METHODOLOGY OF STANDARDIZING THE QUALITY IN SUBURBAN BUS TRANSPORT AND ITS APLICATION IN SLOVAKIA – TOTAL APPROACH

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Summary: The article deals the standardization of the quality level in suburban bus transport in the total approach. The procedures respect the legislative requirements which are valid in the Slovak Republic. There are applied the proposed methods to specific measurement results of expectation and perception of the quality of the passengers with the help of service quality loop. The results are objectified with the measurements of controllers in a significant transport hub of northern Slovakia. This approach is not yet applied in the Slovak Republic.

Key words: Quality, Standard, Measurement, Transport service

INTRODUCTION

The service quality in public passenger transport is a factor that significantly affects passengers' demand. The study of ITF recognizes the influence of service quality to demand for services.

Tab. 1 - The influence of service quality to demand for services

demand with respect to:	elasticity (short-run)	elasticity (long-run)
fares	-0.047	-0.331
income	0.026	0.183
quality of service	0.072	0.507

Source: Anderson et al., OECD/ITF, 2013

The demand for public passenger transport services is decreasing in long-term. The guarantee of quality level from operators and public authority with the objective of meeting the passengers' expectations is the one possible tool for slowing of demand decline or for demand support. Therefore, the service quality standards should be applied to the procurement of service ability and then they should be applied to the public service contracts. The quality standardization in the area of public passenger transport is follows:

- defining of minimum set of quality criteria' measured and evaluated;
- defining of minimum fulfillment level of quality criteria by operators.

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The article is dealing with the standardization of quality level in total approach, it means it is the transformation of the service quality loop by STN EN 13816.

1. VALID LEGISLATION RELATED TO SERVICE QUALITY IN SLOVAKIA

The service quality in public passenger transport is characterized by a set of quality criteria. The issue of service quality in suburban bus transport (SBT) in Slovakia is dealing with following legislation: ***Law No 56/2012 collection of Laws about road transport***, ***STN EN 13816*** and ***STN EN 15 140, Regulation (EC) No 1370/2007 on public passenger transport services by rail and by road.*** [3] (4, 6, 7, 8, 9)

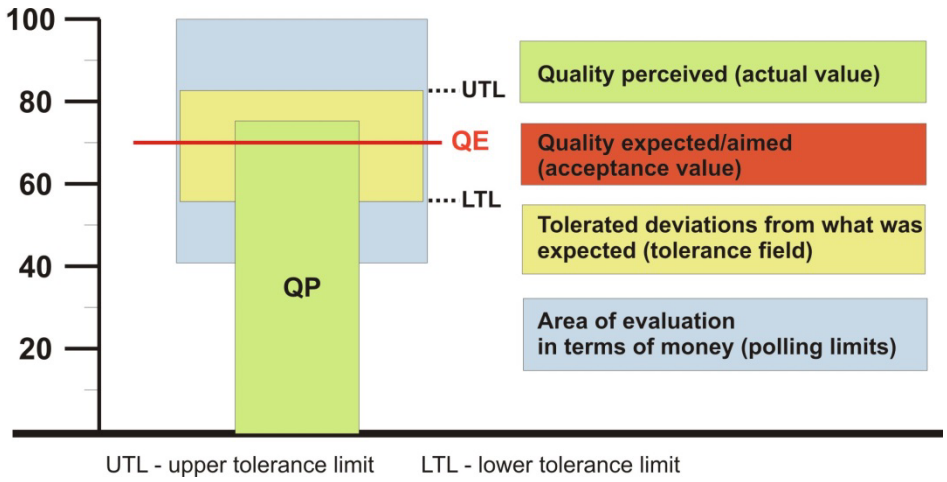
2. METHODOLOGY OF STANDARDIZING THE QUALITY LEVEL

The main objective is to define a standard of the service quality level as a requirement for public procurement in suburban bus transport. Another 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 defining of standard is needed to divide the quality criteria to the quality criteria of service ability and the quality criteria of transport service. It is important for dividing of responsibility between public authority and operator because the operator can influence the service quality and the public authority can influence the quality of service ability. For the passenger is not important if the quality criterion is quality criterion of service ability or quality criterion of transport service; the passenger wants service quality. The valid legislation in Slovak Republic does not divide the quality criteria to quality criteria of service ability and quality criteria of transport service. It is significant to be inspired by abroad experiences.

For each quality criterion included in the measurement and evaluation system of the quality, the evaluation side (public authority and operator) have to define the standardized parameters the evaluation of criterion. The results of standardization are a necessary basis for quality level measuring and assessing. The structure of parameters and their relationships are shown in Figure 2. (4, 5)

[3] KONEČNÝ, V. – KOSTOLNÁ, M.: *The quality standards in suburban bus transport and their meaning.* In: Perner´s Contacts. ISSN 1801-674X. Volume 10, Issue 2 (2015), online, s. 26-37. Available: http://pernerscontacts.upce.cz/39_2015/Konecny.pdf



Source: elaborated by authors

Fig. 1 - Definition of parameters for the quality evaluation – general approach

Methodology of standardization of quality criteria includes the following steps:

I. Definition of the level of expected / target quality.
II. Definition tolerated deviations from the mean expected quality.
III. Determination of the perceived quality level.
IV. Calculation of passenger satisfaction with the performance of quality criteria.
V. Measurement and evaluation of quality criteria by contracting parties (public authority and operator) based on contractually defined practices.[4] (4, 5)

This approach based on passenger quality requirements and his measurements satisfactions used to determine the measurement and evaluation of quality criteria. Now, in the Slovak Republic in transport organizations and organizations of public authority this approach does not apply.

Based on this approach was in the autumn of 2013 and 2014 carried out an extensive research of passenger requirements and their satisfaction with the provision of transport services (left side of service quality loop). There also were performed the objectified measurements realized by controllers in the area a provision of transport services. This part of the research represents a right side the service quality loop. The researches were realized in the months October and November 2013 (a sample of 1,880 respondents) and 2014 (a sample of 1,880 respondents) in the region and the city of Žilina.

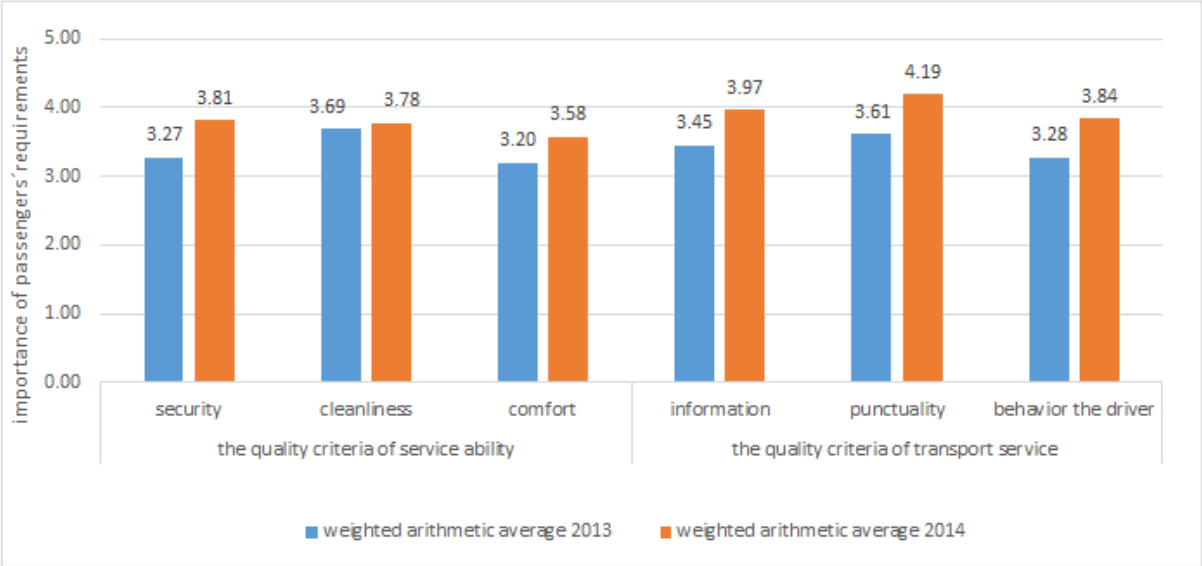
To identify the passenger requirements and to determine their level of satisfaction were applied standardized questionnaires for several modes of transport which respected the differences of the individual transport modes. For the purposes of this article were processed analysis and evaluation, which are based on a standardized part of the questionnaire, i.e. which are considering the quality criteria and requirements for SBT. The individual aspects of

[4] KONEČNÝ, V. – KOSTOLNÁ, M.: *The possibilities of standardizing the quality level in public passenger transport from customer point of view.* In: Perner´s Contacts. ISSN 1801-674X. Volume 9, Issue 2 (2014), online, s. 26-37. Available: http://pernerscontacts.upce.cz/ 35_2014/Konecny.pdf

quality criteria are subject to independent research. As an evaluation tool of respondents view was used the point scale with a range of 0-5 points, 0 - minimal importance (satisfaction), 5 - maximum importance (satisfaction). (4, 5)

2.1 Identification of passengers requirements for quality transport services- an expected quality

The indicator says about the level of customer requirements which should be on the basis of their legitimacy. This specified level should respect the opinion of the majority, i.e. have to be set the mean value. In our case, it is the weighted arithmetic average.



Source: elaborated by authors

Fig. 2 - Importance of selected passenger requirements for the quality in SBT

As we can see, the passengers have to the higher quality expectations in all quality criteria in 2014 than in 2013. The biggest increase in quality importance occurred at two criteria of transport service *punctuality* (+0.58 in 2014), *behavior the driver* (+0.56 in 2014) and one criterion of service ability *security* (+0.54 in 2014). Only very small increase in quality importance occurred at the criterion of service ability *cleanliness* (+0.09 in 2014).

The results are then used to determine the target quality level from public authorities. This quality level should be part of the contractual relationship between the public authority and operator and part of measure the individual quality criteria included in the set of criteria too. This approach respects the recommendations STN EN 15140.

Table 2 contains the results of analyzes including a variability expressed of passenger requests by using standard deviation. The variability value of passenger´s expected 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. 2).

Tab. 2 - Selected passenger requirements (expectations) for the quality of SBT

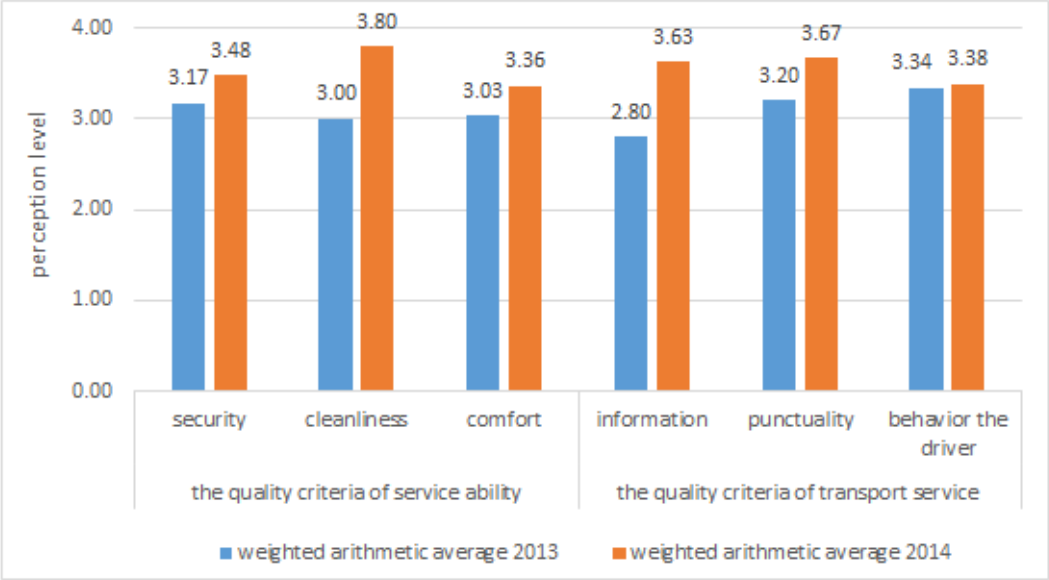
the quality criteria		2013		2014	
		weighted arithmetic average	σ	weighted arithmetic average	σ
the quality criteria of service ability	security	3.27	0.665	3.81	0.271
	cleanliness	3.69	0.621	3.78	0.348
	comfort	3.20	0.638	3.58	0.316
the quality criteria of transport service	information	3.45	0.578	3.97	0.414
	punctuality	3.61	0.619	4.19	0.330
	behavior the driver	3.28	0.538	3.84	0.404

Source: elaborated by authors

2.2 Perception of the service quality level by passengers

At the same time the survey of passenger requirements was conducted the passenger satisfaction survey with the implementation of selected quality criteria by the operators.

Figure 3 depicts a comparison the operator´s perception level compliance of selected quality criteria by operators in SBT.



Source: elaborated by authors

Fig. 3 - Perception level compliance of selected quality criteria in SBT

As we can see, the perception level compliance of selected quality criteria in 2014 is higher in all quality criteria than in 2013. The biggest change occurred at the one criterion of transport service *information* (+0.83 in 2014) and the one criterion of *service ability* (+0.80 in 2014). Almost no change occurred at the criterion of transport service *behavior the driver* (+0.04 in 2014).

The selected parameters for which the passengers considered the level of satisfaction are shown in Table 3, it also includes perception variability of the quality level expressed by standard deviation.

Table 3 contains the results of quality perception analyzes by passengers. Perception of quality is expressed in the form of the arithmetic mean. There are given the values of the standard deviation too.

Tab. 3 - Perception the compliance of selected quality criteria

the quality criteria		2013		2014	
		weighted arithmetic average	σ	weighted arithmetic average	σ
the quality criteria of service ability	security	3.17	0.230	3.48	0.455
	cleanliness	3.00	0.747	3.80	0.661
	comfort	3.03	0.641	3.36	0.489
the quality criteria of transport service	information	2.80	0.642	3.63	0.351
	punctuality	3.20	0.645	3.67	0.368
	behavior the driver	3.34	0.561	3.38	0.416

Source: elaborated by authors

2.3 Customer Satisfaction Index

Assessment of perceived quality and expected quality by passengers we can use absolute and relative indicators. Absolute indicator is for example *the Customer Satisfaction Value*. It is the absolute difference between perceived value and expected value. If is achieved positive value the operator provides a level of service that exceeds customer expectations. A negative value indicates the customer dissatisfaction. Measuring the satisfaction of a set of quality criteria usually consists of more than one criterion; this indicator should be relativized through theory of indices. This indicator:

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

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*

Correlation between what the customer perceives and what he expects we can express by *Customer Satisfaction Index*:

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

If a value is more than 1 the level of quality perception by passenger is higher than his expectations. If a value is less than 1, there are not met the customer expectations by operator.

The equation (2) is used to calculate the degree of passenger satisfaction. If there is tolerated no deviation from the mean value of the expected (yellow field of Fig. 2 is identical with marked red line).

To define the tolerance limits of the expected quality is possible to use the theory of control charts where the limits are defined as ± σ from the mean value. If we respect this approach we can modify the equation (2) for customer satisfaction index as the equation (3):

$$\text{CSI} = \frac{\bar{x}_{QP}}{LTL_{EQ}} = \frac{\bar{x}_{QP}}{\bar{x}_{EQ} - \sigma_{EQ}} \tag{3}$$

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.* [4, 5]

2.3.1 Customer satisfaction index in practical conditions

Values of CSI were calculated on the basis of formula (2). The calculated values of CSI are shown in Table 4.

Tab. 4 - CSI for selected quality criteria in SBT

the quality criteria		CSI 2013	CSI 2014
the quality criteria of service ability	security	0.97	0.91
	cleanliness	0.81	1.01
	comfort	0.95	0.95
the quality criteria of transport service	information	0.81	0.91
	punctuality	0.89	0.88
	behavior the driver	1.02	0.88

Source: elaborated by authors

Note: The red fields represent the values where passengers have higher expectations than their actual performance by operators. Green fields represent the opposite when the fulfillment of quality criteria from operators is higher than the passenger requirement.

As we can see, CSI is higher than 1 only in two cases (once in 2013 in criterion of transport service *behavior the driver* and once in 2014 in criterion of service ability *cleanliness*) but very close (behavior the driver (1.02), cleanliness (1.01)). We cannot talk about any significant higher perceived quality by customers against its specified requirements. In almost all cases we can see that customer requirements are stricter than its actual satisfaction with what he perceives and what he is given.

2.3.2 Standardization of quality level in practical conditions

The standardized parameters were calculated on the basis of research of expected and perceived quality by passengers in SBT and on the basis of measurement of controllers in the region and the city of Žilina. Figure 4 depicts standardized values of quality expected, quality

perceived, tolerated deviations for selected quality criteria and values of performance measurement.

Expectations and perceived values of quality reached by research were transformed from 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.

Controllers' quality measurement were transformed to percentage too.

Tab. 5 - Standardized parameters for selected quality criteria in SBT in the region and the city of Žilina

the quality criteria		year									
		2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
		QE		UTL		LTL		QP		MP	
the quality criteria of service ability	security	65	76	79	82	52	71	63	70	93	79
	cleanliness	74	76	86	83	61	69	60	76	67	82
	comfort	69	79	81	88	57	71	56	73	80	77
the quality criteria of transport service	punctuality	72	84	85	90	60	77	64	73	88	65
	behavior the staff	66	77	76	85	55	69	67	68	64	88

Source: elaborated by authors

Note: UTL- upper tolerance limit, LTL- lower tolerance limit, QE- quality customer expectations, QP- quality customer perceived, MP- the measurement of performance.

CONCLUSION

The research presents the measurement of the customer satisfaction (it is the left side of service quality loop- see Fig.1) and the measurement of the performance (it is controllers' measurement, the right side of service quality loop- see Fig.1).

The objective of quality measurement and evaluation is to review the service quality from customer point of view. It is necessary to confront the service quality from customer point of view with the measurement of performance on the basis of the real quality parameters. Then, the result is the quantification of quality in relation to quality criteria in specific period. On the basis of thus service quality measurement there is possible to examine the relationship between the service quality and demand for service quality and so to influence the demand for public passenger transport services.

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