

# Transport Problems

Volume 7



Problemy transportu



GLIWICE 2012

SCIENTIFIC  
JOURNAL

**TRANSPORT PROBLEMS**

*Volume 7 Issue 3*

**PROBLEMY TRANSPORTU**

*Tom 7 Zeszyt 3*

QUARTERLY

WYDAWNICTWO POLITECHNIKI ŚLĄSKIEJ  
GLIWICE 2012

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ISSN 1896-0596

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Gliwice 2012

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pedestrians, level of service (LOS), sidewalk,  
microscopic simulation model, modeling, low speed urban street

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## CONTRIBUTION TO SIDEWALK PEDESTRIAN LEVEL OF SERVICE ANALYSIS

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## WKŁAD W ANALIZĘ POZIOMU USŁUGI DLA PIESZYCH NA CHODNIKU

**Streszczenie.** Głównym celem niniejszej pracy jest przyczynienie się do rozwoju metodologii analiz poziomu usługi, którą odczuwają piesi jako użytkownicy ulicy, poruszając się wzdłuż chodników, jak również wkład w proces modelowania i symulacji ruchu pieszych. Został rozwinięty mikroskopijny model symulujący SFStreetSIModel, wersja 1.0, który symuluje ruch samochodów i pieszych na dwupasmowym i dwukierunkowym odcinku wolnej ulicy miejskiej. Obok pozostałych parametrów wyjściowych, model symuluje też piętnastominutowe natężenie ruchu pieszych jako miarę usługi dla pieszych pod wpływem tarcia statycznego wywołanego przez statyczne przeszkody na ulicy i chodniku: parkowanie na ulicy i sprzęty miejskie. Zostanie tutaj przedstawiony moduł, który odnosi się do modelowania stanu pieszych w dowolnym momencie czasu (t), ich atrybuty i elementy procesu potwierdzające poziom usługi dla pieszych.

### 1. INTRODUCTION

The concept for sustainable urban development is of a special interest for analysis in the developing countries, countries with low developed economy, demographic and economic rise and infrastructure with low capacity and design. That is, the resulting problems caused low missed ability on the functional elements on the streets, fall of the quality of the transport system, higher number of

incidents and degrading of the environment, which is a result by saturating the streets traffic, polluting the environment, lower safety and comfort while traveling, rise of stress by all the users of the traffic systems but special lowered security for Vulnerable Road Users - VRU, that is pedestrians and cyclist.

The pedestrians and the cyclist are unprotected or vulnerable category in the traffic. In the EU cities the vulnerability is explained by the number of incidents in which pedestrians are involved in 15-30% of the total number of accidents. According to the report "Forgiving Roadsides" of the European Transport Safety Council – ETSC, (2008), is considered that pedestrians will survive an accident with motor vehicle if the speed is up to 30 km/h, which shows that the pedestrians should be separated from the fast traffic. The flexibility of the pedestrians is a privileged to themselves, but at the same time a problem when they are in heterogeneous traffic flow. The pedestrians are insufficiently stable and insufficiently visible in comparison with the vehicles, lack which is increased in night conditions. Finally, the pedestrians have different capabilities: children with insufficient experience, old people, old people with limited opportunities and people with limited mobility.

Among the best known European studies in which the research subject are the vulnerable participants in the traffic are MASTER-Managing Speeds of Traffic on Europeans Roads [10], DUMAS-Developing Urban Management And Safety [4], PROMISING-Promotion of mobility and safety of vulnerable road users [12] and WALCYNG-How to enhance Walking and Cycling instead of shorter car trips and to make these modes safer [18]. The basic safety principles and the measures extracted with the analysis of these studies are presented on Tab. 1.

Table 1

Preview of the elementary safety measures and the principles obtained from the analysis of the most famous study for the vulnerable road user

Study	Safety principles, measures and strategies
MASTER	<ol style="list-style-type: none"> <li>1. Comfort which means higher quality on the surface for the pedestrians and cyclist;</li> <li>2. Limited speed from vehicles especially on residential, industrial and historic streets;</li> <li>3. Coherence, continuity on pedestrians paths.</li> </ol>
DUMAS	<ol style="list-style-type: none"> <li>1. Removing all obstacles which do allow movement or low view on safety</li> <li>2. Attractive or appropriate labelling, regulating and lightening the pedestrians paths and cyclist lanes.</li> </ol>
PROMISING	<ol style="list-style-type: none"> <li>1. Sufficient level of service for pedestrians;</li> <li>2. Sufficient level of service for cyclist;</li> <li>3. Managing with pedestrians and cyclist flow;</li> <li>4. Adequate view;</li> <li>5. Planning land use in order to decrease the risk for pedestrians and cyclist;</li> <li>6. Informing pedestrians and cyclist.</li> </ol>
WALCYNG	<ol style="list-style-type: none"> <li>1. High safety for pedestrians;</li> <li>2. High safety for cyclist;</li> <li>3. Managing with pedestrians and cyclist flow;</li> <li>4. Change of attitudes and the behavior of drivers by informing, training and enforcement of law.</li> </ol>

## 2. CHARACTERISTICS AND PARAMETERS OF PEDESTRIAN FLOWS

The basic characteristics for pedestrians in the traffic flow naturally are similar with the characteristics of the flow of motor vehicles. But, they are specifics, like: possibilities for cutting the flow for pedestrians, movement in opposite direction and maneuvering without conflicts and change of speed.