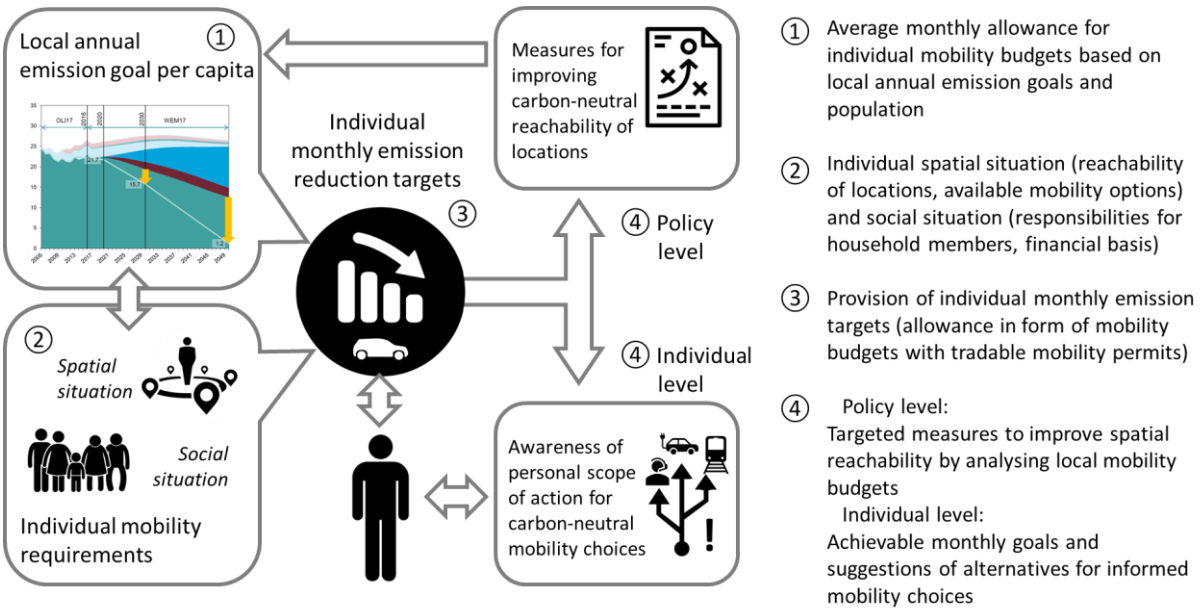

Figure 1: Concept of Individual Mobility Budgets (Millonig, 2022[1]).

2. Basic principles for minimum mobility allowance/standards

In the course of the MyFairShare project, a minimum standard for mobility (or a minimum right to mobility) needs to be defined to ensure that mobility budgets do not jeopardise the basic necessities of life related to basic human functions of existence. The initial concept is based on two findings from human geography and one transport related factor:

1. Constancy of travel time
2. Activity spaces
3. Emission factors per person and kilometre for different transport modes

2.1. Constancy of travel time

The first to describe the robustness of average travel times and its consequences for urban development was Cesare Marchetti in 1994 in his paper “Anthropological invariants in travel behavior”[2]. Since then, the observation has been confirmed by several other researchers, casting doubt on the contention that investment in infrastructure saves travel time. Instead, it appears that people invest travel time saved in travelling a longer distance[3]. Furthermore, a study on different transport disadvantaged groups has shown that their travel times - depending on the type of disadvantage - are significantly higher or lower than the average travel time, e.g., single parents and parents of three or more children spend more time travelling due to their family responsibilities, while persons with severe physical or sensory disabilities spend less time travelling. Although there is some criticism regarding this apparent constancy for example when comparing cities globally, it is unclear if such differences actually disprove the assumed constant or if the differences are rather caused by city structures. Cites with strong spatial separation of functions may for example force residents to deviate from their preferred daily travel time budget of 70 minutes plus or minus 10[4].

It can therefore be assumed that an average travel time of about 60 to 80 minutes per day (regardless of the mode of transport) is a kind of "natural" behaviour. Individuals who are forced to spend more or less time travelling, experience this as a burden. This is also confirmed by studies on commuter trips: the increased risk of mental and physical health issues caused by long commutes is well explored[5], but even the lack of commutes as observed during the COVID-19 pandemic has shown negative effects on mental and physical health due to the limitation of social interactions, the loss of a daily structure defined by commutes and the opportunity to relax on these transport-related pauses between daily activities[6].

For the definition of a minimum mobility standard, we therefore stipulate that the average daily travel time of an average person should not fall below or exceed the time span of 60 to 80 minutes.

2.2. Activity spaces

In human geography, an activity space is defined as the space within which daily activity occurs and it consists of the locations a person is regularly visiting and the transport routes that are usually taken[7]. The locations are defined by the basic functions of existence in everyday life and are usually categorised by their purpose or the basic need there are fulfilling. In the German literature, the following six basic functionalities are predominantly listed:

- Living (home location)
- Working
- Providing (for oneself or also for others)
- Education
- Recreation
- Social interaction

In the recent discussion and especially due to the restricted travel options during the COVID-19 pandemic, the physical activity space and the spatially distributed functions therein have gained the possibility to shift some of the trips to the "virtual space" by replacing shopping trips by ordering online or by keeping contact (private or work related) via digital platforms. However, there is also some indication that the physical travel time "saved" by using virtual alternatives is at least to some extent reinvested into an increased travel time budget for other purposes, e.g., more leisure travelling when working in home office[8]. This could be further evidence of constant travel time budgets, but needs to be monitored further in the future, as it cannot be ruled out that the average travel time will decrease in the long term.

2.3. Emission factors

To link minimum mobility standards to a lower boundary for mobility budgets, mode-specific emission factors (per person and kilometre travelled) need to be considered to achieve a ranking of transport options that should be prioritised. The emission factors may vary between countries (see Figure 2 for a UK example), as they are partly based on regional circumstances and mobility cultures. Among the two main aspects influencing emission factors are the vehicle occupancy rate[a] (higher occupation of smaller vehicles can dramatically improve the emission factor) and the type of energy used (e.g., petrol vs. diesel, electricity from renewable energy or mixed electricity). The following example from the UK shows the carbon footprint of selected modes of transport per kilometre of travel in 2018 (in grams of carbon dioxide equivalent per passenger kilometre). In Austria, emission factors are also calculated for a wider range of modes including several types of urban and regional public transport and non-motorised modes e.g., bike[9].

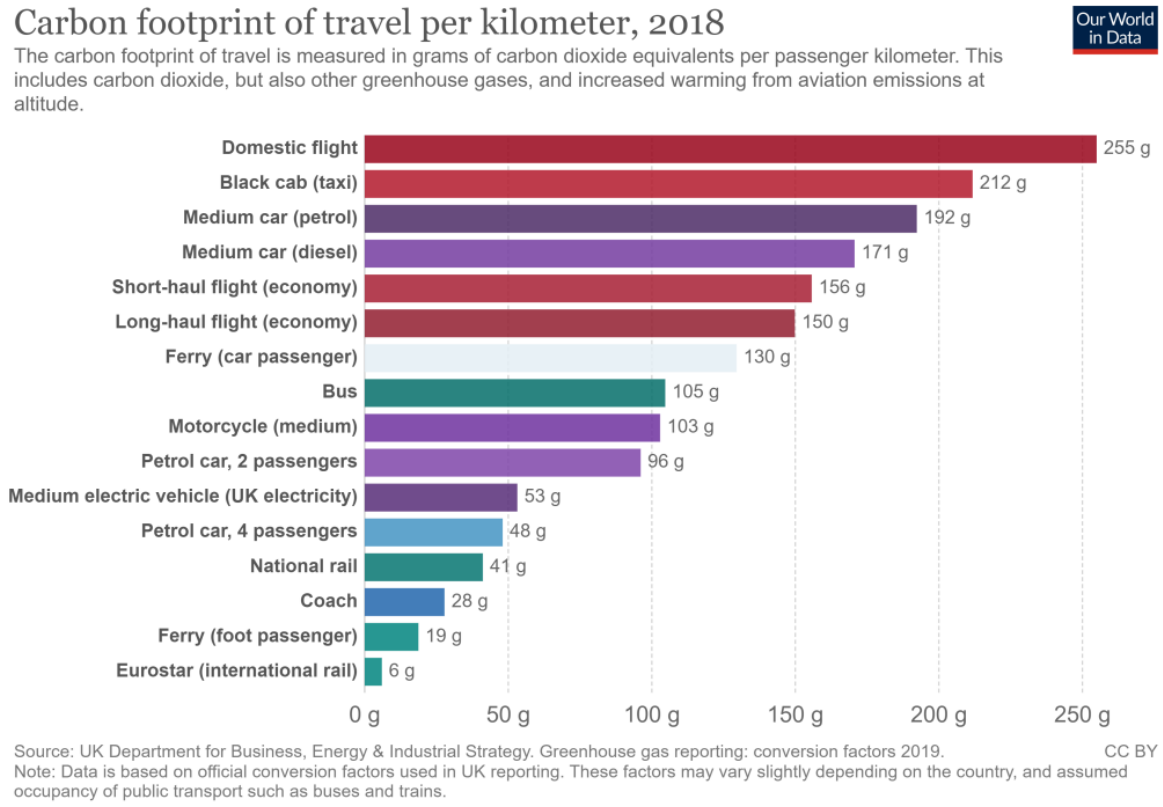

Figure 2: Emission factors per kilometre of travel in 2018 (in grams of carbon dioxide equivalent per passenger kilometre)[10]

[a] „Vehicle occupancy rate" is used as a factor for any type of vehicle, including buses, trams, trains or aircrafts

2.4. A basic concept for minimum mobility standards

In the context of individual mobility budgets, the minimum right to mobility and related emission credits is defined as follows:

The minimum mobility budget of a person is defined by the minimum amount of CO2 emissions which has to be accepted to allow this person to reach 3-4 of the nearest places providing basic functions of life (any suitable work, education, utilities including health care, recreation, and social contacts) within a maximum of 80 minutes per day.
The minimum standard does not consider personal preferences for providers of functionalities (e.g., brand of local supplier, type of recreation), but the most accessible (nearest) opportunity to satisfy a basic need.

The lowest possible minimum budget is given if a person can reach the nearest location of all types of basic function on foot within the time span of 60 to 80 minutes. If this is not possible, the trip that requires the greatest proportion of travel time may be done by the means of transport in the next higher emission category (or a combination of the current and the next higher category). If this is not sufficient, another trip can be replaced, if all trips using this mode are still exceeding the travel time budget, the next higher category can be used for the trip requiring the most time etc.

In a next step, individual constraints affecting the travel time budget can be considered in addition to this basic concept, e.g., socio-economic status and affordability of transport modes, walking disabilities or frailty reducing the activity space within the time budget, etc. The concept has also been applied in a GIS analysis combined with transport modelling calculating accessibility indexes for any given home location in the greater Vienna area (Figure 3). The spatial analysis shows the accessibility of locations and provides an indicator for where measures to improve accessibility need to be prioritised. In a next step of the project, the approach will be applied to the areas of four other Living Labs in Germany, Norway, Latvia and the UK.

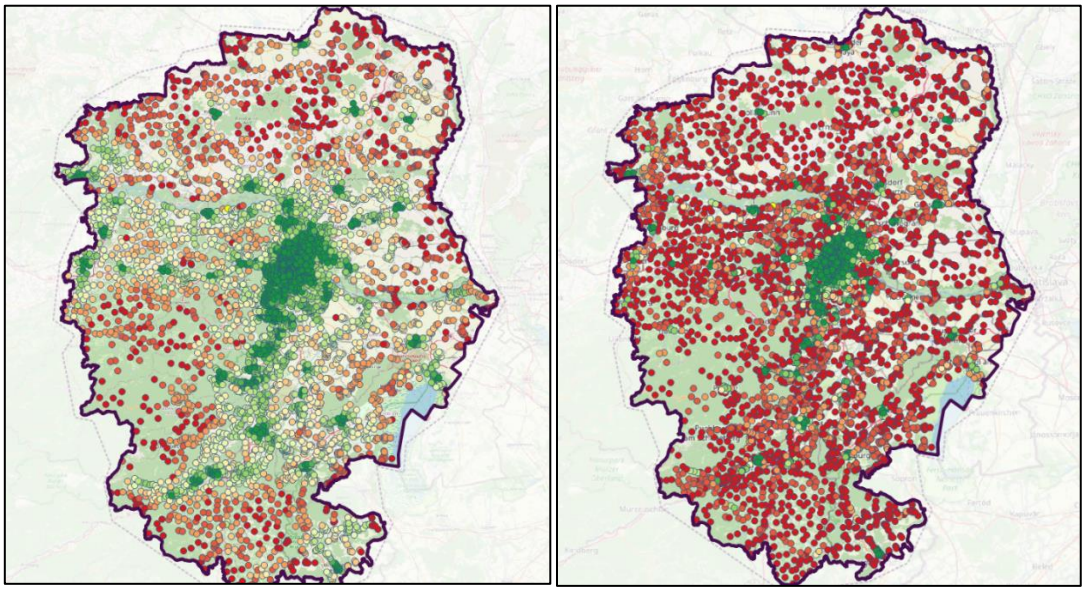

Figure 3: Colour coded centroids illustrating locally required transport emission levels to reach minimum mobility standards in the region surrounding the city of Vienna. Dark green dots mark locations where any combination of the nearest destinations for basic functions of life can be reached by walking within a maximum of 80 minutes, ranging to dark red marking locations where a car is required for reaching these destinations. The map on the left shows the results for an average person with no limitations, the one on the right shows emission levels for elderly persons (considering a different set of required destinations, e.g., no workplaces, and accessibility requirements, e.g., slower walking speeds).

References

[1] Millonig, A., Rudloff, C., Richter, G., Lorenz, F., & Peer, S. (2022). Fair mobility budgets: A concept for achieving climate neutrality and transport equity. Transportation Research Part D: Transport and Environment, 103, 103165.

[2] Marchetti, C. (1994): Anthropological invariants in travel behavior. In: Technological Forecasting and Social Change 47 (1), p. 75-88. DOI: 10.1016/0040-1625(94)90041-8.

[3] Metz, D. (2012): The Limits to Travel: How Far Will You Go? Taylor & Francis. ISBN: 9781136553288.

[4] Ahmed, Asif; Stopher, Peter (2014): Seventy Minutes Plus or Minus 10 - A Review of Travel Time Budget Studies. In: Transport Reviews 34 (5), S. 607-625. DOI: 10.1080/01441647.2014.946460.

[5] Chatterjee, K., Clark, B., Martin, A. & Davis, A. (2017). The Commuting and Wellbeing Study: Understanding the Impact of Commuting on People's Lives. UWE Bristol, UK.

[6] Nirmita Panchal , Rabah Kamal , Cynthia Cox Foll and Rachel Garfield (2021): The Implications of COVID-19 for Mental Health and Substance Use. KFF Issue Brief 9440-03, Kaiser Family Foundation.

[7] Schönfelder, Stefan; Axhausen, Kay W. (2003): Activity spaces: measures of social exclusion? In: Transport Policy 10 (4), S. 273-286. DOI: 10.1016/j.tranpol.2003.07.002.

[8] Heinfellner, Holger; Lambert, Stefan; Vogel, Johanna; Praschl, Michael (2020): PoviMob. Potentiale virtueller Mobilität - Rahmen und Maßnahmen für eine bestmögliche Verknüpfung virtueller und physischer Mobilität. Project report. Vienna, Austria.

[9] Emissionsfaktoren für Verkehrsmittel (umweltbundesamt.at)

[10] Which form of transport has the smallest carbon footprint? - Our World in Data