Available online at www.sciencedirect.com

ScienceDirect

Transportation Research Procedia 20 (2017) 347 – 354

Transportation Research Procedia

www.elsevier.com/locate/procedia

12th International Conference "Organization and Traffic Safety Management in large cities", SPbOTSIC-2016, 28-30 September 2016, St. Petersburg, Russia

Engineering Tools and Methods of Estimation of Traffic Capacity Using Mobile Video Monitoring

Andrey Kotov [a]*, Pavel Pospelov [b]

Moscow Automobile and Road Construction State Technical University (MADI), 64 Leningradsky av., Moscow, 125319, Russia

Abstract

The article considers development of a technology of road service quality assessment with the help of automated engineering tools of non-contact monitoring. The purpose of this technology is automation of comprehensive assessment of highways, provision of uniform objective accounting of traffic characteristics and road infrastructure. Recommendations on application of a mobile monitoring technology for creation of a client-server model of highways are given in the article.

The authors propose an approach to assess road service quality, which is aimed at improving of highway performance data accounting systems. Key engineering tools of video monitoring of engineering data on road service quality have been studied and are practically applied in production by specialists of the Moscow Automobile and Road Construction State Technical University (MADI) laboratory “Geotrans”.

Peer-review under responsibility of the organizing committee of the 12th International Conference “Organization and Traffic Safety Management in large cities”

Keywords: data integration; engineering structures; engineering record keeping; software and hardware; video monitoring; highways; traffic intensity, geoinformational technologies

1. Introduction

Accurate and reliable information on the state of the highway network is necessary for comprehensive control of linear extended objects and utilities, as well as targeted allocation of funds for development and maintenance of highways. Directed actions imply solving of issues on the basis of objective data describing road service quality

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .
E-mail address: gt@madi.ru[a*], pospelov@madi.ru[b]

Peer-review under responsibility of the organizing committee of the 12th International Conference “Organization and Traffic Safety Management in large cities”
doi:10.1016/j.trpro.2017.01.044

(RSQ). Forecasting of distribution of traffic flows and traffic intensity in the highway network can be performed accurately with the help of transportation modeling, taking into account demand (movement of vehicles) and supply (service quality of highway sections) [Pospelov et al. (2012)].

2. Main text

The RSQ database provides the following data on engineering structures:

1. Recent data on geometric characteristics (3D-models, maps, plans).
2. Data on local and global locations for monitored objects, integrated with the geoinformational component.
3. Archival and real-time high-resolution panoramic images [Pospelov (2011)].
4. Formal parameters determining traffic capacity and simulated traffic intensity.

The total data stated above provide an interactive platform — a server for RSQ engineering data control.

A database of engineering structures is compiled on the basis of the map server; the database may include full-scale quantitative and qualitative characteristics of traffic flows and driving modes, elements of engineering structures, quantitative and qualitative characteristics of elements of engineering structures, analytical notes and reports, video data to support decision making.

Modern high-performance automated hardware and software systems (HSS) for large-scale collection of traffic data are used to control diverse information flows about the state of highways (transportation supply for road users). Geovideo HSS was developed in the laboratory “Geotrans”; it is a client-server technology for monitoring performance of transportation supply and demand, used to determine road service quality [Kotov and Pospelov (2013)]. Geovideo HSS provides for the following:

1) referencing of video data to geoinformational maps according to the data received from global navigation satellite systems (GNSS) and further rendering of locations directly in the Geovideo;

2) video monitoring under critical weather conditions;

3) increasing of video monitoring mobility by installation of devices on roofs of vehicles;

4) video recording of a large number of traffic directions from one point with the help of multifunctional equipment (height of a mobile device is up to 6 m, installation of up to 8 cameras with low distortion and the observation angle of more than 90º each on one support bearing or use of panoramic cameras with the observation angle of 360º and a fisheye lens).

The hardware of Geovideo provides data collection, i.e. recording of traffic flows and subsequent automated processing. Two configuration types of equipment (mobile and stationary) are applied depending on RSQ values and work conditions. Mobile sets are used to study traffic modes in the areas with substandard infrastructure, where it is impossible or impractical to perform accounting with stationary engineering tools. A mobile video monitoring set includes a device with a required number of cameras (connected via WiFi or USB), a telescopic tripod with the height of up to 5 m and a static fixing or a portable supermagnet fastener, a vehicle, a laptop and a GNSS receiver.

When studying the demand of road users, the number of cameras installed on the platform is determined by the number of directions to be covered by one camera [Kotov and Pospelov (2013)]. Fig. 1 shows an example of arrangement of shooting points. It can be seen that devices with a single camera shoot directions 6-11, 2-12-13 and 3-7, meanwhile devices with two cameras shoot directions 1-10-5 (one camera shoots directions 1 and 10, the second one shoots direction 5) and 4-8-9 (one camera shoots directions 4 and 8, the second one shoots direction 9).