METPEX

Deliverable 5.2

A COMPREHENSIVE SET OF QUALITY AND ACCESSIBILITY INDICATORS FOR TRANSPORT SERVICES
Publishable summary

Coordinator:	**Author:**
Professor Andree Woodcock, Coventry University tel.:+44 (0)2476 158349, a.woodcock@coventry.ac.uk	Responsible partner: POLITO Participants: INTECO, ITENE, ZHAW, VTM, FIA, RSM Tel: +39 011 090 5638 marco.diana@polito.it
Duration of Research: Project Duration Nov 2012 – October 2015 Deliverable Duration January-May 2015	**WEBSITE** WWW.METPEX.EU

Grant Agreement no: 314354

Project Full Title 'A Measurement Tool to determine the quality of the Passenger Experience'

A COMPREHENSIVE SET OF QUALITY AND ACCESSIBILITY INDICATORS FOR TRANSPORT SERVICES

Summary details

This deliverable presents analyses on the dataset originating from the implementation of the METPEX tools, targeted at developing indicators that can be used to clarify through a synthetic index how individuals evaluate from a subjective viewpoint different issues related to quality and accessibility during their journey experience. Overall, the data available from the survey campaign allowed us to reach the task goals, since the identified set of indicators has a good coverage on all interesting travel means and user groups and could also offer some insights on more specific issues such as those measured through indicators developed in the deliverable.

Purpose

The goal of the present deliverable is to develop a set of indicators that can give a synthetic and quantitative evaluation on quality and accessibility-related issues from the traveller perspective. On the basis of the variables measured through the METPEX tools and of the review of the state of the art in the sector that was analysed in METPEX Deliverable 5.1, several alternative sets of quality and accessibility indicators are developed, covering the most important relevant quality dimensions and taking into account indicators that have been implemented successfully in the past.

Method

The first step of this work is devoted to explore the possibility of defining some classification schemes of the variables in the dataset and then to extract indicators by jointly considering the variables that fall inside each one of these newly defined classes, irrespective of where the corresponding question was actually asked within the questionnaire. Five main classifications are produced:

- Classification "C1" allows selecting at once all relevant questions for a given travel means and it is therefore useful to develop mode-specific indicators.

- Classification "C2" similarly allows selecting at once all relevant questions for a given user group and it is therefore useful to develop user group-specific indicators.

- Classification "C3" is based on the quality components (or "quality tags") that were identified in METPEX Deliverable 2.1.

- Classification "C4" considers the specific phase of the traveller experience (pre-trip, on-trip or post-trip).

- Classification "C5" deals with the kind of measurement implied by the variable (objective, subjective, satisfaction rating).

Then, data reduction techniques are applied to identify the components on several different subsets of variables:

- 21 groups of Tier-2 variables,

- 10 groups of mode-specific questions

- 11 groups of user-specific questions

- Additional groups of variables clustered according to the previous classifications.

For each one of these groups of variables, the following two statistical analyses have been performed:

- Cronbach's Alpha computation, to check if the group of variables can be considered as a unique indicator of an underlying unidimensional construct, or if it is representative of more than one latent variable.

- Principal Component Analysis, to further check if more than one factor is needed to adequately represent the observed variability of the responses in the dataset. In case that more than one factor is needed, factor loadings representing the indicator are presented and an interpretation of the meaning of the factor, and therefore of the corresponding potential indicator, is offered.

These analyses allowed the identification of a wide range of factors, each factor constituting a potentially interesting indicator for different user groups, travel means and journey phases. A selection process of all these factors led to the definition of an initial set of the following indicators:

- 27 indicators covering the different aspects related to perceived quality of the whole journey experience

- 13 indicators that are specific to different forms of public transport
- 10 indicators that are specific to active means (pedestrian, bikes)
- 35 indicators that are specific to different user groups
- 7 more specific indicators that focus on the views of communication impaired and mobility restricted using public transport
- 9 indicators that focus on different phases of the journey experience (pre-trip and during the trip).

Each indicator is analytically defined through one of the following two methodologies. If the indicator comes out from a factor obtained through the Principal Component Analysis (PCA), the component (or factor) score coefficients are used to compute the indicator according to the following formula:

$$I = \Sigma_i \, C_i * Z_i \; ;$$

where C_i are the component (or factor) score coefficients pertaining to the i variables that have a significant loading on the factor and Z_i are the standardised scores of those i variables.

Instead, when the construct is unidimensional, we will simply sum the scores of the corresponding items to build a summated rating scale.

The manual to be drafted in METPEX task 5.4 will guide the analyst to choose which indicators to consider according to the objectives of the study. Some of the above generated indicators are in fact partially overlapping but their best ambit of use is different.

An example of indicator identification

An example of indicator development focusing on the "low income" group is provided below. PCA is applied to the answer to questions of the dataset referring to this group and Table 1 shows the resulting factors, along with their loadings.

low income Variable definition	Variable code	Component			
		1	2	3	4
Transport availability was adequate for my needs	u19	0.761			
The quality of pre-trip information before I started my journey was good	u11	0.723			
The quality of transport infrastructure (e.g. whole transport service) during my journey was good	u12	0.710			
Design of transport stops was adequate for my needs	u3	0.676			
My passenger rights (e.g. able to access all transport services) were respected	u6	0.675			
Design of stations was adequate for my needs	u1	0.674			
The quality of my ride was good	u13	0.666			
The different modes of transport I used worked well together	u5	0.664			
Design of transport interchanges (main terminals) was efficient	u2	0.660			
The city supported my mobility needs	u4	0.653			

low income Variable definition	Variable code	Component 1	2	3	4
The quality of travel information available during journey was good	u10	0.640			
Provision of information on arrivals and departures was adequate for my needs	u8	0.627			
The overall accessibility of my journey was adequate for travellers with additional needs	u7	0.623		0.426	
Support for intermodal (e.g. different forms of transport during same journey) travel was provided	u15	0.617			
My safety and security while travelling was good	u14	0.597			
Vehicle design was suitable for my needs	u20	0.595	0.520		
Time the journey took was as promised	u18	0.591			
Easiness of connections with other modes of transport	v29	0.532			0.472
Service coverage across city	u128	0.531			
Recognition of the needs of motorised vehicle users	u16	0.519			
Reliability of services	v62	0.467	0.443	0.444	
Respect shown by public transport staff	v63		0.661		
Public Transport Staff were receptive to my needs	u9	0.463	0.632		
Fines for incorrect tickets	v35		0.588		
Service availability at all times	u127		0.569	0.401	
Safety and security at transport stops	v64		0.537		
Ticket purchasing process was easy to follow	u17	0.469	0.516		
Behaviour of other passengers	u126	0.406	0.431	0.401	
Level of noise	v44			0.755	
Level of crowding	v43			0.752	
Air temperature and ventilation inside vehicles	v8	0.453		0.591	
Cleanliness of vehicles	v20			0.566	
Notification on timetabling changes	v48			0.507	
Level of assistance available during journey	v42		0.462	0.501	
Availability of affordable services	u125				0.732
Range of fares offered	v60				0.726
Ability to buy one ticket which covers different forms of transport	v1				0.699
Availability of preferential prices	v12				0.676
Value for money of services was good	v73				0.600
Comprehensibility of ticketing structure	v23				0.462

Table 1 Components loadings of low income; Tier-1 variables are marked in green

From the above Table 1 it is possible to identify four different factors, that could be better described and labelled as done in Table 2.

Factor #	Description	Factor Name
Factor 1	Describes variation with variables related to the quality of city support, information and integration	Quality City Support, Information and integration
Factor 2	Describes variation with variables related to frequency of the service and staff helpfulness	Low cost services issues
Factor 3	Groups comfort aspects	Comfort
Factor 4	Indicates service value´s for money, ticket structure and range of fares issues but also the ability to buy integrated tickets and availability of preferential prices	Convenience

Table 2 Components descriptions of low income

As it can be observed in Table 2, Factor 1 explains the variance of the variables related to the quality of city support, information and integration. Factor 2 takes into consideration the variables associated to the frequency, availability of the service and also the staff helpfulness. Factor 3 aggregates comfort aspects and Factor 4 convenience aspects.

Then, three interesting indicators are retained from this analysis. In fact, the first factor is summarising Tier-1 questions pertaining to quality aspects (green lines), so it is not specific for this analysis. Therefore, Table 3, Table 4 and Table 5 show the new indicators, where C_i values represent the component scores coefficients that are needed to compute the indicator value on the basis of the individual ratings.

LOW1	Low cost services issues	C_i
v63	Respect shown by public transport staff	0.297
u9	Public Transport Staff were receptive to my needs	0.276
v35	Fines for incorrect tickets	0.264
u127	Service availability at all times	0.211
v64	Safety and security at transport stops	0.181
u17	Ticket purchasing process was easy to follow	0.208
u126	Behaviour of other passengers	0.108

Table 2 Indicator LOW1: Low cost services issues

LOW2	Comfort	C_i
v44	Level of noise	0.340
v43	Level of crowding	0.343
v8	Air temperature and ventilation inside vehicles	0.209
v20	Cleanliness of vehicles	0.177
v48	Notification on timetabling changes	0.171
v42	Level of assistance available during journey	0.135

Table 2 Indicator LOW2: Comfort

LOW3	Convenience	C_i
u125	Availability of affordable services	0.293
v60	Range of fares offered	0.290
v1	Ability to buy one ticket which covers different forms of transport	0.324
v12	Availability of preferential prices	0.268
v73	Value for money of services was good	0.221
v23	Comprehensibility of ticketing structure	0.116

Table 2 Indicator LOW3: Convenience

Results

The above mentioned initial set of indicators is proposed on the basis of the interpretation of the factors found. On the whole, the following main classes of indicators were therefore defined:

- Indicators that are measuring different components of the perceived quality of the journey, irrespective of the transport system and of the kind of traveller;

- Indicators that are measuring different components of the perceived quality of the journey when different forms of public transport and active means are used, irrespective of the kind of traveller;

- Indicators that are measuring different components of the perceived quality of the journey when travellers belong to specific groups, irrespective of the travel means;

- Indicators that are measuring different components of the perceived quality of the journey when travellers belong to specific groups and public transport is used;

- Indicators that are measuring different components of the perceived quality of the journey for the different phases of the journey experience (pre-trip, walking to/from travel means, waiting…).

Several practical uses of those indicators can be envisaged. On one side, the consideration of how indicators were defined can help policy makers to understand what are the underlying factors that have the highest impact on the way in which travellers evaluate transport services and options, and how those factors compound to form an overall judgement. On the other, the implementation of the METPEX tools that has been done in WP 4 leads to a very long and complex survey, even if according to the goals of the application (e.g. focusing on only some user groups, travel means or specific aspects of the traveller experience) only a much smaller number of questions would be really needed. The analyst can then select the indicators that better cover the issue s/he wishes to consider, take note the variables used to build them and only include these latter in the survey tool.

Conclusion & Opportunities for Further Research

Data availability issues have left some additional open questions that could be the focus of additional efforts in subsequent developments of the METPEX tools, according to the business plan that is being developed in WP 8. It is in fact important to underline that, despite the richness of the dataset and the large number of available observations, we do not claim to have reached the exhaustiveness concerning all quality aspects for all user groups and travel means.

Rather than adding new questions to fill-in those gaps, it would be probably more sensible to revise the experimental design when administering the tool to achieve a larger number of observations for given combinations of modal usages and users groups. The activity has been geared towards the stated objectives on METPEX, therefore focusing more on specific travel means (public transport and active modes) and user groups (e.g. mobility challenged). Activities similar to those here reported could lead to the definition of additional indicators for the remaining travel means and user groups that were defined when designing the survey.

In particular, the following activities should be carried out to complete the analysis within tasks 5.3 and 5.4:

- Validation and confirmation of the factor scores coefficients, including an assessment of their stability when changing the values of the baseline questions (socioeconomic characteristics of the respondent and travel attributes).

- Indicators will be evaluated through SWOT (Strengths, Weaknesses / Limitations, Opportunities, and Threats) analysis and assessing to what extent they are SMART (Specific, Measurable, Achievable, Realistic and Time-bound).

- Benchmarking exercises will be envisaged in order to see how their values change across the different METPEX test sites and to inform their presentation in the final manual (i.e. the METPEX Deliverable 5.4).