THE POSSIBILITIES OF STANDARDIZING THE QUALITY LEVEL IN PUBLIC PASSENGER TRANSPORT FROM CUSTOMER POINT OF VIEW

Vladimír Konečný [1], Mária Kostolná[2]

Summary: The article deals with the possibilities of standardizing the quality level of public passenger transport. 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 of the passengers in a significant transport hub of northern Slovakia. The findings will be applied in the design of the standardization quality level in public passenger transport to its anchoring into the service contract between public authority and operator. This approach is not yet applied in the Slovak Republic.

Key words: Quality, Standard, Passenger transport, Expectation, Satisfaction

INTRODUCTION

The service quality in public passenger transport is characterized by a set of quality criteria. The issue of service quality in public passenger transport in Slovakia is dealing with following legislation.

Law No 56/2012 collection of Laws about road transport in §21 (Service contract) in article 1 states that the purpose of a service contract, concluded between the public authority with the operator, is to ensure to public safe, effective and quality services. In article 9 this law adds that part of this contract are the 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, environmental impact. Each criterion standard in more detail classifies into sub-criteria. Services are determined by the quality loop.

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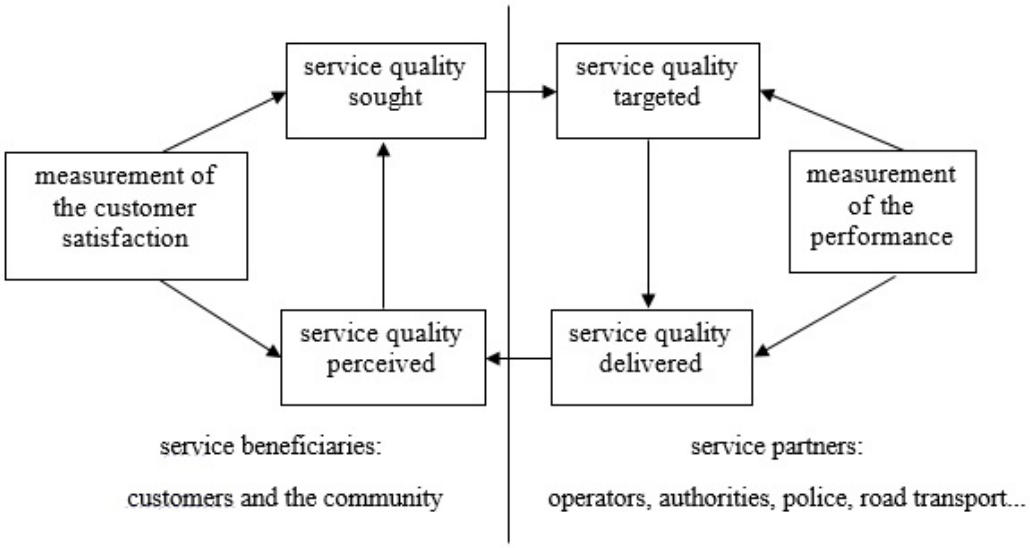

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Fig. 1 - Service quality loop

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, 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.

1. METHODOLOGY OF STANDARDIZING THE QUALITY LEVEL IN PUBLIC PASSENGER TRANSPORT

The primary objective is to define a standard of the service quality level as a requirement for public procurement in public passenger 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 measure and evaluate the quality, the evaluation side (public authority and operator) have to define the standardized parameters the evaluation of criterion.The results of standardizationare a necessary basis for measuring and assessing of quality level. The structure of parameters and their relationships are shown in Figure 2.

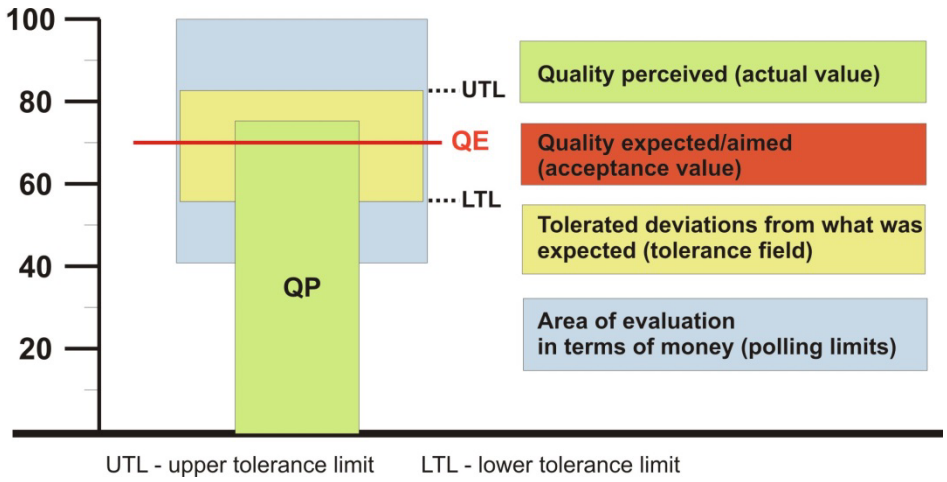

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Fig. 2 - Definition of parameters for the quality evaluation – general approach

Methodology of standardization of quality criteria includes the following steps:

I. Definition of the level of expected / target quality - standard STN EN 15140 recommends that a set of measuring and evaluating quality criteria 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 passenger survey of actual passengers. It is a red line in figure 2.

II. Definition tolerated deviations from the mean expected quality - in terms of descriptive statistics can be used standard deviation to define the tolerated deviations of expected quality, 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 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 satisfied passenger has passenger perception 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, there have to be defined tolerance limits.

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.

This approach based on passenger quality requirements and his measurements satisfactionis 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 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, given the scale of data still under development, it is a right side the loop quality. The researches were carried out in the months October and November 2013 on a sample of 2,868 respondents. The research was realized 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 that are common to all reviewedtransport modes. Te individual aspects of quality criteria by mode of transport 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, 5 - maximum importance.

1.1 Identification of passengers requirements for quality transport services by mode of transport

It is an expected quality level. 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 weightedarithmetic average.Analyzes were performed with the help of median values. The calculations confirmed the occurrence of any atypical extreme values in the reviewed statistical files.

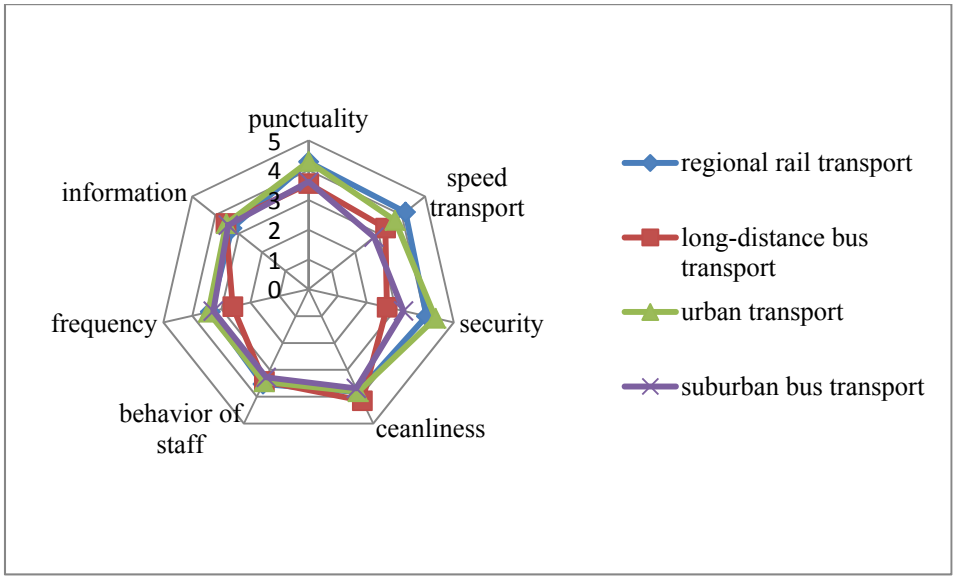

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Fig. 3 - Importance of selected passenger requirements (expectations) for the quality in public passenger transport by mode

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 measurethe individual quality criteria included in the set of criteria too. This approach respects the recommendations STN EN 15140.

Table 1 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. 1 - Selected passenger requirements (expectations) for the quality of public passenger transport by mode

Criterion	regional rail transport		suburban bus transport		long-distance bus transport		urban transport	
	average	σ	average	σ	average	σ	average	σ
punctuality	4,28	0,252	3,61	0,619	3,55	0,803	4,29	0,728
speed transport	4,16	0,186	2,81	0,464	3,3	1,090	3,71	0,617
security	4,06	0,146	3,27	0,665	2,7	0,928	4,37	0,597
cleanliness	3,83	0,215	3,69	0,621	4,15	0,325	3,82	0,636
behavior of staff	3,53	0,323	3,28	0,538	3,43	0,797	3,45	0,631
frequency	3,38	0,142	3,28	0,332	2,61	0,445	3,45	0,582
information	3,29	0,595	3,45	0,578	3,55	1,045	3,53	0,664

Source: elaborated by authors

Note: For criterion behavior of staff means the staff in the bus transport a driver and in the rail transport train supervision.

The average importance of ***information*** has a range from 3.29 points in rail transport to 3.55 points inlong-distance bus transport. ***Cleanliness*** reaches the values from 3.69 points in the suburban bus transport to 4.15 points in long-distance bus services. For criterion ***punctuality*** are the values in range from 3.55 points inlong-distance bus transport to 4.28 points in rail transport. The criterion ***speed transport*** is disperses from 2.81 points in suburban bus transport to the 4.16 points in rail transport. ***Security*** reaches the values from 2.7 points in long-distance bus transport to 4.37 points in urban transport. For criterion ***behavior of the staff*** are the values of importance in a range from 3.28 points in the suburban bus transport to 3.53 point inrail transport. And ***frequency*** reaches the importance from 2.61 point in the long-distance bus transport to 3.45 points in urban transport.

1.2 Perception of the service quality level by passengers by mode

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. The survey was carried out on a sample of 2,742 respondents in four modes of transport. The research was realized in the region and the city of Žilina.

Figure 4 depicts a comparison the operator´s perception level compliance of selected quality criteria by type of operator.

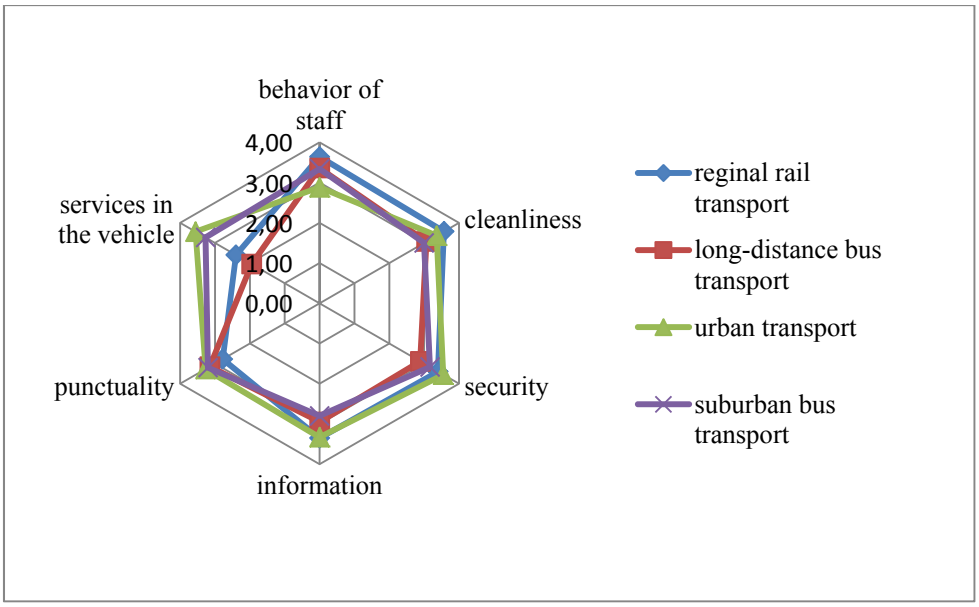

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Fig. 4 - Perception level compliance of selected quality criteria by mode of transport

The selected parameters for which passengers considered the level of satisfaction are shown in Table 2, it also includes perception variability of the quality level expressed by standard deviation.

Table 2 contains the results of quality perception analyzes by passengers. 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.

Tab. 2 - Perception the compliance of selected quality criteria by mode of transport

Criterion	regional rail transport		suburban bus transport		long-distance bus transport		urban transport	
	average	σ	average	σ	average	σ	average	σ
behavior of staff	3,64	0,216	3,34	0,561	3,36	0,324	2,88	0,495
cleanliness	3,57	0,330	3,00	0,747	3,07	0,253	3,36	0,551
security	3,40	0,135	3,17	0,230	2,89	0,250	3,55	0,744
information	3,35	0,830	2,80	0,642	2,95	0,523	3,33	0,681
punctuality	2,78	0,368	3,20	0,645	3,15	0,010	3,27	0,589
services in the vehicle	2,40	0,172	3,27	0,424	1,95	0,540	3,56	0,316

Source: elaborated by authors

The average perception of compliance the quality criterion ***information*** is in the range from 2.80 points in urban transport to 3.35 points in rail transport. For criterion ***punctuality*** the values are in the range from 2.78 points in the rail transport to 3.27 points in urban transport. Criterion ***behavior of staff*** is disperses from 2.88 points in urban transport to 3.64 points in the rail transport. ***Security*** reaches values from 2.89 points in the long-distance bus transport to 3.55 points in urban transport. For ***cleanliness*** are the satisfaction values in the range from 3.00 points in the suburban bus transport to 3.57 points in rail transport. And the

criterion ***services in the vehicle*** reaches the importance level from 1.95 points in long-distance bus transport to 3.56 points in urban transport.

For determining the dispersion of individual criteria values we used the standard deviation. Based on the calculation we found the following facts. The criterion ***punctuality*** starts at 0,010 in long- distance bus transport and it ends at 0,645 in suburban bus transport. Criterion ***cleanliness*** starts at 0,330 in rail transport and it ends at 0,747 in suburban bus transport. ***Behavior of staff*** has the lowest deviation 0,2016 for rail transport and the highest deviation 0,561 in suburban bus transport. ***Security*** starts at 0,135 in rail transport and it ends at 0,744 in urban transport. ***Information*** has the lowest deviation 0.523 in long-distance bus transport and the highest deviation 0,830 in rail transport.

1.3 Analysis of the relationship between expected and perceived service quality in public transport

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 it 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 picture 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):

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

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*

1.3.1 Customer satisfaction index in practical conditions

Approach 1: No tolerance of expected quality

Based on the research of passengers expectations and their perceptions of the quality level has been performed the relational analysis of the results by the equation (2). The calculated values of customer satisfaction index are shown in Table 3.

Tab. 3 - CSI for selected quality criteria by mode of transport

quality criteria	the mode of transport			
	regional rail transport	long- distance bus transport	urban transport	suburban bus transport
punctuality	0,65	0,89	0,76	0,89
security	0,84	1,07	0,81	0,97
cleanliness	0,93	0,74	0,88	0,81
behavior of staff	1,03	0,98	0,83	1,02
information	1,02	0,83	0,94	0,81

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 the fulfillment of quality criteria by operators is higher only in 4 cases (information in rail transport, behavior of staff in rail transport and in suburban transport, security in long- distance bus transport) and even it is only closely. 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.

Approach 2: Tolerance of expected quality $\pm\sigma$ of average expectations

Values of CSI were calculated on the basis of formula (3), calculation respects lower tolerance limits (LTL) of customer expectations. The calculated values of CSI for this approach are shown in Table 4.

Tab. 4 - CSI for selected quality criteria by mode of transport with respecting LTL of expectations

quality criteria	the mode of transport			
	regional rail transport	long- distance bus transport	urban transport	suburban bus transport
punctuality	0,69	1,07	1,15	0,92
security	0,87	1,22	1,63	0,94
cleanliness	0,99	0,98	0,80	1,06
behavior of staff	1,14	1,22	1,28	1,02
information	1,24	0,98	1,18	1,16

Source: elaborated by authors

1.3.2 Standardization of quality level from customer point of view in practical conditions

The standardized parameters were calculated on the basis of research of expected and perceived quality by passengers in public passenger transport in the region and the city of Žilina. Figure 5 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 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 great differences between expected and perceived quality in relation to concrete quality criterions and to concrete mode of transport.

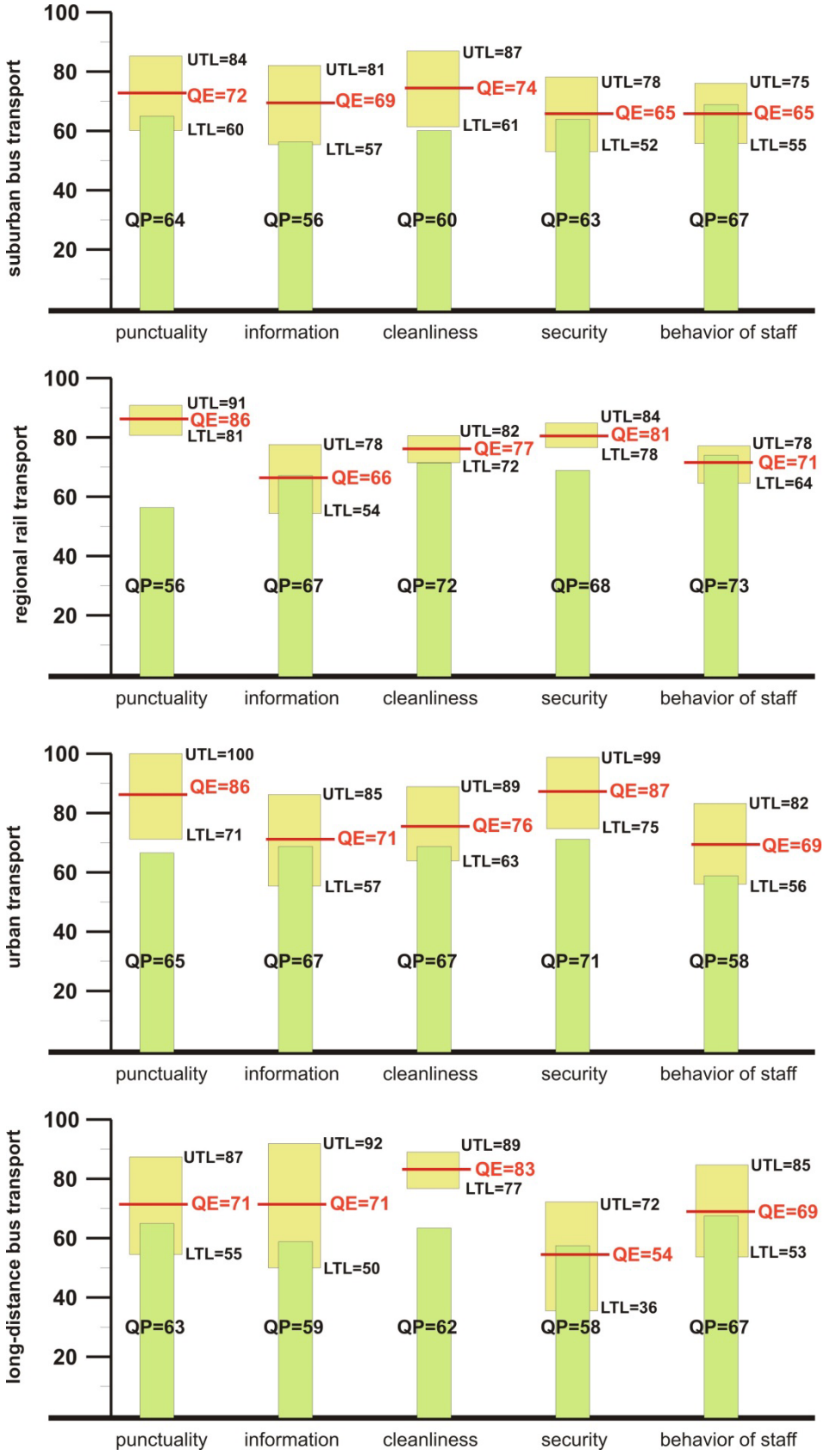

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Fig. 5 - Standardized parameters for selected quality criteria by modes of transport in the region and the city of Žilina

CONCLUSION

There are no unified methods for measuring and evaluating the quality of public passenger transport. There are European standards (EN 13816 and EN 15140), that provide 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 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 of concrete quality criterions of public passenger transport in the region and the city of Žilina.

This article analyses selected quality criterions of the first level of standard STN EN 13816, criterions of second and third level will be investigated separately with all of aspects of quality criterions for each mode of transport.

Results should be 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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