Defining Standardized Quality Level in Suburban Bus Transport

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Abstract The article deals with the possibilities of standardizing the quality level of suburban bus transport services. The procedures respect the legislative requirements which are valid in the Slovak Republic. The proposed theoretical methods are applied to specific measurement results of expectation and perception of the quality by the passengers in a significant transport hub of northern Slovakia, the region of Žilina. The findings will be applied in development of the standardization quality level in suburban bus transport to its anchoring into the service contract between self-governing region and operator of bus transport. This approach has not yet been applied in the Slovak Republic.

Keywords quality, suburban bus transport, passenger, expectation, satisfaction

JEL R41, R49

1. Introduction

The quality of suburban bus transport (SBT) is characterized by a set of quality criteria. It includes criterions related to quality of transport services (soft quality criterions) and quality of transport serviceability of territory (hard quality criterions). The following legislation deal with the issue of service quality in public passenger transport in Slovakia:

Act No 56/2012 collection of Laws on Road Transport in Article 21 (Service contract), part 1 states that the purpose of a service contract, concluded between the public authority and the operator, is to provide safe and effective public transport and quality services. In part 9 this law adds that part of this contract are requirements for quality standards, i.e. STN EN 13816 and STN EN 15140.

STN EN 13816 –Transportation. Logistics and services. Public passenger transport. Service quality definition, targeting and measurement. This European Standard specifies the requirements to define, target and measure quality of service in public passenger transport and provides guidance for the selection of related measurement methods. The standard defines a set of eight quality criteria for public passenger transport- availability, accessibility, information, time, customer care, comfort, security, and environmental impact. The standard classifies each criterion in more detail into sub-criteria. Services are determined by the quality loop.

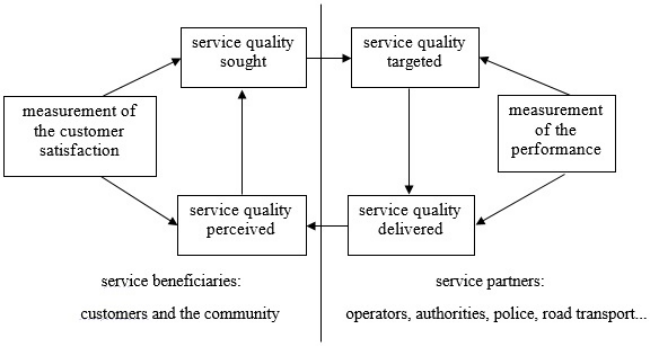

Figure 1. Service quality loop

STN EN 15140 – Public passenger transport – basic requirements and recommendations for systems that measure delivered service quality. This standard provides guidelines and recommendations for measuring the quality criteria defined by standard STN EN 13816.

Regulation (EC) No 1370/2007 on public passenger transport services by rail and by road. The purpose of this Regulation is to define how, in accordance with the rules of Community law, competent authorities may act in the field of public passenger transport to guarantee the provision of services of general interest which are, among other things, more numerous, safer, and of a higher quality. When competent authorities, in accordance with national law, require public service operators to comply with certain quality standards, these standards shall be included in the tender documents and in the public service contracts.

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The particular design of measurement and assessment must be based on both the legislative requirements associated with the measurement and assessment of quality. It must also respect the current status and requirements for quality assessment in terms of specific areas as well as already implemented procedures and experience in quality measurement and assessment in other regions of the SR or abroad, if appropriate.

The measurement and assessment system must be designed respecting the simplicity of measurement and to ensure satisfactory expressing power of the results of the provided transport services quality assessment. The diagram of certain steps in the design and implementation of measurement and assessment is shown in Figure 2.

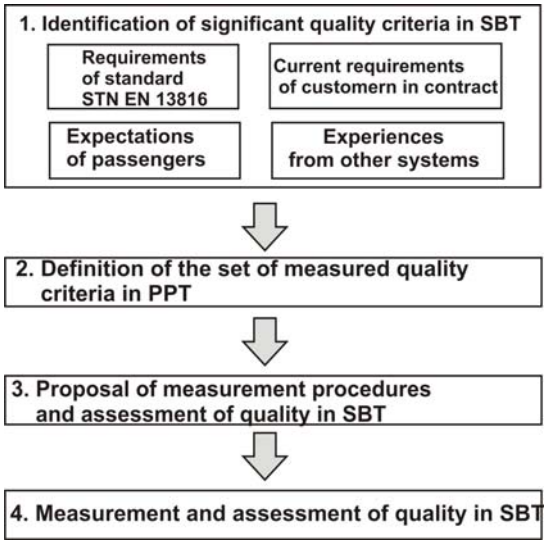


Figure 2. Quality measurement and assessment procedure diagram

Quantification of standardized quality level is needed for stages 3 and 4 of Figure 2.

2. Analysis of quality requirements in current contracts between self-governing regions and operators

We analyzed quality requirements in current contracts between self-governing regions and bus transport operators in concrete eight self-governing regions of the SR. It is on the right side of the quality loop, Figure 1. There are great differences between contracts.

Comparative analysis of quality requirements and financial sanctions in current valid contracts between self-governing regions and bus transport operators is presented in Table 1.

Table 1 Selected quality criterions required and sanctions in current valid contracts

Self-governing region	Quality criterion	Sanctions
ZA, TT, PO, BB, BA	safety, comfort, peaceful transportation (active safeguarding by staff in an accident)	to 300 € (ZA), to 6,638 € (PO, KE)
ZA, TT, PO, BB, BA	identification of bus, information about a bus line in the bus stops	to 300 € (ZA), to 6,638 € (PO, KE)
ZA, TT, PO, BB	clean and operational facilities for customers	to 300 € (ZA), to 6,638 € (PO, KE)
ZA, TT, PO, BB, BA	provision and disclosure of information	to 300 € (ZA), to 6,638 € (PO, KE)
ZA, TT, PO, BB, BA	skills of staff	to 300 € (ZA), to 6,638 € (PO, KE)
ZA, TT, PO, BA	transport of handicapped and visually impaired people	to 300 € (ZA), to 6,638 € (PO, KE)
ZA, TT, PO, BA	more comfort for mothers with children, senior people and pregnant women	to 300 € (ZA), to 6,638 € (PO, KE)
ZA, TT, NR, KE, BB, BA	fluency, regularity, quality and safety of services and vehicle load factor	to 300 € (ZA)
ZA, TT, PO, BB, BA	information about modification of timetable, street direction, change and removing of bus link	to 300 € (ZA), to 6,638 € (PO, KE)
ZA, NR, KE, BB	electronic check-in system of passengers	to 300 € (ZA)
ZA	omitting over 6% bus links from overall number of bus links	the end of contract (ZA)
ZA, PO, NR, KE, BB	the end of public interest for services	the end of contract (ZA, PO, KE)
ZA, NR	buses maximum 16 years old	No sanction
ZA, NR	early bus departure from bus stops	to 500 € (ZA, NR)
ZA	delay of bus over 15% from overall travelling time from not objective causes	to 500 € (ZA)
ZA, PO, NR, KE	omitting of bus link (without reason)	to 1,000 € (ZA), to 6,638 € (PO, KE), to 700 € (NR)

Source: elaborated by authors on the basis of valid contracts

Note 1: Acronyms of self-governing regions: ZA- Žilina, TT- Trnava, PO- Prešov, NR- Nitra, KE- Košice, BB- Banská Bystrica, BA- Bratislava.
Note 2: The data from the self-governing of Trenčín were not found. Neither the penalties in BA, BB and TT were provided

The limits for meeting / not meeting the quality criteria is the most discussed in the contract for operator of Žilina. The given contract deals mainly with punctuality of buses. Financial sanctions are the highest for the omitting of bus and for its earlier departure from bus stop. The contract involves customer satisfaction, i.e., their complaints about the service that was provided for them. The contract deals mainly with security, fluency of transport, punctuality. The operator´s objective is to increase transport quality and comfort.

Public contracts in Prešov and Košice self-governing regions are very similar. They both have specified quality criteria which primarily related to security, comfort and fluency in transport. The individual conditions, which determine the meeting of targets, are not specified.

The Nitra self-governing region published its financial sanctions only for omitting a bus or its earlier departure from bus stop. The fines are imposed for unheated buses or failure to issue ticket or an incorrect issue ticket for passenger.

The self-governing regions Banská Bystrica, Bratislava and Trnava did not publish their financial sanctions related to low quality level services. They published only general targets of quality increasing. The self-governing region Trenčín did not provide its contract.

3. Standardizing the quality level in suburban bus transport from passenger point of view

The primary objective is to define a standard of the service quality level as a requirement for public procurement in suburban bus transport. Another equally important objective is to guarantee the level of quality requirements set down in contracts between the public authority and the operator throughout the duration of the contract. For each quality criterion included in the system that measures and evaluates the quality, the evaluation parties (public authority and operator) have to define the standardized parameters of the evaluation of criterion. The results of standardization are a necessary basis for measuring and assessing the quality level. The structure of parameters and their relationships are shown in Figure 2.

Methodology for standardization of quality criteria includes the following steps:

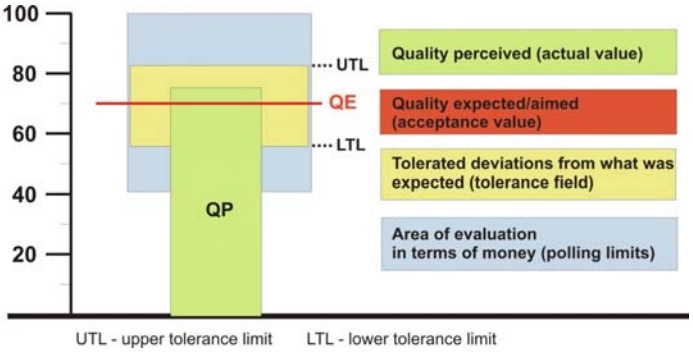
I. Definition of the level of expected / target quality - standard STN EN 15140 recommends that a set of measuring and evaluating quality criteria is based on customer expectations. Expected / target quality can be defined as a mean value calculated on the basis of a statistically significant sample of statements obtained through a passenger survey. It is a red line in Figure 2.

II. Definition tolerated deviations from the mean expected quality - in terms of descriptive statistics standard deviation to define the tolerated deviations of expected quality can be used; it is a yellow field in Figure 2.

III. Determination of the perceived quality level- based on a passenger's perception survey of quality criteria, their fulfillment by the operator. Perceived quality can be defined as the mean value calculated on the basis of a statistically significant sample of passenger statements obtained from the survey of passenger's quality perception. It is a green field in Figure 2.

IV. Calculation of passenger satisfaction with the performance of quality criteria- evaluation the relationship between perceived and expected quality. In the case of a satisfied passenger the passenger perception has a higher level than the level of passenger expectation, i.e. perceived quality is higher than the minimum value of the tolerance field. The red and green fields in Figure 2 are compared together. If the tolerance is not zero, it is a comparison of the green and the yellow field. In this case, tolerance limits have to be defined.

V. Measurement and evaluation of quality criteria by contracting parties (public authority and operator) based on contractually defined practices. The results are compared with a specified level of quality standard which is defined in the contract of public passenger transport services on the basis of steps 1 and 2.



Source: elaborated by authors

Figure 3. Definition of parameters for the quality evaluation – general approach

This approach based on passengers quality requirements and on the measurements of satisfaction is used to determine the measurement and evaluation of quality criteria. Now, in the Slovak Republic this approach is applied neither in transport organizations nor in public authorities.

Based on this approach an extensive research of passenger requirements and their satisfaction with the provision of transport services was carried out in autumn 2013 (left side of service quality loop). The objectified measurements were made by controllers in the area of transport services provi-

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sion. This part of research is still under development due to the scale of data; and it represents the right side of service quality loop. The research was carried out in October and November 2013 on a sample of 2,868 respondents. The research was performed in the region and the city of Žilina. 931 passengers and their opinions on quality in SBT were investigated.

To identify the passenger requirements and to determine their level of satisfaction standardized questionnaires for several modes of transport were used; they respected differences of the individual transport modes. For the purposes of this article analysis and evaluation based on a standardized part of the questionnaire were processed; they take into account the quality criteria and requirements that are common to all reviewed transport modes. The individual aspects of quality criteria by mode of transport are subject to independent research. As an evaluation tool of respondents´ view the point scale with a range of 0-5 points, 0 - minimal importance, 5 - maximum importance was used.

3.1. Identification of passengers´ expectations and perceived quality in SBT

Passenger requirements for quality represent expected quality level. The indicator says that the level of customer requirements should be on the basis of their legitimacy. This specified level should respect the opinion of the majority, i.e., the mean value has to be set. In our case, it is the weighted arithmetic average. Analyses were performed with the help of median values. The calculations of analyses did not confirm the occurrence atypical extreme values in the reviewed statistical files.

Then these results are used for determination of target quality level from the position of public authorities. This quality level should be a part of the contractual relationship between the public authority and operator and should contain the measurement procedures of individual quality criteria included in the set of criteria. This approach respects the recommendations of STN EN 15140.

Table 2 contains the results of analyses including a variability which expresses passenger's requests by using standard deviation. The variability value of passenger´s expectations can be used in the standardization of quality level for determination called tolerance deviations for individual quality criteria included in the methodology for measuring and assessing the quality (the yellow part of Fig. 3).

Table 2 includes the results of quality perception by passengers too. Perception of quality is expressed in the form of the arithmetic mean for each mode of transport and quality criteria. There are given the values of the standard deviation too.

Table 2. Values of average expectations and perceptions of selected quality criterions in suburban bus transport

Criterion	expectation		perception	
	average	σ	average	σ
punctuality	3.61	0.619	3.20	0.645
speed of transport	2.81	0.464	2.42	0.418
safety	3.27	0.665	3.17	0.230
cleanliness	3.69	0.621	3.00	0.747
behavior of driver	3.28	0.538	3.34	0.561
information	3.45	0.578	2.80	0.642
in vehicle comfort	3.2	0.638	3.03	0.641
ride comfort	3.10	0.651	3.19	0.840
bus stop/station comfort	3.24	0.955	2.77	0.469

Source: elaborated by authors

3.2. Analysis of the relationship between expected and perceived service quality in SBT

For assessment of perceived and expected quality absolute and relative indicators can be used. Absolute indicator is, for example, *the Customer Satisfaction Value*. It is the absolute difference between perceived value and expected value. If the positive value is achieved, the operator provides a level of service exceeding customer expectations. A negative value indicates the customer dissatisfaction. Set of quality criteria for measuring satisfaction usually consists of more than one criterion therefore this indicator should be relativized through theory of indices.

This indicator:

$$CSV = \bar{x}_{QP} - \bar{x}_{EQ} \quad (1)$$

Where
$\bar{x}_{QP}$ is the average value of quality perception by passengers
$\bar{x}_{EQ}$ is the average value of expected quality by passengers

The relationship between what the customer perceives and what he expects can be expressed by *Customer Satisfaction Index*:

$$CSI = \frac{\bar{x}_{QP}}{\bar{x}_{EQ}} \quad (2)$$

If the value is more than 1, the level of quality perception is higher than his expectations. If the value is less than 1, the customer´s expectations are not met.

The equation (2) is used for calculating the degree of passenger satisfaction if no deviation from the mean value of the passengers expectation is tolerated (yellow field of Fig. 3 is identical with marked red line).

To define the tolerance limits of the expected quality is possible when the theory of control charts where the limits are defined as ± σ from the mean value is used. If we re-

spect this approach we can modify the equation (2) for customer satisfaction index as equation (3):

$$CSI = \frac{\bar{x}_{QP}}{LTL_{EQ}} = \frac{x_{QP}}{\bar{x}_{EQ} - \sigma_{EQ}} \quad (3)$$

Where
LTL_{EQ} is the lower tolerance limit of the expected quality by passengers
σ_{EQ} is the standard deviation of expected quality by passengers

3.2.1. Customer satisfaction index in conditions of Žilina region

We made two calculations of CSI.

Approach 1: No tolerance of expected quality

Based on the research of passengers´ expectations and their perceptions of the quality level, the relational analysis of the results by the equation (2) was performed. The calculated values of customer satisfaction index are shown in 2nd column of Table 3. Only two of nine quality criterions have been met.

Approach 2: Tolerance of expected quality ±σ of average expectations

Values of CSI were calculated on the basis of formula (3), the calculation respects lower tolerance limits (LTL) of customer expectations. The calculated values of CSI for this approach are shown in 3rd column of Table 3. Seven of nine quality criterions have been met.

Table 3. CSI for selected quality criteria with no respecting and respecting LTL of expectations

Criterion	CSI	CSI with LTL
punctuality	0.886	1.070
speed of transport	0.861	1.032
safety	0.969	1.217
cleanliness	0.813	0,978
behavior of driver	1.018	1.218
information	0.812	0.975
in vehicle comfort	0.947	1.183
ride comfort	1.029	1.303
bus stop/station comfort	0.855	1.212

Source: elaborated by authors

Note: The red cells represent the values were passengers have higher expectations than the actual performance by operators. The green cells represent the opposite, when the fulfillment of quality criteria from operators is higher than the passenger requirement.

3.2.2. Standardization of quality level from customer point of view in SBT in Žilina region

The standardized parameters were calculated on the basis of research of expected and perceived quality in public passenger transport in the region of Žilina. Figure 4 depicts standardized values of quality expected, quality perceived and tolerated deviations for selected quality criteria. Expectations and perceived values of quality reached by research were transformed from the point scale (from 0 to 5 points) to points (from 0 to 100 points or percentage).

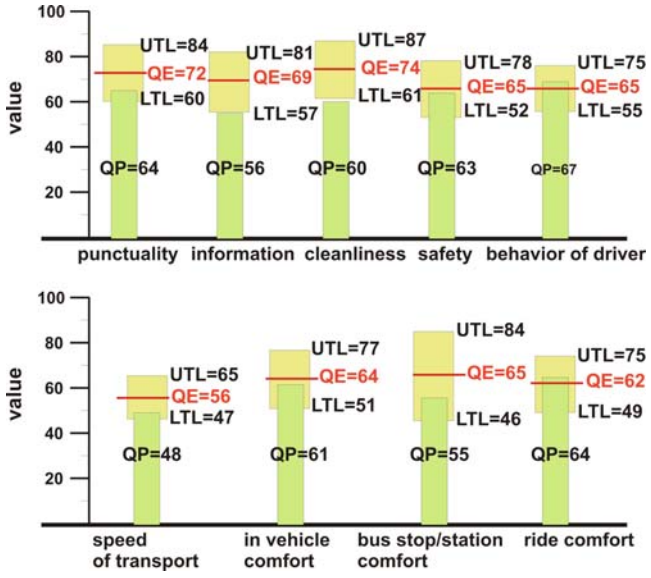
Tolerated deviations of expected quality were calculated on the basis of following formulas:

$$UTL_{EQ} = \bar{x}_{EQ} + \sigma_{EQ} \quad (4)$$

$$LTL_{EQ} = \bar{x}_{EQ} - \sigma_{EQ} \quad (5)$$

Tolerated values (UTL, LTL) reached the values from 0 to 5 points, the values for selected quality criteria were transformed to percentage too.

There are differences between expected and perceived quality in relation to concrete quality criterions in suburban bus transport. The greatest differences are in cleanliness, information and bus stop/station comfort, Fig.4.



Source: elaborated by authors

Figure 4. Standardized parameters for selected quality criteria for SBT in the region of Žilina

4. Conclusions

There are no unified methods for measuring and evaluating the quality of public passenger transport. There are European standards (EN 13816 and EN 15140) providing guidelines for measuring and evaluating the quality of public passenger services. Recommendations of standards are general. Only application of recommendations is insufficient. Application of general guidelines causes differences

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in approaches to measuring and evaluating the quality of public passenger transport at national and international level.

The results of research in the field of customer expectations and perceptions will be compared with results of measuring concrete quality criterions of public passenger transport in the region and the city of Žilina.

The results should be an important source for definition of standardized level of quality for contracting in public passenger transport and for proposal of methodology of measuring and evaluation of concrete quality criterions in public passenger transport.

Standardized level of quality in public passenger transport can be the base for comparison of quality of provided services by different operators. It should respect the customer´s expectations too.

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