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## Urban Transport System Reliability Indicators

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### Abstract

In 2014–2015, the Transport Laboratory of the National Research Irkutsk State Technical University (TL-ISTU) participated in development of the Federal Methodological Guidelines "Quality Evaluation of Traffic Management". This article represents a number of suggestions in the framework of the document in development. As follows from the analysis of special periodicals and literature as well as considering the onrush of geoinformation technology, the following quantitative criteria have been chosen to assess reliability: time index, Herman–Prigogine criterion; buffer time. In this context, time index is offered to be used for comparative analysis of functioning reliability of transport systems in different cities. Based on these inspections (about 600 tracks in Irkutsk), rating scales of the chosen criteria have been offered.

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*Keywords:* functioning reliability of urban transport system; time index; buffer time; Herman-Prigogine criterion; level of service; GPS; GLONASS

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The Transport Laboratory of the National Research Irkutsk State Technical University (TL-ISTU) has been participating in development of the Federal Manual "Quality Evaluation of Traffic Management" since 2014. This article considers a part of the criteria offered in these guidelines.

In conditions of high level of saturation of the street and road network (SRN), quality evaluation of SRN projects surely has to include evaluation of conditions of traffic flow movement. Therefore, both projects of SRN sites and traffic management projects being evaluated on the basis of modeling have to get a uniform system of evaluation criteria (i.e. it is necessary to form something that got the name Traffic Analysis Tools in the international practice).

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Consequently, SRN functioning is characterized by two parameters — reliability and quality of traffic conditions provided to a user. It should be noted at once that the second indicator got an unambiguous definition as a level of service long ago.

The approaches to reliability evaluation are much more various. One of the most widespread approaches to reliability determination is assessment of transport system behavior in conditions of congestion. In this context, we interpret congestion as a state (of both SRN and a route system of the public passenger transport, etc.) at which transport demand begins to exceed transport supply.

As follows from the analysis of the international practice, special periodicals and literature [Bakhirev and Mikhailov (2015), Rumyantsev and Mikhailov (2010), Rumyantsev (2012), Sharov and Mikhailov (2014), Susilawati and Taylor (2010)] as well as considering the onrush of geoinformation technology, the following quantitative criteria have been chosen to assess reliability:

- Time index
- Herman–Prigogine criterion
- Buffer time and buffer index

In conditions of high loading levels of SRN and influence of random factors, time expenditures for trip begin to vary in a wide range of values and have to be considered as a random variable. Consequently, the time index  $TTI$  is a ratio of time spent for passing the site in conditions of a rush hour to way time in conditions of a free flow.

$$TTI = \frac{T_{PP}}{T_{FF}}, \quad (1)$$

where  $TPP$  — time spent for passing the site in conditions of a peak period, min;  $TFP$  — time spent for passing the site in conditions of a free flow, min.

According to the results of the own investigations and data of other authors, the following gradation of reliability levels presented in Table 1 is offered for urban SRN.

Table 1. Assessment of traffic conditions at sites of main streets and roads.

Reliability level	Extent of a site, km	Traffic conditions	
A	< 5	25	Deterioration in traffic conditions is not observed in peak periods
B	<1.2	<1.2	Insignificant deterioration in traffic conditions is observed in peak periods
C	1.3–1.5	1.3–1.45	Deterioration in traffic conditions is observed in peak periods
D	1.5–2	1.45–1.6	Considerable deterioration in traffic conditions is observed in peak periods
E	>2	>1.6	The road functions unreliably in peak

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