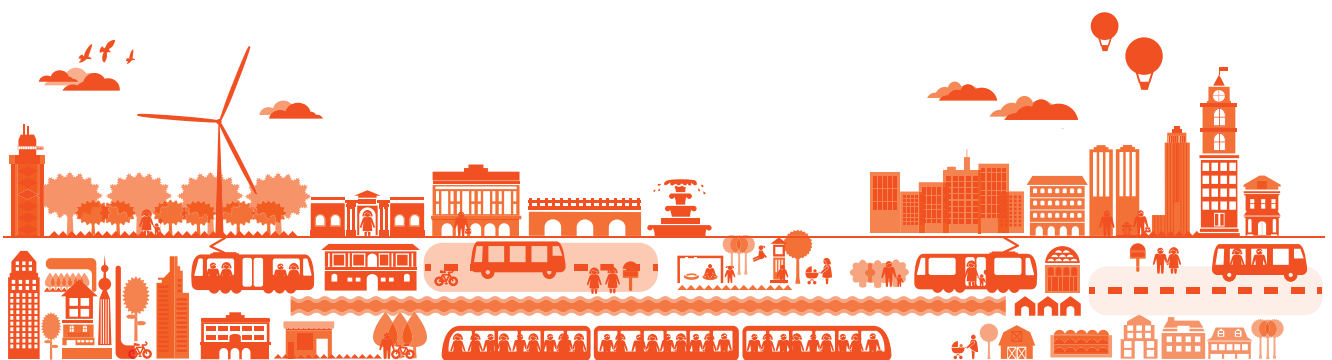




K2 WORKING PAPERS 2018:7

Defining regional public transport

Joel Hansson, Fredrik Pettersson, Helena Svensson & Anders Wretstrand



Datum: 2018-08-28

Tryck: Media-Tryck, Lunds universitet, Lund

De slutsatser och rekommendationer som uttrycks är författarnas egna och speglar inte nödvändigtvis K2:s uppfattning.

Contents

Preface	3
Abstract/Sammanfattning.....	5
1. Introduction.....	7
2. Survey setup and respondents.....	9
3. Results	11
3.1. Regional-interregional boundary	11
3.2. Local-regional boundary.....	12
3.3. Thesaurus	13
4. Analysis	15
4.1. From labour market area to regular travel	15
4.2. Urban area and density.....	16
4.3. Relation between the administrative and functional criteria.....	16
5. Discussion	18
6. Conclusions.....	19
7. References.....	20

Preface

This report is the starting point of a research project on regional public transport, funded by the Swedish Transport Administration through Lund University and K2. The results in the report will guide our coming research efforts in the field, with the overarching aim to develop knowledge about effective regional public transport services.

The authors would like to thank all respondents for their valuable input in the survey. Thanks also to Professor Peter White from the University of Westminster for sharing his previous work on the topic.

Lund, August 2018

Joel Hansson

Main author

Abstract

When exploring preferences of existing and potential public transport passengers, it is relevant to acknowledge differences between different geographic scales: local, regional and interregional. However, the boundaries between these categories remain unclear. Some previous attempts have been made to define regional travel – and hence local and interregional travel – but the resulting definitions are somewhat vague and use diverse sets of metrics. In order to sort the terms, this paper aims to explore the perception of the concept *regional travel* through a survey among public transport professionals. In total, 290 completed questionnaires were collected. All continents are represented in the survey, but with a strong concentration of responses in North America and Europe. The results emphasise the importance of maintaining a distinction between functionality and technology, meaning that factors such as vehicle type or speed should not be included in the definition. Instead, the survey indicates a clear preference for either an administrative or a functional definition, depending on the purpose. The functional definition is argued to best fit the purpose of exploring passengers' preferences, and hence the following working definition of regional public transport can be adopted: *Regional public transport targets passengers travelling between separate urban areas or to rural areas, and a majority of the trips are made on a regular basis (daily to weekly in general).*

Sammanfattning

I studier av resenärernas, och potentiella resenärers, preferenser är den geografiska skalan en intressant parameter: lokalt, regionalt, interregionalt. Det finns emellertid ingen tydlig bild av gränsdragningarna däremellan. Ett antal möjliga definitioner har identifierats i litteraturen, men dessa definitioner är tämligen vaga och använder dessutom olika typer av indikatorer. I syfte att reda ut begreppen och utforska tolkningen av begreppet *regionalt resande* i kollektivtrafikbranschen har en enkätundersökning genomförts. Totalt erhöles 290 ifyllda enkäter, från 40 olika länder. Alla kontinenter är representerade i undersökningen, men merparten av enkätsvaren kommer från Nordamerika och Europa. Resultaten understryker betydelsen av att upprätthålla en distinktion mellan funktionella och tekniska attribut, vilket innebär att faktorer såsom fordonstyp och hastighet inte bör inkluderas i definitionen. I stället visar resultaten av enkätstudien en tydlig preferens bland respondenterna för antingen administrativa eller ett funktionella kriterier. Av dessa båda alternativ är en funktionell definition bäst lämpad, mot bakgrund av syftet att studera resenärers preferenser. Slutsatsen är att följande definition av regional kollektivtrafik kan användas i samband med studier av resenärernas preferenser: *Regional kollektivtrafik riktas mot resor mellan tätorter eller till områden utanför tätort, och en majoritet av resorna genomförs regelbundet (generellt dagligen till en gång i veckan).*

1. Introduction

In public transport research, services are often categorised according to their technical attributes, such as mode, right-of-way strategy or stopping schedule. For instance, comparisons of bus-based and rail-based alternatives are common in public transport literature (e.g., Hensher & Waters, 1994; Ingvardson & Nielsen, 2018; Sivakumaran, Li, Cassidy, & Madanat, 2014). However, when exploring passengers' preferences it may be more relevant to base the categorisation on geographic scale – local, regional, interregional – rather than technology.

The general characteristics of local travel are substantially different from regional travel, and similarly there are important differences between the regional and interregional levels. These travel characteristics have an impact on the preferences of potential and existing passengers, e.g. expressed on an urban-interurban scale (Román, Martín, & Espino, 2014) or a short distance-long distance scale (Börjesson & Eliasson, 2014). A confounding factor, though, is that the boundaries between the local, regional and interregional categories remain unclear.

A previous attempt to define regional travel – and hence local and interregional travel – has been made by UITP (2013). They note that a single definition is “difficult to establish due to the great diversity that exists within regional transport” (p. 1), and as a result, their definition is somewhat ambiguous. Interestingly, the notion of *captive riders* is included in the definition, possibly implying the challenge in designing attractive regional public transport services: “Regional public transport covers all collective passenger transport services excluding most public transport within cities and urban centres. In general, regional transport services bring captive riders from lower-density and suburban areas to larger city centres and serve small- and medium-sized cities.” (p. 1)

Some other previous publications touch upon definitions of terms related to regional public transport. For instance, White (2016, chapter 10) adopts the definition of *rural transport* used in the National Travel Survey in UK. It concludes that rural areas consist of settlements below 10,000 people or are open countryside. However, White notes that for transport planning purposes, smaller urban areas are often also served by the rural network, providing interurban links to larger regional centres of employment, shopping etc.

Exurban is another related term, used by Petersen (2012), who writes about public transport for exurban settlements in Australia. He presents two alternative definitions of exurban: “Beyond the suburbs, the Australian exurban region is defined by [...] the region surrounding an urban area, bounded on the outer by how far commuters are willing to travel, and on the inner by contiguous urban or suburban development.” (pp. 24–25) Alternatively, exurban areas can be defined as “the mainly small town and rural regions within 150 kilometres radius from the state's capital and largest city” (p. 25).

A systemisation of bus services in three categories is made by Godlund (1954, pp. 32–42), as a tool to describe the development of bus services in Sweden from the early years of the 20th century to the 1950's. The network is categorised in α -services, β -services and γ -services. The first category, α -services, include urban and suburban lines (up to 6 km from an urban area). β -services include rural to urban services, interurban services with intermediate rural stops, as well as purely rural services. Finally, γ -services are interurban express lines.

Interurban bus services are explored in a number of case studies by Luke, Steer & White (2018), unfolding the current state and future development of such services in Britain. For this purpose, they adopt a working definition of *interurban bus*: “two or more urban areas (typically towns, but might be cities) are linked by a bus service with intermediate stops typically to serve villages en route.” (p. 1)

To conclude, existing definitions of regional public transport and related terms (such as rural, exurban and interurban) are somewhat vague and use diverse sets of metrics. Besides demographics, definitions are based on elements such as travel distances or stopping pattern of the public transport service.

In order to sort the terms, this paper aims to explore the perception of the concept *regional travel* through a survey among public transport professionals. The survey outcomes form a foundation for a working definition of regional public transport, clarifying the boundaries between local, regional and interregional. The resulting definition will guide our coming research efforts in the field, with the overarching aim to develop knowledge about effective regional public transport services.

2. Survey setup and respondents

To explore how the term *regional public transport* is perceived, a survey was conducted among public transport professionals. The survey was conducted online, and disseminated through various mailing lists and social media groups of public transport planners. The goal was to identify practitioners and academics that in their work use a distinction between local and regional, or between regional and interregional public transport.

The sampling method is non-probabilistic, meaning that the sample is not representative of all public transport professionals. Therefore, the results cannot be generalised to reflect the views of the whole community of practitioners and academics working with public transport. Nevertheless, the survey results are useful to explore the perceptions of a variety of experts, and the findings may uncover clear and homogenous trends. (Boisjoly & El-Geneidy, 2017)

The questionnaire was constituted by three main questions: firstly about the regional-interregional boundary, secondly about the local-regional boundary, and thirdly about how regional public transport relates to some selected associated terms. The third question focused on bus services, due to a wider supply of bus-related concepts in comparison with rail services. Rail services are generally more easily categorised, with concepts such as regional rail or commuter rail. Finally, the questionnaire finished with a few background questions about the respondent. All three main questions were single choice questions, with open-ended alternatives and comment opportunities.

In total, 290 completed questionnaires were collected. 118 of these, 41 %, contained open-ended answers and comments concerning at least one of the three main questions.

The respondents were located in 40 different countries, and all continents are represented in the survey. However, there is a strong concentration of responses in North America (N = 153) and Europe (N = 105), compared to the other continental regions (N = 32).

86 % of the respondents are practitioners working in the public sector, as consultants, in the industry (e.g. public transport operators), or in non-governmental organisations. 11 % are academics, and the remaining 3 % uncategorised are primarily retirees.

A majority of the respondents, 60 %, are active in a country or region where the public transport authority structure is separated between the local and regional level.

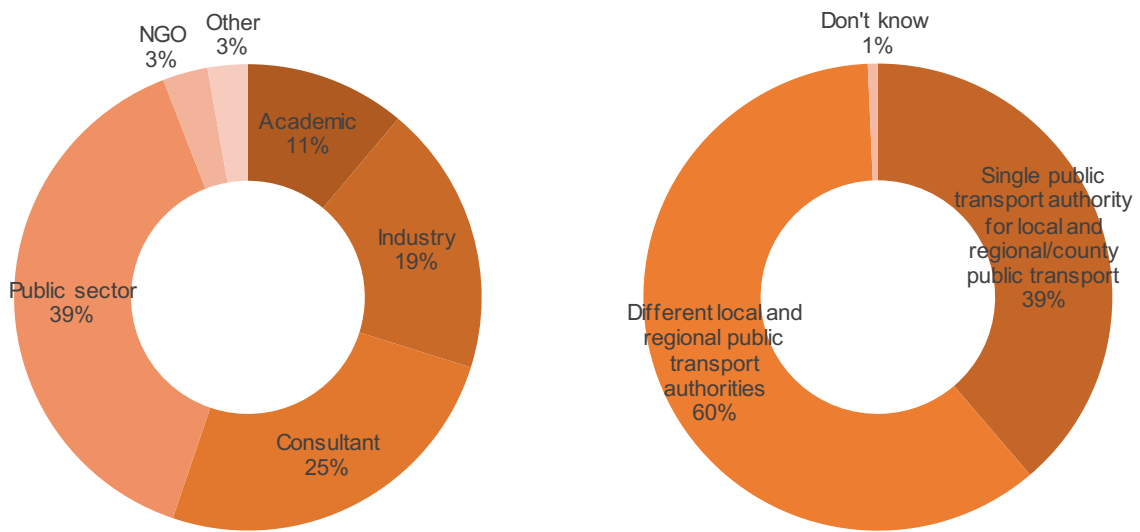


Figure 1
 Profile of respondents by sector of employment (N = 288), and public transport authority structure in their country or region (N = 289).

3. Results

3.1. Regional-interregional boundary

First, the respondents were asked to define the outer boundary of regional travel. The results indicate a clear preference for two of the given options: within an administrative region, e.g. county or equivalent, or within a labour market area. These two options are essentially equal in numbers, and together account for 82 % of the responses. Also within the open-ended “other-option” a majority of the responses are closely related to either the administrative definition or the labour market area, or a combination of them.

The results are similar in North America, Europe, and the other continental regions, as well as across sectors of employment. The public transport authority structure, though, has some impact on the results. Respondents that are active in a country or region where a single authority is responsible for local and regional public transport have a slightly stronger preference for the administrative definition. Still, the overall pattern with two dominant options is valid also in this case.

Table 1
Preferred definition of the outer boundary of regional travel.

How would you define regional as opposed to interregional travel?	N	%
Within administrative region, e.g. county or equivalent.	128	44 %
Within labour market area.	110	38 %
The travel time is at most t minutes.	10	3 %
The trip distance is at most x km.	8	3 %
Other	34	12 %
SUM	290	100 %

Some respondents, 6 %, have opted for a maximum trip length or travel time as a limit between regional and interregional travel. These respondents were asked to specify the limits. The results are very diverse, covering wide spectra ranging from 15 to 100 km (median 40 km), and from 15 to 90 minutes (median 50 minutes).

The survey results contain many comments regarding the labour market area, indicating that this option may need revision. Commuting flows are a primary consideration in defining labour market areas, but many respondents stress the importance of also taking other trip purposes into account. As one of the respondents expresses it, this would mean that regional travel also can be defined as “within the service area for major regional institutions”, such as regional hospitals, schools and universities. Some respondents also mention that travel for daily or weekly leisure activities and shopping needs to be included in the definition, indicating that the determinant should be the frequency of travel rather than trip purpose.

3.2. Local-regional boundary

Also for the inner boundary of regional travel, the results show a clear preference for two of the given options: one functional and one administrative. Either of these two options were chosen by 83 % of the respondents. The functional option in this case is that some portion of a regional trip has to be outside an urban area, e.g. trips from cities into rural areas and trips between separate urban areas are regional regardless of distance. The administrative option means that a regional trip crosses an administrative border, e.g. city, town or municipality limits.

Analogous to the outer boundary definition, the results are similar across continents, sectors of employment, and public transport authority structure. The distribution of responses follow approximately the same pattern in all subgroups.

Table 2

Preferred definition of the inner boundary of regional travel.

How would you define regional as opposed to local travel?	N	%
Any part of the trip is outside an urban area.	134	46 %
The trip crosses an administrative border.	106	37 %
The trip stretches at least x km from a city or town into a rural area or to another urban area.	12	4 %
The trip is at least y km (regardless of urban or rural environment).	12	4 %
The travel time is at least t minutes.	6	2 %
The average speed is at least v km/h.	1	0 %
Other	19	7 %
SUM	290	100 %

8 % of the respondents would like to include a specific distance in the definition, divided equally by those who think that this distance should be measured from the fringe of an urban area into a rural area (variable named x in Table 2), and those who think that the distance should be equal to the trip length regardless of urban or rural environment (variable named y in Table 2). The respondents' specifications of these two types of distances display large variations, with responses ranging from 5 to 24 km (median 10 km) and from 3 to 500 km (median 25 km), respectively. Some respondents have instead opted for a minimum travel time or average speed, but the sample sizes for quantification of these two limits are even smaller.

The comments on this question are mainly focused on three subjects. Firstly, several respondents suggest a modification of the first option from urban area to a more general formulation around density. Alternatively, a classification of *city centres* or *central business districts* can be used in the definition. In both cases, the idea is to include trips between different parts of a conurbation in the definition of regional travel, e.g. connecting suburban neighbourhoods in the conurbation to the city centre. Secondly, a number of respondents comment on the difference in characteristics between different regions, and the consequential difficulty of creating a general definition. According to these respondents, regional travel should then be defined by travel patterns in each area rather than by administrative boundaries or settlement patterns. Thirdly, the possibility

of combining criteria is raised by some respondents, arguing that there might be more than one factor to take into account.

3.3. Thesaurus

The third question in the survey aimed at exploring the respondents' perception of how some selected terms relate to regional public transport. The selection of terms focused on bus services, and hence the respondents were asked to indicate each term's relation to "regional bus".

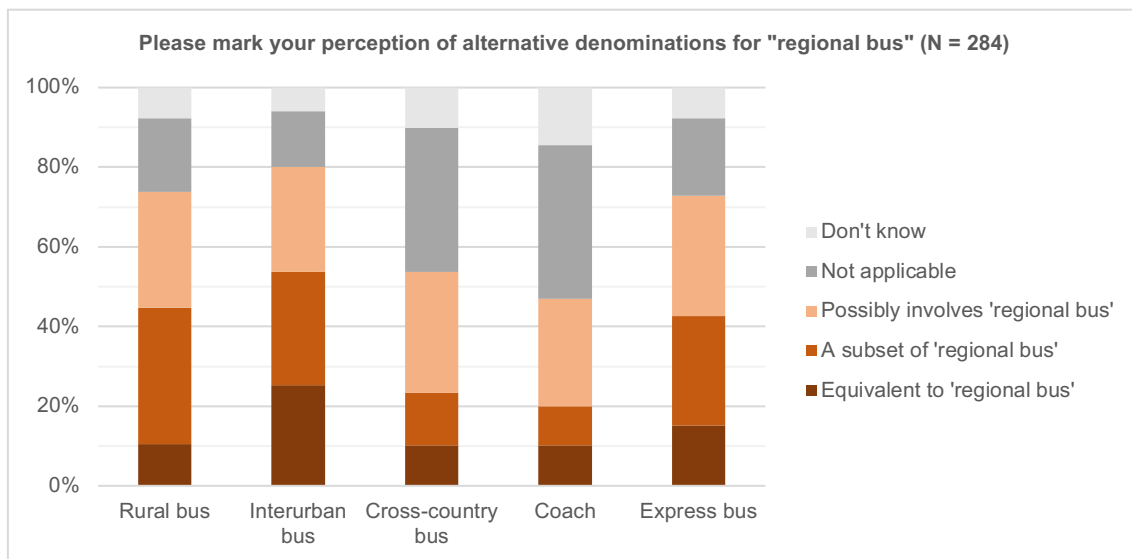


Figure 2
Perception of the terms *rural bus*, *interurban bus*, *cross-country bus*, *coach*, and *express bus* in relation to *regional bus*.

The results indicate a stronger relation to *rural*, *interurban*, and *express bus* than to *cross-country bus* or *coach*. This is elaborated in some of the comments, arguing that coaches and cross-country buses are typically used in long-distance services rather than regional services.

Several respondents comment on the importance of maintaining a distinction between functionality and technology, meaning that factors such as vehicle type or stopping pattern should not be included in the definition of regional public transport. The terms in this question represent, in a sense, other dimensions of public transport. For instance, express services can be local, regional or interregional, with a technical rather than functional implication, concerning speed or stopping pattern.

Some additional related terms are mentioned in the comments, such as *suburban bus*, *commuter bus*, and *intercity bus*. Similar to the preselected terms in the survey, these terms may be relevant as keywords when searching for literature about regional public transport. However, they do not add anything to the local-regional-interregional dimension, and hence not to the definition of regional public transport.

Additionally, a few possible synonyms to local, regional and interregional can be extracted from the comments:

- *Intraurban*, meaning within an urban area, i.e. possibly equivalent to local, depending on the definition of local versus regional.
- *Intraregional*, meaning within a region, i.e. equivalent to regional.
- *National*, meaning across regions but within a country, i.e. in most cases equivalent to interregional.

Finally, some respondents stress the importance of context when using the words *regional* or *region*. The meaning of these words range from city-region to continental region, and to quote one of the respondents: “region and city are dynamic in nature, not a static concept”.

4. Analysis

The survey rendered a similar pattern for both the inner and the outer boundary of regional travel, with a clear preference for either an administrative or a functional criterion. The administrative version is bounded on the outer by county limits, or an agglomeration of counties, and on the inner by city, town or municipality limits. The functional version of the definition needs further elaboration before we can continue to a conclusion.

4.1. From labour market area to regular travel

The functional criterion for the outer boundary in the survey is based on labour market areas, which are defined primarily by commuting flows. Many respondents stress the importance of also including other trip purposes than commuting to work, and hence it might be favourable to base the definition on travel patterns in general rather than on labour market areas. This could mean that the idea of defining regional travel as within a certain geographic area, delimited administratively or by a labour market, should be abandoned in favour of a definition that is geographically more fluid.

One possible approach could be to establish a definition founded on the frequency of travel. Based on comments in the survey, a regional trip occurs on a regular basis, at least weekly. For practical reasons, trips made on a regular basis can be roughly interpreted as trips within a certain distance or within a certain travel time. However, it is hard to draw a general conclusion about the quantification of such distance or time limits, at least according to the survey results. The response samples from the corresponding options in the survey are small, and the respondents' quantifications of such criteria display large variations. This means that the survey results do not support the inclusion of distance or travel time limits in the definition, let alone give any trustworthy indications of at what levels they should be set.

Possibly, the interpretation of regular travel in terms of distance or travel time might depend on the national or regional context. In Sweden, for instance, regional public transport is defined by the government as services where the majority of trips are made on a regular basis, which is explicated as trips shorter than 100 km and with travel times less than one hour (Swedish Ministry of Enterprise and Innovation, 2010, pp. 59–60). As a comparison, 150 km is used in an Australian context for a similar definition of exurban settlements around Melbourne (Petersen, 2012, p. 25).

This issue is related to the concept of a travel time budget (Zahavi & Ryan, 1980; Zahavi & Talvitie, 1980), implying that individual's average daily travel time tends to be relatively constant in the order of 1 to 1.5 hours (Mokhtarian & Chen, 2004, p. 644). If this concept is accepted, regular trips will generally not exceed travel times in the order of 30 to 45 minutes one-way. This is a mean over the year and over a population,

so in order to include some of the tail of the distribution it would probably be advisable to extend this travel time when used as a limit in the definition of regional travel. However, the concept of a travel time budget is not uncontroversial. At an aggregate level there seems to be stability, but empirical studies that examine the existence of travel time budgets at different times and locations are often found to give widely different results (Mokhtarian & Chen, 2004). Hence, there is no evident support for the inclusion of a specific travel time in the definition of regional travel. This also applies to distance, which in this sense is merely a function of travel time and speed.

4.2. Urban area and density

The functional criterion for the boundary between local and regional is in the survey based on urban areas. Some respondents suggest instead a more general formulation around density, in order to include travel between different parts of a conurbation in the definition of regional travel. An approach would then be to identify changes in land use density, and to define trips crossing such density variations as regional.

The idea is compelling, trips between two areas in a conurbation probably have many things in common with trips between two distinct urban areas. However, there are practical issues of defining what level of density change to be used, and how to measure it. Inevitably, the definition will be less clear-cut than a definition based on urban areas, which usually are well-defined.

4.3. Relation between the administrative and functional criteria

For both the regional-interregional and the local-regional boundaries, the respondents' preferences for the administrative and the functional definitions are roughly equal. One approach could then be to combine these criteria using logical conjunction or disjunction (AND/OR).

First of all, there is in most cases a large overlap between the two criteria. As for the regional-interregional boundary, most of the trips made on a regular basis are almost certainly within an administrative unit such as a county or an agglomeration of counties, and vice versa. As for the local-regional boundary, most trips to and from an urban area will cross an administrative boundary such as city, town or municipality limits.

To be able to decide how to combine the criteria, we need to focus on what lies outside the overlaps. As for the regional-interregional boundary, the administrative definition will include trips that are not made on a regular basis, especially if the administrative region is large. On the other end of the Venn diagram (see Figure 3), trips made on a regular basis but crossing a regional (or national) administrative border, even between towns just a few kilometres apart, are excluded in the strictly administrative definition.

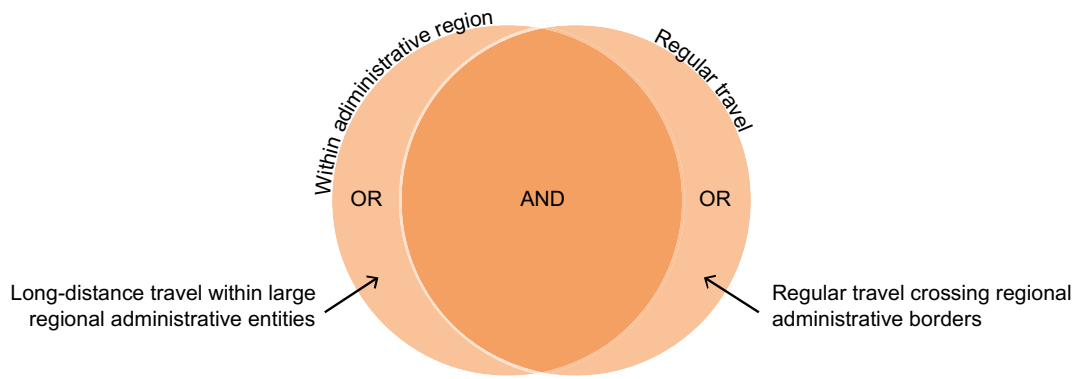


Figure 3
Venn diagram for the outer boundary of regional travel.

Since the purpose of this project is focused on passengers' preferences and factors influencing ridership on regional public transport services, it is reasonable to exclude long-distance travel within large administrative regions from the definition of regional travel. Regular travel crossing administrative borders, though, share key characteristics with other regular travel, and should therefore be included. This means that a combination of the administrative and functional criteria is superfluous. The criterion of regular travel is sufficient in itself, for our purpose, and will moreover include a majority of the trips that are regional according to the administrative criterion.

The line of reasoning is similar for the local-regional boundary. Trips crossing an administrative border, but carried out within an urban area, are local in terms of passengers' preferences. On the other end of the Venn diagram (see Figure 4), trips that to some extent pass outside urban areas, but are within a local administrative entity, have much in common with other interurban or urban-to-rural trips. Analogous to the outer boundary, this means that the functional criterion is sufficient for our purpose, and will also in this case include a majority of the trips that are regional according to the administrative criterion.

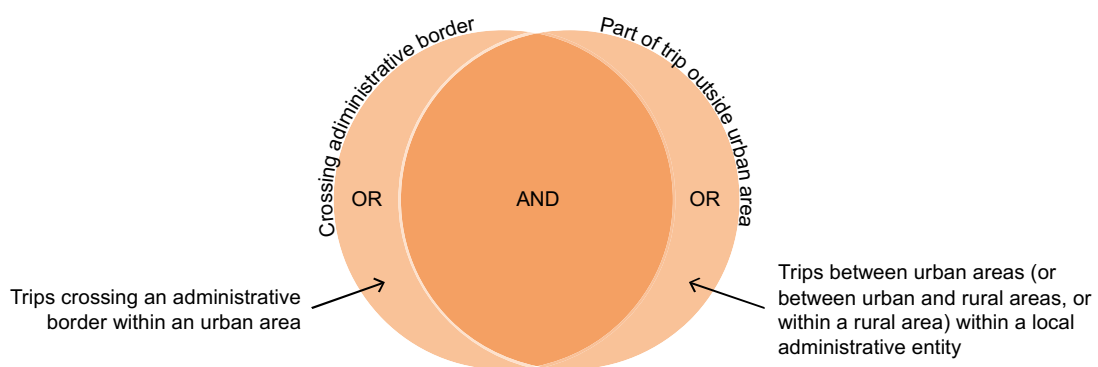


Figure 4
Venn diagram for the inner boundary of regional travel.

5. Discussion

When exploring preferences of existing and potential passengers, it is relevant to acknowledge differences between different geographic scales: local, regional and interregional. However, the boundaries between these categories remain unclear. The aim of this paper has been to clarify these boundaries through an exploration of how the term *regional travel* is perceived among public transport professionals.

The results show a similar pattern for both the inner and the outer boundary of regional travel, with a clear preference for either an administrative or a functional criterion. A possible interpretation of these results is that the definition of regional travel, administrative or functional, depends on the purpose. As we have argued in the analysis (section 4.3), the functional criteria are sufficient for our purpose of exploring passengers' preferences. There are large overlaps, and in practice most of the regional travel according to the functional definition will also be regional in an administrative sense, and vice versa.

Identified previous literature with definitions of regional public transport, and related terms, have also opted for similar functional criteria. As for the inner boundary, definitions include the notion of *urban area* (Godlund, 1954, pp. 32–42; Luke et al., 2018, p. 1; Petersen, 2012, p. 24; White, 2016, p. 201) or “cities and urban centres” (UITP, 2013, p. 1). The outer boundary is neglected in most cases, but Petersen (2012) mentions “how far commuters are willing to travel” (pp. 24–25) as a possible limit. This conforms with the *labour market area* option in the survey, and with the wider notion of *regular travel* suggested in the analysis.

Since the sampling method used in this study is non-probabilistic, the results cannot be generalised to reflect the views of the whole community of practitioners and academics working with public transport. The results represent the views of the 290 respondents, allowing us to explore the perceptions of a variety of experts. The aim of the study has not been to create a general definition to be used for all purposes and in all contexts, but rather to sort the terms and collect valuable input for further research about regional public transport.

The sample is largely composed of respondents from North America and Europe. This means that the results have to be interpreted primarily from a North American and European perspective. Future studies could aim at including more respondents from other continental regions, to be able to further analyse the influence of national or regional context.

6. Conclusions

In order to study public transport in different geographic scales, the three categories local, regional and interregional can be used. This categorisation is useful as a complement to technical aspects, such as vehicle type or stopping pattern, and it is important to maintain a distinction between technology and functionality.

For the purpose of exploring passengers' preferences, the following working definition of regional public transport can be adopted. The definition implicitly also defines local and interregional public transport.

Regional public transport targets passengers travelling between separate urban areas or to rural areas, and a majority of the trips are made on a regular basis (daily to weekly in general).

The definition includes urban areas instead of a criterion based on density or urban centres, implying that travel between different parts in a conurbation (belonging to the same urban area) is local rather than regional.

Labour market areas were abandoned in the definition, in favour of regular travel, to be able to include other trip purposes than commuting to work. This means that regional travel is not defined as within a certain geographic area, but instead focuses on travel patterns in each case.

The working definition will guide our coming research efforts in the field, with the overarching aim to develop knowledge about effective regional public transport services.

7. References

- Boisjoly, G., & El-Geneidy, A. M. (2017). The insider: A planners' perspective on accessibility. *Journal of Transport Geography*, 64(August), 33–43.
- Börjesson, M., & Eliasson, J. (2014). Experiences from the Swedish Value of Time study. *Transportation Research Part A: Policy and Practice*, 59, 144–158.
- Godlund, S. (1954). *Busstrafikens framväxt och funktion i de urbana influensfälten*. Lund: C.W.K. Gleerup.
- Hensher, D. A., & Waters, W. G. (1994). Light rail and bus priority systems: Choice or blind commitment? *Research in Transportation Economics*, 3, 139–162.
- Ingvardson, J. B., & Nielsen, O. A. (2018). Effects of new bus and rail rapid transit systems – an international review. *Transport Reviews*, 38(1), 96–116.
- Luke, D., Steer, J., & White, P. (2018). *Interurban Bus : Time to raise the profile*. Greengauge 21.
- Mokhtarian, P. L., & Chen, C. (2004). TTB or not TTB, that is the question: A review and analysis of the empirical literature on travel time (and money) budgets. *Transportation Research Part A: Policy and Practice*, 38(9–10), 643–675.
- Petersen, T. (2012). *Public Transport for Exurban Settlements*. Faculty of Architecture, Building and Planning, University of Melbourne.
- Román, C., Martín, J. C., & Espino, R. (2014). Using Stated Preferences to Analyze the Service Quality of Public Transport. *International Journal of Sustainable Transportation*, 8(1), 28–46.
- Sivakumaran, K., Li, Y., Cassidy, M., & Madanat, S. (2014). Access and the choice of transit technology. *Transportation Research Part A: Policy and Practice*, 59, 204–221.
- Swedish Ministry of Enterprise and Innovation. (2010). Ny kollektivtrafiklag Prop. 2009/10:200.
- UITP (Union Internationale des Transports Publics). (2013). *Core Brief: Demographic changes and challenges for regional transport*.
- White, P. (2016). *Public transport: its planning, management and operation*. New York : Routledge, 2016.
- Zahavi, Y., & Ryan, J. (1980). The stability of travel components over time. *Transportation Research Record*, 750, 19–26.
- Zahavi, Y., & Talvitie, A. (1980). Regularities in travel time and money expenditures. *Transportation Research Record*, 750, 13–19.



K2 är Sveriges nationella centrum för forskning och utbildning om kollektivtrafik. Här möts akademi, offentliga aktörer och näringsliv för att tillsammans diskutera och utveckla kollektivtrafikens roll i Sverige.

Vi forskar om hur kollektivtrafiken kan bidra till framtidens attraktiva och hållbara storstadsregioner. Vi utbildar kollektivtrafikens aktörer och sprider kunskap till beslutsfattare så att debatten om kollektivtrafik förs på vetenskaplig grund.

K2 drivs och finansieras av Lunds universitet, Malmö universitet och VTI i samarbete med Stockholms läns landsting, Västra Götalandsregionen och Region Skåne. Vi får stöd av Vinnova, Formas och Trafikverket.

www.k2centrum.se

