



Transportation Engineering Division
SCHOOL OF ENGINEERING, UNIVERSITY OF SEVILLE

17th meeting of the
EURO WORKING GROUP ON TRANSPORTATION

EWGT 2014

JULY 2nd - 4th, 2014

SEVILLE, SPAIN

BOOK OF ABSTRACTS



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Edited and Published by:

Francisco G. Benitez

Noelia Caceres; Francisco J. Cores;
Jose M. del Castillo; Francisco J. Morales;
Jesus Moreno; Antonio Reyes;
Luis M. Romero; Cayetano Ruiz de Alarcon;
Jose I. Sanabria; Johan Wideberg

Transportation Engineering Division
School of Engineering University of Seville
Camino de los Descubrimientos s/n, ES-41092, Seville, Spain

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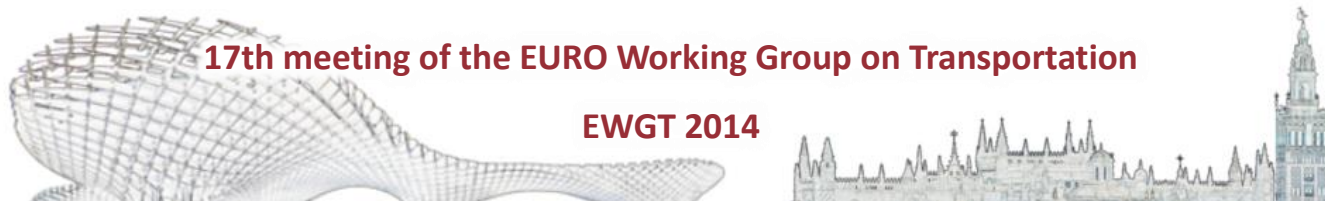
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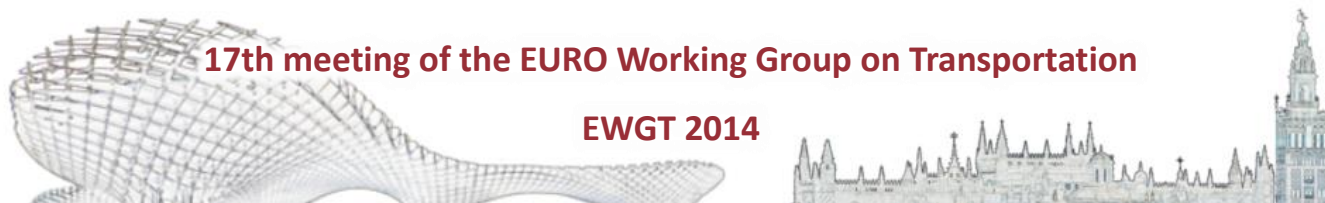


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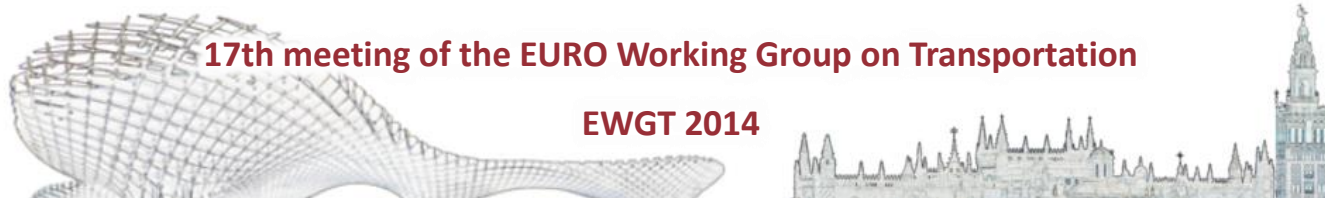
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Presentation

In less than fifty years, transportation engineering has been developing very rapidly over the world. The spheres of both theoretical research and application have been much expanded, and many new theories and computing methods have lately emerged. The tendency shows that numerical and computational methods, econometric and sociometric analysis, more and more close integrate with engineering and other sciences, and provide powerful analytical tools for professionals of the sector. These new results and ideas will be exchanged at this International Conference on Transportation.

Nearly 200 contributions cover a wide range of topics, from pure theoretical development, computing and numerical methods, optimization in transport design, applied software, and practical applications.

Former editions of these Meetings have proved to be a success of exchange and cooperation of ideas and friendship in this field. We, all of you and us, intend to continue with this spirit.

All EWGT Committees, supported by the local organising team warmly welcome all attendants to this gathering.

Francisco G. Benitez

Chairman

EWGT2014 Congress

Professor of Transportation Engineering

School of Engineering, University of Seville, Spain

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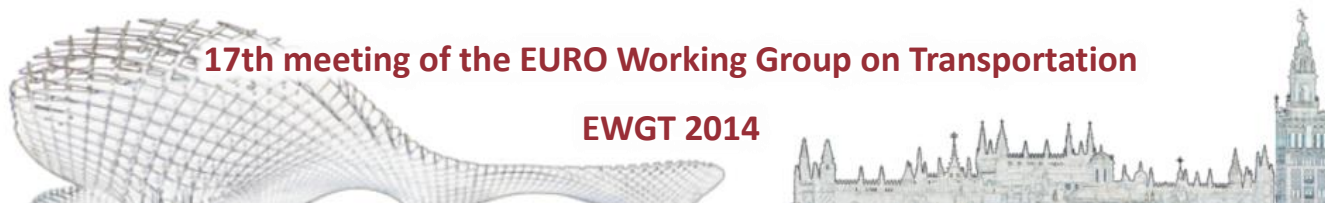
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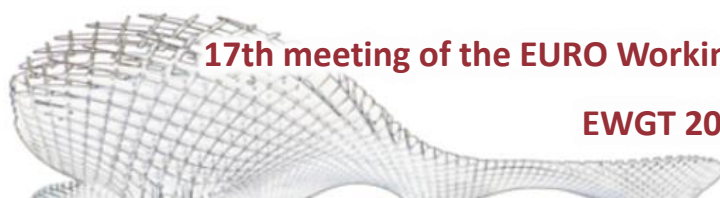
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Abstracts

3. THE ACADEMIC LITERATURE ON INTERMODAL FREIGHT TRANSPORT

Mathisen T.^(a*), Sandberg Hanssen T. E.^(a)

(a) University of Nordland, Bodø Graduate School of Business, Bodø, Norway

Abstract

It is widely accepted that non-road freight transport is less energy intensive than freight transport by road. The use of other transport modes than truck for long haul freight transport can therefore contribute to more energy efficient transportation systems. As a result, the successful promotion of intermodal transport, using rail or sea on the long haul part, has been identified as the most critical action to achieve a sustainable transport sector. The aim of this paper is twofold. First, we will examine the historical development of academic research on intermodal freight transport. Second, we will identify the seminal works on the topic.

In our analysis we identify and classify the academic literature on intermodal freight transport. This approach has also previously been used to aggregate knowledge about particular fields of research and it aims to be as unbiased as possible by being auditable and repeatable. A timeline on the evolution of the academic literature on intermodal freight transport is presented and the development in publication frequency and topics are commented on in relation to keywords, journals, author affiliations and countries. Publishing frequencies are measured, and reported, both in terms of absolute and relative values. Finally, what is likely the most important and influential papers on intermodal freight transport are identified, using citation frequency.

4. A BILEVEL MULTI-OBJECTIVE ROAD PRICING MODEL FOR ECONOMIC, ENVIRONMENTAL AND HEALTH SUSTAINABILITY

Wang J. Y. T.^(ad*), Ehrgott M.^(bd), Dirks K. N.^(c), Gupta A.^(d)

(a) University of Leeds, School of Civil Engineering & Institute for Transport Studies, Leeds, United Kingdom

(b) Lancaster University, Department of Management Science, Lancaster, United Kingdom

(c) The University of Auckland, School of Population Health, Auckland, New Zealand

(d) The University of Auckland, Department of Engineering Science, Auckland, New Zealand

Abstract

Sustainable development in transport follows the concept of sustainability as meeting the needs of the present without compromising the ability of future generations to meet their own needs. To enhance sustainability in transport, congestion pricing is a policy instrument that has been applied in many cities around the world, e.g. Singapore, London and Stockholm, as part of an integrated strategy not only to reduce congestion but also to improve the environment in terms of air quality and hence reduce the negative impact of vehicle emissions on health. To support transport policy analysis, it is important to be able to assess if such an integrated strategy can help achieve these three objectives. From an optimisation point of view, to maximise the effectiveness of congestion pricing, it is only natural to consider internalising the externalities congestion and air pollution, including the costs associated with their impact on the environment and population health, by charging road users an appropriate toll. The classical formulation of toll optimisation in a road network is a bilevel optimisation problem, whereby the upper level represents the decisions of the planner or policy decision maker, and the lower level represents the decisions of the travellers. Multiple objectives have been considered at either the

upper or lower level in the literature but not both. In this paper, we propose a bilevel multi-objective approach to optimise the tolls in a road network. We consider three objectives at the upper level: (1) minimising system travel time; (2) minimising total vehicle emissions; and (3) minimising negative health impacts. The impact on health is modelled as the level of pollutant uptake during the journey. For the lower level, we adopt a time surplus maximisation bi-objective user equilibrium model, assuming that all users have two objectives: (1) minimising travel time; and (2) minimising toll cost. The complete bilevel optimisation problem is solved using a combination of a metaheuristic and a classical optimisation algorithm.

7. ENERGY AND ENVIRONMENTAL IMPACTS OF POTENTIAL APPLICATION OF FULLY OR PARTIALLY ELECTRIC PROPULSION VEHICLES: APPLICATION TO LISBON AND SÃO MIGUEL, PORTUGAL

Baptista P.^(a*), Tavares J.^(a), Gonçalves G.^(a)

(a) University of Lisbon, Institute of Mechanical Engineering (IDMEC), Lisbon, Portugal

Abstract

The transportation sector has been one of the fastest growing sectors in the recent decades resulting in a high final energy consumption in Portugal (40% in 2011), with road transportation sector being responsible for 82% of that energy consumption. Besides that, the transportation sector is the major source of emissions (responsible for about 70% of the CO₂ equivalent emissions). Similarly, the road transportation sector represents 90% of the total emissions in the transportation sector. As a result, alternative vehicle technologies such as electric vehicles are becoming increasingly important since they may contribute to greater energy efficiency in the transport sector. However, their electric autonomy limitations influence the mobility paradigm, making their acceptance dependent on the location and context of driving.

Thus, the objective of this study was to characterize mobility patterns and compare the potential application of fully or partially electric propulsion vehicles in two different Portuguese contexts: the Lisbon region (coincident with a city pattern) and the Island of São Miguel, Azores (corresponding to a rural pattern). This characterization was performed by on road monitoring of 9 drivers in the Lisbon Metropolitan Area (Portugal) and 17 drivers in São Miguel (Azores, Portugal), for a minimum period of one month. Regarding the mobility patterns, São Miguel drivers are those which have a more suitable pattern for using alternative vehicles comparably to the Lisbon region, since they travel about 47% less than the Lisbon population (33 km daily compared to 62 km per day) and, consequently, having a charging time availability about 30% higher. The São Miguel population also has greater presence in lower vehicle specific power (VSP) modes, with an average speed 25% lower than the Lisbon population. In terms of possible energy usage when shifting to alternative vehicle technologies, São Miguel drivers present greater efficiency in electricity consumption per kilometer (25% more efficient) than the Lisbon sample. Finally, the impacts of using these alternative vehicles were quantified in a fuel life cycle perspective, concluding that the alternative technologies would reduce the Well-to-Wheel (WTW) energy consumption per kilometer between 37% and 68%.

9. TRIP ALLOCATION AND STACKING POLICIES AT A CONTAINER TERMINAL

Güven C.^(a), Türsel Eliyi D.^(b)

(a) BIMAR Information Technology Services S.A., Izmir, Turkey

(b) Izmir University of Economics, Izmir, Turkey

Abstract

There are three crucial resources at container terminals; the yard, cranes and the vehicles. The main objective of the terminal is the efficient use of these resources while performing different

operations. The yard is a temporary storage area where containers remain until transported to their next location by truck, train or vessel. Containers are stacked on top of each other in order to utilize the yard space efficiently. However, stacking cranes can only directly access those containers at the top of the stack. As a result, reshuffling/shifting occurs, defined as an unproductive move of a container required to access another stored underneath. We focus on increasing the efficiency of the yard via consideration of the container stacking optimization problem for transshipment, inbound and outbound containers at a container terminal. The objective of the problem is to minimize container storage and retrieval times through avoidance of reshuffles, resulting in more efficient loading/unloading operations, and in turn minimizing the dwell time of containers. The main inputs are the type, weight, discharge port/location, destined vessel/vehicle of the container, and the expected departure time. Different stacking policies are proposed in this study, and we also investigate the problem of allocating the transit containers to outbound vessels to minimize dwell time at the terminal. Transit containers require multiple sea - trips to reach their final destination. Vessels departing from the terminal and destined for the same port may provide exchangeable trips for this type of container, based on their several attributes and capacity restrictions. We consider this problem taking into account several factors that affect container/trip allocation decisions. The solution of this problem also has implications for the stacking problem.

10. EFFECTS OF COMBINED CURVES ON DRIVER'S SPEED BEHAVIOR: DRIVING SIMULATOR STUDY

Bella F.^(a*)

(a) Roma Tre University, Department of Engineering, Rome, Italy

Abstract

The probability to occur in drive perception errors increases as the complexity of the road alignment increases. In particular perceptions errors could be significantly relevant in the conditions of horizontal curves overlapped with sag vertical curves (sag combinations or combined curves). The highway geometric design guidelines of several Countries provide suggestions for the coordination of the sag combinations in order to avoid combined configurations which can bring to undesirable optical effects and a reduced safety. Such suggestions come from studies based on the drawing of the perspective of the road. This drawing method is heavily limited with regards to the simulation of the perspective view of the highway to the driver during the dynamic task of the driving. Interactive driving simulation methods are deemed to be more efficient for these aims.

This paper reports the results of a study carried out using an interactive driving simulator and aimed at evaluating the effects on the driver's speed behavior of different configurations of sag combinations and non-combined curves on flat grade with the same features as the horizontal curves of the sag combinations (reference curves).

The main result was that on suggested sag combinations the driver's speed behavior did not differ in any statistically significant way from that on the reference curves. Whereas the critical sag combinations (configurations that should be avoided) caused a high reduction in speed along the tangent-curve transition, which pointed the driver's reaction to the wrong perception of the road alignment. This result, therefore, confirmed the effectiveness of the road design guidelines for

the coordination of horizontal curves and sag vertical curves.

11. ITS FOR E-GROCERY BUSINESS: THE SIMULATION AND OPTIMIZATION OF URBAN LOGISTICS PROJECT

Cagliano A. C.^(a*), Gobbato L.^(b), Tadei R.^(b), Perboli G.^(bc)

(a) Polytechnic University of Turin, DIGEP, Turin, Italy

(b) Polytechnic University of Turin, DAUIN, Turin, Italy

(c) Canada Research Chair in Distribution Management (CIRRELT), Montreal, Canada

Abstract

Internet-based grocery finds it hard to expand also due to a lack of control on physical logistics connected to delivery and on the associated information flow. Thus, the e-grocery sector needs to improve purchase transactions in order to be a valuable alternative to traditional grocery channels. In this context, Intelligent Transportation Systems (ITSs) play a significant role because they enable the management of logistics activities and, most importantly, they connect all the supply chain (SC) members with real time information. However, an accurate evaluation of the operational and economic impacts of ITSs on every SC echelon is needed in order to assure their feasibility and guarantee their success.

In the paper we investigate the delivery of fresh food developing an ITS solution and proposing a framework to assess the performance related to its integration in a mobile application, with particular attention to the benefits and diffusion of such tool. The application allows users to monitor the flow along the entire SC and enables real-time optimization of route planning and traffic congestion mitigation. This work gives to the e-grocery distribution systems not only technical solutions but also a general approach to directly analyze their effectiveness and to test possible business policies. Such a contribution is of great relevance from both an academic and a practical perspective. On the one hand, the performance evaluation framework can support

researchers in identifying the most valuable characteristics ITSs for e-grocery should include. On the other hand, the project provides users with a complete ITS solution integrated with a systemic methodology to assess its performance and diffusion in specific application cases.

13. EXTRACTING URBAN ACTIVITIES THROUGH AGGREGATE CELLPHONE USAGE

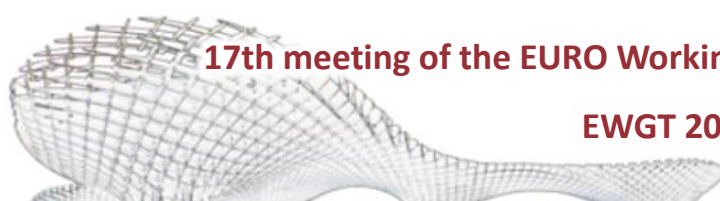
Demissie M. G.^(a*), Correia G.^(a), Bento C.^(b)

(a) University of Coimbra, Department of Civil Engineering, Coimbra, Portugal

(b) University of Coimbra, Center for Informatics and Systems, Coimbra, Portugal

Abstract

Urban areas have been facing a rise in car ownership and commuting that lead to increased congestion and pollution, and lose of space for productive activities. To address these problems, urban planners should develop means to profile urban activities in a dynamic way. However, obtaining data to create the required information with traditional survey methods is expensive and time consuming. Meanwhile, cellular networks produce massive amount of data that could allow us to sense the presence and movement of people. This study applies passive mobile positioning data such as, Call Volume, Handover, and Erlang to detect the spatiotemporal distribution of activities. Our observations are based on hourly aggregated cellphone data obtained from a dataset of communications in Lisbon, Portugal. Fuzzy c-mean clustering algorithm was applied to the cellphone data to create clusters of locations with similar features in what respects to two aspects of activities: daily patterns and intensity. In order to validate those clusters as actual predictors of human activity we compare them with clusters formed using ground truth variables: presence of people, buildings, POIs, bus and taxi movement. In what respects to identifying daily patterns of activities, the Erlang data provided a better match with the ground truth giving 68% of accurate predictions. In the



case of the intensity of activities the Call Volume data provided the highest match with the ground truth yielding 79% of accurate predictions. Hence, results demonstrate the potential of aggregate cellphone data in detecting density of activities that are superimposed on the different activity patterns, which is fundamental piece of information for transportation and urban studies.

14. REAL-TIME SINGLE DETECTOR VEHICLE CLASSIFICATION

Dodsworth J.^(a*), Shepherd S.^(a), Liu R.^(a)

(a) University of Leeds, Institute for Transport Studies, Leeds, United Kingdom

Abstract

The estimation of speed from a single vehicle detector has been a popular area of research largely due to the potential for reduced maintenance and installation costs associated with the more conventional method of using two closely spaced detectors with a known offset distance. Speed cannot be directly measured using a single detector but flow and occupancy measurements (the percentage of time a detector is occupied in any given sample) can be recorded and used to estimate the speed and subsequently, using the vehicle presence time, the length of vehicles.

The approximation of space occupancy from the time occupancy provided by a single short detector requires that vehicle speeds in each sampling interval are constant. This has led to the vast majority of research on this subject being concentrated on freeway applications where speeds can generally be assumed constant during each sampling interval. However, in urban situations and particularly in the vicinity of traffic signal controlled junctions it cannot be assumed that this is the case due to the rapid variation in vehicle speed.

Centralised on-line adaptive traffic signal optimisation strategies use data received from detectors placed on approaches upstream of junctions to feed information into an underlying traffic model. Despite the advancement in

communication technology 4Hz and 10Hz protocols are still used widely in Urban Traffic Control (UTC) and consequently this research explores the accuracy of speed estimation and basic vehicle length classification that can be achieved using data sampled at these rates.

Coifman proposes an algorithm to improve the estimation of speed and vehicle length using the distribution of vehicle presence times, sampled at 240Hz, for a sample of 33 vehicles to estimate the speed of the middle vehicle. The size of the sample required for this method makes it inappropriate for most on-line traffic signal optimisation strategies where data must be available within a time window of a few seconds to be useful in the optimisation process. This work investigates what level of accuracy can be obtained by estimating vehicle speed and length immediately following a vehicle leaving the detection zone using a process of speed matching to provide useful data to an on-line traffic model.

15. SENSITIVITY ANALYSIS OF DIFFERENT SUPPLY DESIGN ALTERNATIVES: EXPERIMENTAL RESULTS

Sacco N.^(a*), Gattorna E.^(a), Baudà A.^(a)

(a) University of Genoa, DIME, Genoa, Italy

Abstract

The continuous increase in traffic, intended as interacting vehicles using a common infrastructure, leading to traffic congestion whenever mobility demand exceeds the infrastructure capacity itself, has put into evidence the need of research and investments in effective solutions.

Obviously, the design of any transportation application assumes to know the present mobility demand and to be able to forecast it with the best accuracy as possible. Therefore, the main effort of this paper is to define a suitable criterion which helps in resource planning and in decision making, based on a sensitivity matrix computed

for an a-priori chosen transportation performance index.

16. ROBUST OPTIMIZATION OF INTERSECTION CAPACITY

Sacco N.^(a*)

(a) University of Genoa, DIME, Genoa, Italy

Abstract

Although traffic light have been introduce in transportation network with the aim of improving the safety of transportation systems users, their capabilities of also improving the traffic network performances has soon become evident. Nevertheless, most of the proposed approaches assume the incoming flows to be known and constant for each design reference period, neglecting the effects of the uncertainty of the incoming flows or of other intersection characteristics such as the saturation flows or the lost time. The aim of this paper is to reformulate three well known mathematical programming models for maximizing the intersection capacity in terms of stochastic programming and discuss their application to traffic light design. The results of the proposed approach are discussed by means of a real world case study.

17. SHORT-TERM RAIL ROLLING STOCK ROSTERING AND MAINTENANCE SCHEDULING

Giacco G. L.^(ab), Carillo D.^(a), D'Ariano A.^(b), Pacciarelli D.^(b*), Marín Á. G.^(c)

(a) Trenitalia, Department of Industrial Planning, Rome, Italy

(b) Roma Tre University, Department of Engineering, Rome, Italy

(c) Technical University of Madrid (UPM), Department of Applied Mathematics and Statistics, Madrid, Spain

Abstract

This paper describes an optimization framework for railway rolling stock rostering and maintenance scheduling. Network-wide rolling stock circulation with integrated short-term maintenance is a key problem in railway rostering planning that requires covering a given

set of services and maintenance works with a minimum amount of rolling stock units. Other relevant objectives are the minimization of the number of empty runs and the maximization of the distance traveled by each train between two maintenance operations of the same type. The constraints of the rolling stock rostering problem require that the different types of maintenance operations must be carried out for each train periodically. The various maintenance tasks can only be done at a limited number of dedicated sites.

The overall problem is solved by a two-step approach that combines the scheduling tasks related to train services, short-term maintenance operations and empty runs. First, the rostering problem is viewed as a graph theoretical approach for scheduling network-wide operations. Starting from the solution of the rostering problem, another graph theoretical approach is adopted to verify the feasibility of the maintenance plan at maintenance workshops.

In this paper, a commercial MIP solver is used for the development of a decision support tool that computes efficient solutions in a short computation time. A campaign of experiments on real-world scenarios from Trenitalia (train operating company in Italy) is illustrated for a comparison of the solutions computed via the MILP solver with the practical solutions. A relevant cost reduction is achieved by using the proposed framework, involving both rostering and maintenance scheduling.

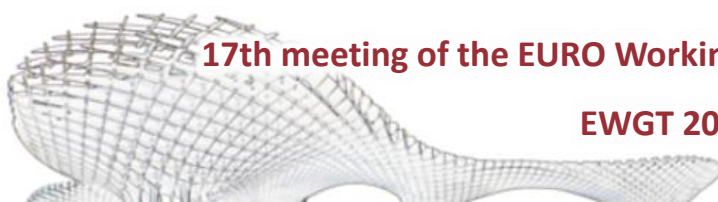
18. EVALUATING THE APPLICABILITY OF ADVANCED TECHNIQUES FOR PRACTICAL REAL-TIME TRAIN SCHEDULING

D'Ariano A.^(a*), Samà M.^(a), D'Ariano P.^(a), Pacciarelli D.^(a)

(a) Roma Tre University, Department of Engineering - Computer Science and Automation Section, Rome, Italy

Abstract

This work reports on the preliminary results of an ongoing project devoted to evaluate the practical



applicability of published techniques for practical real-time train scheduling. The final goal of the project is the development of an advanced decision support system for supporting dispatchers' work and for guiding them toward near-optimal real-time rescheduling decisions. This paper focuses on the optimization system AGLIBRARY (Alternative Graph LIBRARY) to optimize the real-time performance of railway traffic flows. The final aim of this project is the development of an intelligent decision support system for reducing dispatchers workload and for guiding them toward near-optimal train re-timing, re-ordering and re-routing decisions. The problem is formulated by using microscopic information on train travel times and on the status of the network, at the level of block sections and block signals. The outcome of AGLIBRARY is a detailed and conflict-free train schedule, being able to avoid deadlocks and to minimize train delays. The conflict resolution procedure adopted to design a global conflict-free schedule alternates a scheduling phase with fixed routes to a search for better alternative routes. The first phase is solved by a branch and bound algorithm, truncated after a time limit of computation, while train rerouting is solved by a tabu search algorithm. The test bed is based on a British railway network nearby London with dense traffic and multiple routing options for each train. It includes instances with possession constraints, arising when the maximum speed of the trains must be limited in a portion of the line and in a time window due to maintenance works. The results provided by AGLIBRARY have been compared with the optimal solutions provided by a commercial solver. Computational experiments based on realistic instances with multiple train delays demonstrate that near-optimal solutions can be found by AGLIBRARY within very short computation time, compatible with real-time operations.

19. GEOGRAPHIC, SOCIAL-CULTURAL AND MODAL USAGE DETERMINANTS OF ACTIVITY SPACE: A CASE STUDY OF EU INSTITUTIONS IN LUXEMBOURG AND STRASBOURG

Ma TY^(a), Gerber P.^(a), Carpentier S.^(b), Klein S.^(a)

(a) CEPS/INSTEAD, Esch-sur-Alzette, Luxembourg

(b) Aix-Marseille University, Provence, France

Abstract

Human activity space is well-known related with his geographic, social-culture position, build environment and modal usage.

The interrelationships between these observed and unobserved factors shape a person's spatial usage and visited activity locations. This study applies the structural equation modelling approach to identify the direct and indirect effects of these factors on the size of an individual's activity space. The data is based on the recent mobility survey for three European Institutions: European Investment Bank and Court of Justice of the European Union in Luxembourg city and Council of Europe in Strasbourg (France). The results show that the size of a person's activity space is mainly explained by the build environment and less related to the socio-demographic variable when a workplace is controlled. The proposed structural equation model provides a flexible framework to investigate empirical effects of these factors on the activity space.

20. DISTRIBUTED REGRET MATCHING ALGORITHM FOR DYNAMIC CONGESTION GAMES WITH INFORMATION PROVISION

Ma TY^(a*), Gerber P.^(a)

(a) CEPS/INSTEAD, Esch-sur-Alzette, Luxembourg

Abstract

The advance in adaptive learning dynamics to pure Nash equilibrium in game theory provides

promising results for modeling selfish agents with limited information in congestion games. In this study, we propose a distributed game-theoretical learning algorithm with real-time information provision for dynamic congestion games. The proposed algorithm is based on the regret matching process by considering user's past realized payoffs and real-time information. The numerical studies show that the proposed algorithm can converge to non-cooperative Nash equilibrium in both static and dynamic congestion networks. Moreover, the proposed algorithm leads to a plausible real-time route choice modeling framework based on user's perception updating by incorporating user's past experience, real-time information and behavior inertia.

22. THE ANCILLARY ROLE OF CO₂ REDUCTION IN URBAN TRANSPORT PLANS

Nocera S.^(a*), Cavallaro F.^(bc)

(a) IUAV University of Venice, Research Unit "Traffic, Territory and Logistics", Venice, Italy

(b) EURAC European Academy of Bozen, Institute for Regional Development and Location Management, Bozen, Italy

(c) IUAV University of Venice, School of Doctorate Studies in Regional Planning and Public Policy, Venice, Italy

Abstract

In a significant number of scientific and technical reports, the reduction of urban CO₂ emissions from transport constitutes one of the most delicate challenges. Urban transport plans include CO₂ saving as one of the overall goals to be reached, coherently with EU directives. Still, the measures aimed at its reduction seem to operate primarily on different purposes (such as decongestion, improvement of public transport or alternative transport modes). Even though a significant part of such actions has consequences on carbon emissions, their impacts are normally neither estimated nor forecasted. It derives that it is very difficult to evaluate the effectiveness of the plan as far as global warming is concerned. Aware of this criticism, other integrative forms of planning have dealt with the theme of CO₂

reduction at urban level. The paper presents an overview of such strategies, highlighting their criticisms and the necessity for a currently missing integrated vision that aims at quantifying the effectiveness of the transport measures on CO₂ emissions.

24. IEE ENCLOSE PROJECT: THE INTEGRATION OF SUSTAINABLE URBAN LOGISTICS AND MOBILITY PLANS IN 9 EUROPEAN SMALL/MID-SIZE TOWNS

Ambrosino G.^(a*), Pettinelli I.^(a), Bellini R.^(a), Gini S.^(a), Guerra S.^(b)

(a) MemEx srl, Livorno, Italy

(b) Lucense Scpa, Lucca, Italy

Abstract

Freight transport and city logistics are well-known factors of energy consumption and environmental degradation in European urban centres and this is the reason why EU countries are undertaking huge efforts, aiming to improve operations and reduce negative impacts. In this context ENCLOSE Project, started in May 2012 under the European IEE programme (Intelligent Energy Europe), aims to develop Sustainable Urban Logistics Plans (SULP) for Small-/Mid-size towns (SMTs) integrated in Sustainable Urban Mobility Plans (SUMP). Therefore the key findings regarding the needs and potential logistics services for SMTs, are discussed and presented with respect the 9 ENCLOSE towns. Moreover the approach for carrying out the SULP in each ENCLOSE town is presented with the first achieved results. Finally, the real experience of Lucca in terms of measures and logistics solutions and of energy savings and CO₂ impacts is provided, according to the a common evaluation methodology set up in the ENCLOSE project.

25. ACCELERATION STRATEGIES FOR IMPROVING RAILWAY RAPID TRANSIT SYSTEMS: BUILDING SCHEDULES FOR A GIVEN FREQUENCY DISTRIBUTION

Zarzo A.^(a*), Canca D.^(b)

(a) Technical University of Madrid (UPM), Higher School of Industrial Engineering, Madrid, Spain

(b) University of Seville, School of Engineering, Seville, Spain

Abstract

Due to its complexity, railway planning is commonly divided in a set of successive stages comprising network design, line planning, scheduling, timetabling, rolling stock, crew scheduling and rostering. Usually, due to its simplicity, frequencies are line by line obtained following a regular double direction schema with constant headways. After this, a synchronization process is followed to improve connectivity among lines. However, this regular approach and the corresponding frequency allocation gives raise to irregular load profiles in different sections of the line, especially when passenger demand is different in both directions, resulting in unmet demand at certain stations and vehicle overloading situations.

In the past few years a set of acceleration strategies for managing these congestion problems have attracted increasing interest, mainly those based on controlling the frequency of vehicles at stops (e.g. the so called short-turning and deadheading approaches). Usually, the output of these models is an optimal frequency plan including new cycles and deadheading trips between various critical stations. In practice, this new reallocation of frequencies should be finally converted into a concrete and compatible schedule indicating at what time each vehicle stops at each station of the network. In this paper we present a general integer linear programming model to obtain such schedules for a given frequency distribution taking into account network capacity and safety constraints with the objective of preserving regularity as much as possible.

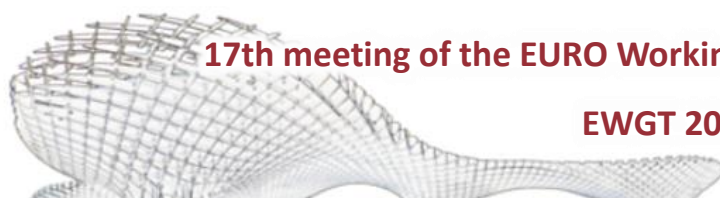
26. ANALYSIS OF THE DRIVING BEHAVIOUR AT WEAVING SECTION USING MULTIPLE TRAFFIC SURVEILLANCE DATA

Kusuma A.^(a*), Liu R.^(a), Choudhury C. F.^(a), Montgomery F.^(a)

(a) University of Leeds, Institute for Transport Studies, Leeds, United Kingdom

Abstract

Weaving sections are formed when a merge area is closely followed by a diverging area, or when an on ramp is closely followed by an off ramp and the two are joined by an auxiliary lane. Driving in the weaving section involves complex car-following and lane-changing interactions. This paper presents two empirical data collection and data extraction processes based on traffic surveillance camera and loop detector measurements. It examines the quality of the extracted data, and highlights the possible sources of measurement errors. This paper proposes local regression method for data cleaning and presents example results to demonstrate the method by combining the two data sources. The study succeeds in identifying some key driving characteristics of vehicles in the weaving section. We found that 30% of the weaving movements took place in the first 50 meters from the point of merge. Around 30% of the total traffic involved in one lane-changing movement. Meanwhile, the transit time for the driver with more than one lane-changing is 4.09 sec in average. The appearance of auxiliary lane in the weaving section provides further opportunity to delay the lane-changing, which affects the traffic performance.



27. INTEGRATING ENVIRONMENTAL POLICIES INTO TRANSPORT BUSINESS STRATEGY: A FRAMEWORK FOR DECISION SUPPORT

Teles M. F.^(a), Freire De Sousa J.^(b*)

(a) CP-Comboios de Portugal, E.P.E., Porto, Portugal

(b) University of Porto, UGEI – INESC, Porto, Portugal

Abstract

Companies are increasingly including their corporate social responsibility into their business strategy. The environmental issues assume here a priority role. In order to get a balance in economic, social and environmental trade-offs, companies need to consider multiple objectives, namely related to the allocation of resources and investments, which can cause contradictory opinions among diverse stakeholders. Companies should incorporate into the decision-making process tangible and intangible elements, identifying and structuring objectives in a consistent way, in order to choose sustainable options for the company and create compromises between stakeholders. The main motivation of this paper is to present the results of the preliminary steps of the development of a methodology or framework to support decision-making and appraisal of corporate environmental strategies and subsequent management approaches. In order to gain a closer view over the proposed approach, we will present some illustrations from a case study in progress within a public passenger transport company.

29. EMISSIONS CAP-AND-TRADE APPROACHES FOR MANAGING URBAN ROAD MOBILITY

Angulo Sánchez-Herrera E.^(a), Espinosa-Aranda J. L.^(a), García-Ródenas R.^(a*), López García M. L.^(a)

(a) University of Castilla-La Mancha, College of Computer Science - Department of Mathematics, Ciudad Real, Spain

Abstract

This paper develops a methodology to analyse the impact of emission taxes for private vehicles for controlling and reducing atmospheric pollution. The main feature of the proposed approach is the integration of emissions from individual emitters (private vehicles) in Emissions Trading Markets designed for macro-emitters. The presented approach consists of two hierarchical levels. At upper level the emissions trading for macro-emitters (cities or consortium of cities) is considered. In this work three emission trading schemes are proposed and studied: i) Fixed emission rights per city, ii) Auction market for the emissions, which tries to reach the environmental objectives at the minimum cost, and iii) Emissions cap-and-trade scheme. These trades allow the system to provide an efficient scheme in a cost-efficiency sense and equity among regulated cities. At lower level the behaviour of the users of the traffic network is modelled for each city. A multi-user equilibrium model with elastic demand and pollution taxes estimates the emissions produced. The lower level represents the emissions market for private vehicles in which the emission taxes paid per user depend on travelled kilometres and the type of the vehicle. The price for each ton of (greenhouse gas) emissions is fixed in the Emissions Trading Market. The three schemes have been solved with a fixed point approach and a numerical study has been carried out to motivate pros and cons of the above schemes.

33. BENEFITS OF A COMBINED MICRO-MACRO APPROACH FOR MANAGING RAIL SYSTEMS IN CASE OF DISRUPTIONS

Placido A.^(a), Cadarso L.^(b*), D'Acierno L.^(a)

(a) "Federico II" University of Naples, Department of Civil, Architectural and Environmental Engineering, Naples, Italy

(b) Rey Juan Carlos University, Fuenlabrada, Spain

Abstract

Optimisation and simulation tools are nowadays vital for planning and managing rail systems, providing performance analysis and evaluation of interactions very rapidly and without any kind of disturbance to the service. Recently, thanks to the development of computers and software, complex railway operations can be optimised and simulated realistically. We may distinguish between combinatorial optimisation and simulation models which can be also classified into macroscopic and microscopic models depending on the adopted level of network details. The former models describe the network and the timetable in a simple way by means of a simplified graph. The latter models consist of the specification of all technical characteristics related to infrastructure, rolling stock and signalling system as well as timetable data.

It is worth noting that macroscopic models are very useful during the planning process when it is necessary to design service frequencies and offered capacities to satisfy the travel demand. The major benefit of this approach is the possibility to consider jointly several features of the rail system obtaining reliable results. By contrast, microscopic models reproduce the network as closely as possible to the 'real world'; basically, this kind of modelling allows evaluating the interactions among trains and the performance of the network precisely and generally they are used to design timetables or analyse the robustness of the service.

The aim of this paper is to propose a new approach for planning and managing the rail system combining both approaches macroscopic and microscopic. In particular, an optimisation

model, based on a macroscopic approach, represents the kernel of the procedure and it is used as a first step to study any kind of scenario. The microscopic simulation model, by contrast, generates detailed (and precise) data, such as headways or running times, to overcome the approximations of the macroscopic model. Above all, in case of disruptions, the combination of the two models provides reliable results taking advantage of the benefits of the two approaches. Numerical applications have been applied in a realistic case taken from a real metro network located in the south of Italy; the preliminary results show the effectiveness of the proposed approach.

34. PARKING PRICING FOR A SUSTAINABLE TRANSPORT SYSTEM

Migliore M.^(a*), Lo Burgio A.^(a), Di Giovanna M.^(a)

(a) University of Palermo, Transport Research Group, Palermo, Italy

Abstract

The purpose of this study has been the development of a model for designing an efficient parking pricing policy. The aim is an intelligent control and management system of parking pricing integrated with a redefinition of the circulation scheme to define for a limited traffic zone in the Central Business District (CBD) of Palermo.

The transport demand over the entire area of the town has been studied in order to design various parking pricing scenarios with the application of an additional cost on parking inside the selected area of the CBD. This area attracts most of the private vehicular traffic and it is characterized by university faculties, schools, hospitals, offices and commercial areas.

The optimal hourly toll is defined by an iterative maximization process of an objective function. This objective function is subject to the following constraint: the percentage of available parking in the various parking zones has to remain major of the 30%. In this way, the users who need to park close to their final destination can easily find

parking. Otherwise it is possible to leave the private car in a “park and ride” area and taking a shuttle bus directed towards the zones of the CBD.

A basic principle of this pricing policy is the re-use of revenues for two purposes: to design a shuttle bus service that connects the various “park and ride” areas to the CBD and to improve the local public transport service on the OD pairs that show high travel demand. At the same time it is necessary to eliminate the stop and go flow in cordon roads to increase the capacity and avoid congestion in these critical links.

The method shows that in a very simple, and relatively fast, way is possible to get a proposal for the modification of the parking pricing scheme that makes the city center no longer stifled by private car traffic.

35. TEMPORAL ADAPTATION TO REWARD SCHEMES: RESULTS OF THE SPITSSCOREN PROJECT

Khademi E.^(a*), Timmermans H.^(a), Borgers A.^(a)

(a) Eindhoven University of Technology, Urban Planning Group, Eindhoven, The Netherlands

Abstract

Reducing congestion and improving the financial and environmental sustainability of urban transport represent new challenges for transportation planners. It requires a better understanding of the impact of various pricing policies on travel behavior. Most pricing policies have involved “push” measures. These measures involve extra charges to certain travel options and thus may lead to adaptation of individuals’ behavior. Although push measures have been studied worldwide, examples of actual applications are still limited due to lack of social acceptability and political support. Public opposition to the implementation of nationwide road pricing in The Netherlands has triggered Dutch policy makers to design and implement an alternative transportation management policy, so-called “reward”

measures. Several real projects have been implemented in The Netherlands, stimulating car drivers to avoid using certain links of the network or certain regions during peak hours. All these projects concluded that the “reward” measures are effective in the short-term. However, the long-term influence of such schemes is still uncertain. Using the data from the Dutch “SpitsScoren” reward project, this paper formulates a panel effects mixed logit model to explore individuals’ adaptive behavior under a reward measure over time. The model is designed to account for correlations between choice options available to individuals in different time periods. Results indicate that except the “teleworking” option, the base utilities of other adaptation alternatives decrease over time, implying that effectiveness of the reward scheme decreases in the long-run. Socio-economic and situational variables seem to strongly affect travelers’ choices of adaptation strategies. The estimated model also shows evidence of significant heterogeneity and covariances between individuals’ choices of specific adaptation options over time.

36. TIME DEPENDENT TRAVEL SPEED VEHICLE ROUTING AND SCHEDULING ON A REAL ROAD NETWORK: THE CASE OF TORINO

Mancini S.^(a*)

(a) Polytechnic of Turin, Turin, Italy

Abstract

Vehicle routing and scheduling play a crucial role in the distribution chain. Although this research area has been broadly studied in the literature, there is still a lack of models closely representing real life problems. Most of the models proposed address constant travel times between nodes, without taking into account rush hours traffic congestion. In real applications in urban contexts the increasing of travel times due to congestion effects cannot be neglected.

Models dealing with time dependent travel times work with simplified step functions, discretizing the time horizon in small time intervals. Even if this approach is broadly used, assuming travel times varying with discrete jumps is a strong approximation of real world conditions which evolve continuously. Another strong approximation adopted in the literature is that travel time (or speed) is computed on direct links, while in the real world vehicles travels on a road network, in which Euclidean distances do not hold anymore. In this paper, a vehicle routing problem (VRP) on a real road network with time dependent travel speed expressed by a polynomial function is addressed. Despite the difficulty to work with these kind of function, in this way congestion evolution behaviour may be more precisely represented. In real situations, it is common to face different congestion peaks during the day, each one of which generally has different characteristics. Morning peaks are very sharp, i.e. congestion level rapidly increase reaching its maximum value which last for a short time after what congestion rapidly decrease, while evening peaks are generally much more spread across a longer time period and congestion variations are much more smoothed. Step functions, commonly used in practice, cannot represent at all realistic situations and peaks; linear functions may acceptable represents sharp peaks but not wider once. Polynomials, indeed, are able to better describe each type of peak. An application on Torino road network is presented. Speed evolution laws on main arcs are computed basing on real data obtained from an analysis carried out on averaged travel speed measured by an electronic system with 5 minutes intervals over two weeks.

Small streets for which this data are not available are supposed to have a constant travel speed. Computational results show that taking advantage on the available information on different rush hour peaks intensity and spread on different arcs, it is possible to obtain better vehicle routing and scheduling plan.

37. DEVELOPMENT OF AN INTEGRATED TRANSPORT-LAND USE MODEL FOR THE ACTIVITIES RELOCATION IN URBAN AREAS

Brandi A.^(a), Gori S.^(a), Nigro M.^(a*), Petrelli M.^(a)

(a) Roma Tre University, Department of Engineering, Rome, Italy

Abstract

The study presents a new model to promote the integration between the land use and the transport system in urban areas: it searches for a specific value of reduction of the residual capacity of the mass transit system; this residual capacity is the variable that indicates location and quantity of activities to be moved.

The idea is to relocate a subset of activities from areas characterized by strong attraction, but poorly connected by the mass transit system, to areas close to the existing mass transit links not yet saturated: in such a way, the aim is to promote the use of the transit system and to increase, consequently, the sustainability of the city.

The model has been applied for the real case study of the city of Rome in Italy. Results demonstrated the capability of the model to be a useful support system to suggest activities relocation pursuing the goal of sustainability for a short term horizon.

39. ROBUST INFRASTRUCTURE DESIGN IN RAPID TRANSIT RAIL SYSTEMS

Codina E.^(a*), Marín Á. G.^(b), Cadarso L.^(c)

(a) Polytechnic University of Catalonia, Department of Statistics and Operations Research, Barcelona, Spain

(b) Technical University of Madrid (UPM), Higher School of Aeronautical Engineering, Madrid, Spain

(c) Rey Juan Carlos University, Fuenlabrada, Spain

Abstract

Incidents such as special social events, infrastructure malfunction, rolling stock breakdowns and bad weather conditions are commonplace in rapid transit rail systems and

may disrupt the system performance imposing with deviations from planned operations. A robust network design may be so expensive to be operated on a regular daily basis that, in practice, only the likely disruptions need to be taken into account, thus minimizing the under-utilization of the network during normal operation. When considering the possible sources for system disruptions, the corresponding scenarios may have associated failure probabilities that are constant and are not a function of the level of operation of the system. Other scenarios of disruption, however, may be associated to failures of the rolling stock which may block the system at given points of the network.

In this case the failure probabilities are considered as a function of both, the amount of services and the routing of the rolling stock on the designed network and they cannot be calculated a priori but are a result of the design process itself. We propose a recoverable robust network design model as an alternative to robust design for reducing the effect of disruptions less likely to occur. The objective is to minimize either a) cost of recovery or b) deviations from undisrupted scenarios. The proposed model can be considered as a two recourse stochastic programming model where the probabilities of failure are an implicit function of the number of services and routing of the transit lines that makeup the transport system. Therefore, the model has a multilevel structure and a heuristic solution method is examined for small to medium networks demonstrating the computational viability of the approach.

on car to infrastructure communication is the upcoming signal state at signalized intersections. For example functions like Green Light Optimized Speed Advisory need a short term forecast of the switching times. Unfortunately, in case of vehicle actuated control these switching times cannot be easily determined and need to be estimated using probability theory. In this paper different driver assistance functions and their respective requirements on the precision of the prediction are discussed. In order to assess the reliability of existing prediction methods, a well-known algorithm based on Markov chains is evaluated using a microscopic simulation study. The internal Markov states are represented by combinations of signal states and corresponding detector counts. In the model which is used for simulation two existing urban intersections are considered: Whereas one of the intersections is characterized by public transport priority, the signal times at the other intersection are adapted with respect to private cars only. Based on the results of the simulation study the performance and the deficiencies of the known Markovchain based prediction method are analyzed in order to derive starting points for the development of an extended approach which takes additional constraints into consideration. Both, the known and the extended prediction method are then evaluated with respect to the specific requirements of the driver assistance functions. Based on the evaluation conclusions are drawn and recommendations for the application of the methods are given.

40. EVALUATION OF A SIGNAL STATE PREDICTION ALGORITHM FOR CAR TO INFRASTRUCTURE APPLICATIONS

Barthauer M.^(a*), Friedrich B.^(a)

(a) Technical University of Braunschweig, Institute of Transportation and Urban Engineering, Braunschweig, Germany

Abstract

One of the most relevant pieces of information for cooperative driver assistance systems based

43. EVALUATION OF A NUMERICAL METHODOLOGY TO ESTIMATE PEDESTRIANS' ENERGY CONSUMPTION AND PM INHALATION

Faria M.^(a*), Duarte G.^(a), Vasconcelos A.^(a), Farias T.^(a)

(a) University of Lisbon, Instituto Superior Técnico (IST), Lisbon, Portugal

Abstract

Walking constitutes the basis of any transportation system as it is irrevocably connected to the other transportation modes (cycling, public transports and private car). Furthermore, it is inexpensive, emission-free and plays a key role for quality of life by its overall health benefits. However, cities have not always evolved to accommodate the needs of pedestrians and in many cases this transportation mode has been neglected in the development of transportation systems. Improving non-motorized modes environment can contribute significantly to meet the challenges of climate change, air pollution and health. Nevertheless, pedestrians are the most vulnerable and exposed road users and this is an important reason why urban environmental sustainability must be pursued.

Considering this, the aim of the present research work is to define and evaluate a new methodology to estimate the total PM potential inhaled dose and energy consumption for different trips, according with PM concentration levels, pedestrian activity (external power requirements) and minute ventilation, considering street topography (slope), walking speed and user characteristics (weight, age, gender). The methodology was applied to a case study in Lisbon and the results were validated with experimental data, using a portable laboratory to acquire the data needed for characterizing pedestrian trips (instant speed, PM concentration, GPS coordinates, etc.).

45. ASSESSING THE IMPACT OF SPEED LIMIT CHANGES ON URBAN MOTORWAYS: A SIMULATION STUDY IN LILLE, FRANCE

Cohen S.^(a*), Christoforou Z.^(b), Seidowsky R.^(a)

(a) University of Paris-Est, IFSTTAR, Marne-la-Vallée, France

(b) Ecole des Ponts ParisTech, Marne-la-Vallée, France

Abstract

Recent directives in France on sustainable development and the preservation of the natural environment have driven local Authorities to the reduction of speed limits on urban highways. This decision, recently taken on the motorway network of the city of Lille, is in line with previous urban development plans and consists in reducing speed limits on all central highway sections as well as in all zones that are close to dense urban areas. Consequently, Local Authorities are interested in a thorough evaluation of this measure and in the estimation of the potential impact upon traffic and emissions.

In this paper, we undertake an a priori evaluation of speed limit reduction from 110km/h to 90km/h on the Lille motorway network, in France. We first provide an overview of key lessons learned from previous speed limit reduction experiences. Then, we present the methodology of the specific prior evaluation on the Lille network. In particular, we use a first order macroscopic traffic simulation tool for this a priori assessment. The model is first calibrated and then statistically validated using traffic data from the A1, A22, A25 motorways as well as from the RN356 national road. This statistical validation is consistent with good practices in simulation. It allows taking into account the variability of the impacts of speed limits. The evaluation output allows for a thorough understanding of the impacts on prevailing traffic conditions and air pollution. Additional scenarios are also considered in order to take into account driver behaviour on the non-compliance with speed limits.

Besides the various limitations of the study, especially those related to its predictive aspects, we can conclude that the intended measure will have a positive impact on traffic and emissions. Nevertheless, the magnitude of this impact is largely variable, in particular in regards to driver compliance.

47. OPTIMAL TIMETABLES AND VEHICLE SCHEDULES IN A TRANSIT NETWORK

Laporte G.^(a), Ortega F. A.^(b), Pozo M. A.^(c*), Puerto J.^(c)

(a) HEC Montreal, Montreal, Canada

(b) University of Seville, Department of Applied Mathematics I, Seville, Spain

(c) University of Seville, Department of Statistics and Operational Research, Seville, Spain

Abstract

The Transit Network Timetabling and Scheduling Problem (TNTSP) aims at determining optimal timetables for each line in a transit network by establishing departure and arrival times at each station allocating a vehicle to each timetable. Customers could know departure times of the line runs offered by the system in a regular way. However, each user, traveling later or in advance than their desired travel time, will give rise to an inconvenience cost, or a penalization cost if that user cannot be served. This paper deals with the optimal timetable and vehicle schedules for a given number of vehicles in a public transit network. The provided formulation guarantees that each user is allocated to the best possible timetable while ensuring capacity constraints

49. THE EFFECTS OF ROAD NETWORK DESIGN ON FUEL CONSUMPTIONS

Gallo M.^(a*), D'Acerno L.^(b), Montella B.^(b)

(a) University of Sannio, Department of Engineering, Benevento, Italy

(b) "Federico II" University of Naples, Department of Civil, Architectural and Environmental Engineering, Naples, Italy

Abstract

The road network design problem is widely studied in the literature, both in urban and rural areas; most papers deal with the solution algorithms and with the mathematical formulation of the problem. The road network design problem is NP-hard and is very difficult to solve in acceptable computing times for real-scale networks. In urban areas, the objective of the design is usually the minimisation in total travel time on the network, while in rural areas it is usually a sum of total travel time and total (i.e. construction and maintenance) road costs. Very few papers consider other terms in the objective function and/or propose a multicriteria approach. In our best knowledge, no papers consider as objective of the design to minimise the fuel consumption, even if it is an actual objective of road network planning and design.

In this paper, we compare the results obtained by solving some road network design problems adopting the classic objective functions and adopting as objective the minimisation in fuel consumptions on the network. In order to obtain this result, in the paper a fuel consumption function is proposed, based on CORINAIR models and depending on the vehicle fleet of the study area; this function is used both for estimating the reduction in fuel consumption due to the design obtained with the classic objective functions and for designing the road network using as objective function the total consumption on the network. The results obtained with these approaches are compared in terms of fuel consumed and total travel time spent on the network.

The minimisation in fuel consumption is very important since greenhouse gas emissions and air pollutants are directly related to the consumption.

Initial tests highlighted that the results obtained with the two different approaches are more significant in rural areas, where higher average flow speeds may produce higher consumption, according to the CORINAIR models.

50. IMPROVEMENT OF THE OPERATION OF THE FEEDER BUS ROUTES TO SUBURBAN TRAIN BUENAVISTA - CUAUTITLÁN (MEXICO DF)

Vázquez González F. J.^(a*), Sastre J.^(b), Signoret Solís A.^(c)

(a) AYESA, Industrial Engineer, Seville, Spain

(b) ALOMON, Civil Engineer, Seville, Spain

(c) AYESA MEXICO, Economist, Mexico City, Mexico

Abstract

The Suburban Railway BUENAVISTA-CUAUTITLÁN was proposed to function as the principal support of the transport system of northwest Mexico Valley area for suburban travel to and from Mexico City. For this, a feeding scheme was proposed by using public transport routes for each of the five stations commuter rail called Modal Transfer Center (CETRAM) in the State of Mexico, composed at least by 34 companies with 148 routes, plus eight more companies with a potential for 108 additional routes. The general objective pursued by the authors of this study is the development of a program that allow to strengthen the feeder routes to Suburban 1, which might allow increasing passenger demand and revenue for the benefit of different service public transport routes with objectives defined to short, medium and long term, based on an promotion of an integrated public transport in the area of influence of the train system. To achieve the objective sought an analysis and diagnosis of the current situation was made, with the completion of extensive field work that has included a generous number of surveys of revealed and stated preference. Based on the above has been constructed and calibrated a model of demand and public assignment, including the different

existing public transport routes in the study area. This model allowed us to estimate the effect of different measures to improve the number of passengers of feeder routes. The transport model is presented in this communication, showing the main results obtained with it, including the elasticity and value of time obtained and the expected demand from the various proposed measures to improve the operation of the feeder routes.

51. ISOLATING DIFFERENT FACTORS AFFECTING TRAVEL TIME RELIABILITY IN AN OBSERVATIONAL BEFORE/AFTER STUDY

Bhouri N.^(a*), Aron M.^(a)

(a) University of Paris-Est, IFSTTAR/COSYS/GRETTIA, Marne-la-Vallée, France

Abstract

It is increasingly recognized that travel time reliability is important to travellers and goods, and hence there is an increasing demand to include reliability in the evaluation and appraisal of transport projects and programs, as a separate factor in its own right. A number of the policy options already in use as congestion mitigation policies have also positive impacts on the travel time reliability. It is therefore important to evaluate impacts of any remedial action separately both for average travel time (congestion) and for variability of that travel time (reliability). The impacts are generally assessed with an observational before/after study. As many things, independent from the system to be assessed, change between the periods before and after the installation of the system, observational before/after studies take also into account a reference site, where the effect of these changes is identified.

In a previous paper (Bhouri&Aron, 2013), the reliability impacts of a managed lane case consisting in a Dynamic Hard Shoulder Running (HSR) during rush hours on a French urban motorway was presented. The study was conducted by comparing reliability indicators

based on data collected in 2002 before the implementation of the system and in 2006 after this implementation. Jacques Chirac, former president of France, launched in 2003 an important campaign for road safety and against speeding. This modified the travel time distribution, differently according to the lane. As reliability is based on the percentiles (and not only on averages), it was necessary, in order not to confound the effect of this campaign with the HSR effects, to develop the observational before/after study method for taking into account the percentiles. This method and the results are presented in this paper.

52. PERFORMANCE INDICATORS FOR PLANNING INTERMODAL BARGE TRANSPORTATION SYSTEMS

Wang Y.^(a), Bilegan I.^(a*), Crainic T. G.^(b), Artiba A.^(a)

(a) University of Valenciennes and Hainaut-Cambrai, Valenciennes, France

(b) University of Quebec, Montreal and CIRRELT, School of Management, Montreal, Canada

Abstract

Various indicators are used to qualify the performance of intermodal transportation systems. Some of these are found in public documents, e.g., annual company reports, usually providing global measures such as total flow volumes, profits, and share values. While of great interest, such measures are not sufficient to support a fine analysis of different operation strategies, commercial policies, and planning methods. A number of additional measures are therefore used in the scientific literature to address these issues. Our first goal is to review the performance indicators found in public sources and scientific literature and to qualify them with respect to tactical planning of intermodal barge transportation systems. We extend this analysis to include revenue management policies, e.g., market segmentation and differential pricing, a topic generally neglected in freight transportation. We also

discuss procedures to generate problem instances that provide the means to analyze planning methods and system behavior based on these performance indicators. This study is clearly of importance to the scientific literature, when comparing proposed models and solution methods. It is of equal value to industry, highlighting the information one should collect out of the massive data flows generated by the cotemporary IT systems, as well as the strategies required to transform this dynamic data into information appropriate for decision making at the tactical planning level, in particular when using revenue management concepts in the service network design.

53. CALIBRATION OF THE GIPPS CAR-FOLLOWING MODEL USING TRAJECTORY DATA

Vasconcelos L.^(a*), Neto L.^(a), Santos S.^(b), Bastos Silva A.^(b), Seco Á.^(b)

(a) Polytechnic Institute of Viseu, Viseu, Portugal

(b) University of Coimbra, Coimbra, Portugal

Abstract

Microscopic simulation models of traffic flow are practical analysis tools used for the evaluation of transportation systems and management strategies. One of the most important tasks in the simulation, assigned to the car following sub-model, is the modelling of the longitudinal movement of vehicles considering their basic motion options and interactions.

The calibration of a car-following model is usually done at an aggregated level, using macroscopic traffic stream variables (speed, flow, density). There is an interest in calibration procedures based on disaggregated data. However, obtaining accurate trajectory data is a real challenge.

This paper presents a low-cost procedure to calibrate the Gipps car-following model. The trajectory data is collected with a car equipped with a datalogger and a LIDAR rangefinder. The datalogger combines GPS and accelerometers data to provide accurate speed and acceleration

measurements. The LIDAR measures the distances to the leading or following vehicle. Two alternative estimation methods were tested: the first follows individual procedures that explicitly account for the physical meaning of each parameter; the second formulates the calibration as an optimization problem: the objective function is defined so as to minimize the differences between the simulated and real inter-vehicle distances; the problem is solved using an automated procedure based on a genetic algorithm.

The results show that the optimization approach leads to a very accurate representation of the specific modeled situation but offers poor transferability; on the other hand, the individual estimation provides a satisfactory fit in a wide range of traffic conditions and hence is the recommended method for forecasting purposes.

54. FACTORS INFLUENCING LOGISTICS SERVICE PROVIDERS' EFFICIENCY IN URBAN DISTRIBUTION SYSTEMS

De Marco A.^(a*), Cagliano A. C.^(a), Mangano G.^(a), Perfetti F.^(b)

*(a) Polytechnic University of Turin, DIGEP, Turin, Italy
(b) Polytechnic University of Turin, DAUIN, Turin, Italy*

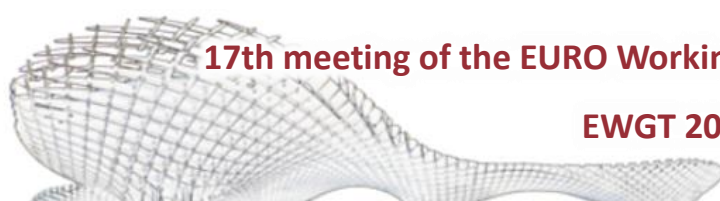
Abstract

The increased urbanization and the awareness of freight transportation impacts have stressed the importance of City Logistics (CL) as a comprehensive approach aimed at mitigating the negative effects of distribution activities without penalizing social, cultural, and economic issues. CL faces a relevant degree of complexity due to the characteristics of modern urban areas, such as traffic congestion, lack of parking spaces, high levels of pollution, and restrictions imposed by local regulations. This environment causes uncertainty about planning and managing delivery activities so that, if not properly organized, urban logistics might not meet its goals. In recent years, many models have been developed to optimize the CL process

considering the perspectives of the different stakeholders involved. Studies mainly focus on the location and role of distribution warehouses, freight flows, the routing task, vehicle loading, the size and type of vehicles that can enter urban areas, and possible charges for accessing city centers. However, a successful implementation of such models requires internal efficiency by each actor. In this context, a crucial role is played by logistics service providers (LSPs) because they are expected to offer high quality services in congested urban areas and the effectiveness of their activities depends on the interactions among all the CL stakeholders.

The paper proposes an empirical analysis on the operational factors determining the level of efficiency of a LSP. Based on the analysis of literature, the efficiency is here assessed through productivity, which in turn is measured as the number of stops that a driver daily makes during his service. Data about a LSP involved in urban freight distribution in Italy are analyzed and a regression analysis is completed. Results highlight that two managerial levers affect the level of productivity. The first one is related to the organization of the distribution network: a more efficient location of warehouses, an extension of the area covered by each driver and a more efficient routing structure can significantly increase the productivity of a LSP. At the same time, the vehicle loading strategy appears to be crucial: as a matter of fact, vehicles should not be excessively loaded, especially with big parcels, so that the business can be performed more efficiently.

This study represents an attempt to develop a comprehensive panel of operational variables that support the efficiency of the urban distribution system of LSPs. The potential benefits associated with the enhancement of efficiency are both economic and environmental.



55. PORT COOPERATION POLICIES IN THE MEDITERRANEAN BASIN: AN EXPERIMENTAL APPROACH USING CLUSTER ANALYSIS

Fancello G.^(ab), Pani C.^(a), Serra P.^(b*), Fadda P.^(ab)

(a) University of Cagliari, Department of Civil and Environmental Engineering and Architecture (DICAAR), Cagliari, Italy

(b) University of Cagliari, CIREM, Cagliari, Italy

Abstract

The great potential of the Mediterranean area, as yet not fully tapped due to the lack of the synergistically integrated management of its ports, calls for innovative management policies for achieving competitiveness within the Mediterranean port system. To this end, the current regime of intra-port competition has proven highly unproductive and needs to be rethought, implementing new cooperation policies. Operating within a port system and not as a single port can enhance competitiveness, the resulting potentiality being far greater than the sum of that of each port. Several actions are able to improve efficiency and significantly reduce costs if performed in a systemic logic: traffic sharing among ports, development of joint management policies, implementation of integrated marketing policies, resource sharing. The main aim of this study is to identify, by means of traditional clustering techniques, homogeneous groups of ports within the Mediterranean region. In so doing, it would be possible to propose new cooperation policies between ports of the same cluster, but also between different clusters, on the basis of their specific features.

A data set has been created for 34 major Mediterranean container ports. For each port contained in the sample, demand and supply data have been collected. The former refers to traffic volumes handled by the terminal over a ten year period, whereas the second mainly concerns structural data (quay length, depth, yard area, etc.), organizational information (equipment, operations system, etc.) and geographic location.

Relations between ports have been evaluated from a quantitative perspective through traditional and multivariate statistical techniques: hierarchical cluster analysis based on the Ward method. Different sets of homogeneous ports have been obtained alternating different combinations of input variables and varying these over suitable ranges, in line with the assumed cooperation policies.

The findings provide the basis for exploring the strategic functional relationships among ports, in order to promote collective integrated actions that could prove essential for the competitiveness of the Mediterranean port system, otherwise destined to remain marginalized.

56. TOOLS FOR ROAD INFRASTRUCTURE SAFETY MANAGEMENT –POLISH EXPERIENCES

Jamroz K.^(a), Budzynski M.^(a), Kustra W.^(a), Michalski L.^(a), Gaca S.^(b*)

(a) Gdansk University of Technology, Highway Engineering Department, Gdansk, Poland

(b) Cracow University of Technology, Cracow, Poland

Abstract

The objective of road safety infrastructure management is to ensure that when roads are planned, designed, built and used road risks can be systematically identified, assessed, removed and mitigated. There are a number of approaches to road safety management. European Union Directive 2008/96/EC requires EU member states to use four basic tools of road safety infrastructure management. An overview of the methods in these countries shows a variety of approaches to how these tools are used in practice. The paper presents a systematics of these tools and a concept of how they could be developed in Poland.

It looks at the life cycle of a road structure and the requirements of risk management processes. The paper focuses on elements of scientific support to help build the necessary tools.



To help with assessing the impact of a road project on the safety of related roads, a method was developed for long-term forecasts of accidents and accident victims and accident cost estimation as well as a risk classification to identify risks that are not acceptable risks. With regard to road safety audits and road safety inspection, a set of principles was developed to identify risks and the basic classification of errors and omissions. In the case of road network safety management, measures of individual and societal risk were selected. A method for classifying dangerous road sections was developed as well. An estimation is given of the consequences and effects of applying the tools of road safety management on the network of national roads in Poland until 2020.

57. AN AHP APPROACH TO AIRCRAFT SELECTION PROCESS

Dozic S.^(a*), Kalic M.^(a)

(a) University of Belgrade, Faculty of Transport and Traffic Engineering, Belgrade, Republic of Serbia

Abstract

Increased competition and unstable situation in the air travel market pressurize airlines to improve their level of service in order to keep constant or achieve better market position. Level of service involves appropriate offer in terms of high frequencies, desired time of operations, attractive and comfortable aircraft from passengers' point of view. An airline, from its point of view, needs aircraft with low operating costs which can be ordered under favourable payment conditions and which will operate highly loaded. In order to bring air travel demand and its capacity as closely together as possible, an airline needs to adopt an appropriate methodological approach for fleet planning process. The goal of this paper is to solve aircraft type(s) selection problem for known route network and forecasted air travel demand by using the Analytic Hierarchy Process (AHP).

59. REDUCED URBAN TRAFFIC AND EMISSIONS WITHIN URBAN CONSOLIDATION CENTRE SCHEMES: THE CASE OF BRISTOL

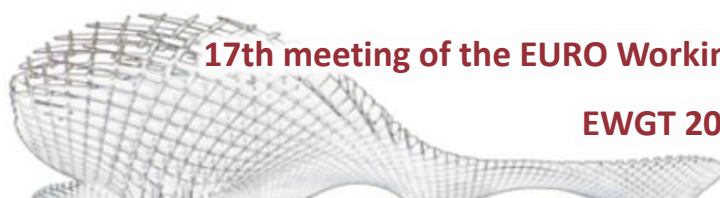
Paddeu D.^(a*), Fadda P.^(a), Fancello G.^(a), Parkhurst G.^(b), Ricci M.^(b)

(a) University of Cagliari, Cagliari, Italy

(b) University of the West of England, Bristol, United Kingdom

Abstract

Urban freight consolidation centres (UFCCs) can provide a significant contribution to reducing the negative impacts of freight transport to city centres whilst at the same time providing a more seamless, higher-value logistics experience for their users. By collecting the goods destined to the target area and consolidating them into a single delivery made by a high load-factor vehicle, UFCCs have the potential to relieve congestion, reduce energy consumption and improve air quality. The paper draws on the experiences of the Bristol-Bath freight consolidation centre (BBFCC), established in 2002 to serve Bristol city centre and uniquely extended in 2011 to cover a second neighbouring city centre, Bath, each served by electric lorries; it appraises the benefits of shared 'final mile' freight services, presenting a model for the evaluation of the reduction in traffic and polluting emissions based on Bristol, with a view to optimising future UFCC design. Data about the number of deliveries made by heavy goods vehicles (HGVs) of different types to the BBFCC and the number of deliveries made from the BBFCC to the two shopping centres covering a period of 17 months are analysed. The correlation between the type and number of HGVs delivering to the BBFCC and the number of deliveries made to the retailers by the BBFCC is explicated by means of a multiple regression model. Its development is based on analysing classic progressive parameters: R Square value (total and adequate), F-statistics and t-statistics for each coefficient. An estimation of the number of HGVs re-routing to the BBFCC and the pollutant emissions avoided in the urban centre is



appraised. The pollutant emissions reduction is based on factors drawn from the UK National Atmospheric Emissions Inventory. Emissions reductions in the host cities are identified as a result of sharing delivery vehicles for the final leg. The regression models developed provide a useful tool for local authorities and logistics/transport planners in optimising the planning of UFCCs to reduce freight traffic and associated emissions.

60. A MICRO-SIMULATION MODEL FOR PERFORMANCE EVALUATION OF A LOGISTICS PLATFORM

Gattuso D.^(a), Cassone G. C.^(a), Pellicanò D. S.^(a*)

(a) Università Mediterranea di Reggio Calabria, Department of Information, Infrastructure and Sustainable Energy Engineering (DIIES), Reggio Calabria, Italy

Abstract

The paper focuses on the receiving area of a logistics platform operating in the agri-food sector. The main aim of this work is to propose a “what to” approach for the resolution of problems related to the vehicles and goods receiving. The approach is based on a dynamic, stochastic discrete-event micro-simulation model, which was properly specified and calibrated.

The work proposes the formulation of the mathematical model defining the receiving activities in the logistics platform. The objective function aims at minimizing the average truck turnaround while respecting constraints on resources and operational capabilities of the platform, which depending on the functional and infrastructural characteristics of the system. The problem formulation considers the introduction of ITS to support the receiving activity management.

61. A LINE PLANNING MODEL FOR DELAY RESISTANCE

Harbering J.^(a), Schöbel A.^(a)

(a) University of Goettingen, Goettingen, Germany

Abstract

In modern public transportation networks, delays are the main issue for disturbing smooth operations and hence the dissatisfaction of passengers.

Thus, it is crucial for the operators to know how to deal with delays in a sophisticated way.

Until now the delay resistance of public transportation networks was widely viewed as a problem that had to be incorporated by planning robust timetables.

The idea of robust timetables is to add security buffers.

However, increasing buffer times in the timetables immediately leads to higher traveling times for the passengers.

We hence have a trade-off between the planned and the actual traveling times.

Thus, the passengers either have to endure additional buffer times when no delay occurs or suffer from the delay if not enough buffer times are added.

Our novel approach tries to work around this problem by tackling the issue of delays even before the timetable is planned.

The aim is to develop a line concept that leads to delay resistant timetables.

When viewed from the stage of line planning, which factors impose delay resistance?

A main factor for propagation of delays are passengers' transfers.

Trains that wait for delayed passengers get themselves delayed and hence carry on the delay into the network.

The idea is to design lines in a way that the number of transfers over all passengers is minimized.

In this new model it is necessary to determine not only the lines but also the paths for the passengers. Additionally, it has to be ensured that

all passengers can travel according to their wishes.

In order to find line plans with a minimal number of changes, an integer program is proposed.

However, on realistic networks the number of possible paths and thus the number of variables is huge.

Hence, our approach for solving such problems is via column generation.

The method is embedded into the LinTim framework which facilitates the evaluation and comparison of solution characteristics using close-to-real world data. Furthermore, LinTim takes care of solving the problems resulting from later planning stages. Having planned the lines and the timetable, the decisions to be taken in the delay management problem is to decide which transfers to maintain. Solving this problem is hard, but is enhanced by only having a small number of decisions to be taken at all. Thus, the new line planning model can, therefore, be viewed in an integrated perspective with delay management and timetabling.

62. QUANTIFICATION OF THE IMPACTS OF ECO-DRIVING TRAINING AND REAL-TIME FEEDBACK ON URBAN BUSES DRIVERS' BEHAVIOR: A LISBON CASE STUDY

Rolim C.^(a*), Baptista P.^(a), Duarte G.^(a), Farias T.^(a), Shifan Y.^(b)

(a) University of Lisbon, Institute of Mechanical Engineering (IDMEC), Lisbon, Portugal

(b) Technion - Israel Institute of Technology, Haifa, Israel

Abstract

The transportation sector is one of the main contributors to enhance quality of life, by providing accessibility to people, places and goods. On the other hand, it also contributes to the degradation of the environment, presenting high levels of energy consumption and pollutants emissions. Solutions to overcome this increasing trend have focused on the development of alternative vehicle technologies and fuels, innovative transport systems, and information

and communication technologies. Users' behavior plays an essential role regarding the impacts of these solutions on reducing energy consumption and emissions. Over the years, rising attention has been given to behavior, both for light-duty and heavy-duty drivers, in particular to the effects of education, training, and feedback regarding driving performance on vehicle purchase, mobility patterns, and driving behavior.

This paper aims at assessing the impacts of on-board devices that provide real-time feedback and eco driving training on bus drivers' behavior. Rodoviária de Lisboa S.A., a Portuguese bus passenger-transport company, uses since 2008 a data logger and a managing software platform, GISFROT, developed by the company, to collect real-time operation data and to identify undesirable driving behaviors. These devices indicate to the driver undesirable driving behavior events through a sound signal. Drivers also participate in annual in class training sessions on eco-driving techniques. The device is currently installed in 100 buses and approximately 600 drivers use these vehicles under regular daily operation, while driving in the Lisbon metropolitan area.

An analysis of data collected from 2010 to 2013 was performed to characterize driving behavior of the sample of drivers. Two monitoring periods, a first one with sound feedback followed by a period without sound feedback, were considered. A comparison between periods was performed regarding the percentage of times drivers were in undesirable driving events such as hard brakes and hard accelerations, among others. This analysis also considered drivers characteristics (age and time working at company) and vehicle characteristics (bus age and type). The comparison between monitoring periods indicates that without sound feedback, inexperienced drivers and senior drivers tend to increase percentage of time in undesirable events, particularly when driving mini buses and articulated buses. These increases are mainly observable in extreme brakes and accelerations,

hard stops and excess RPM, with rises between 8% and 291%.

63. EFFECTS OF INFORMATION PROVISION ACTIVITIES IN STREETS ON DRIVING SPEEDS

Mimura Y.^(a*), Kato H.^(a), Higuchi K.^(a), Ono T.^(a), Ando R.^(a)

(a) TTTRI, Research Department, Toyota, Japan

Abstract

Traffic accidents in the streets have become a very serious issue in Japan. In order to reduce the traffic accidents in the streets, a proper speed reduction of the vehicle is important. Although there are many approaches to make the vehicles reduce the speed, this study focuses on a user measures to encourage the speed reduction by providing the information. Recent years, there was a traffic calming study in which some people stand the roadside and then remind the drivers to decrease their driving speeds by showing the vehicle's speed. In this study, by referring the existed study, we tried to grasp the measurement issues from the viewpoint of vehicle behavior such as reduction of the speed, evaluation by the drivers and neighborhoods consciousness, and possibility of the supports by the government in this area. Results obtained in this study are as follows. 1) When provided speed information for the over speed limit vehicles, it was found that the speed is reduced markedly near the provision position. 2) Vehicle speed provision activities were accepted favorably to the driver. In addition, the trend was noticeable to the driver who lives in the vicinity of the activities. 3) It was recognized by neighborhoods that vehicle speed provision activities are effective compared to the traffic safety campaign activity as usual. In addition, the tendency was more remarkable in the people who recognized that the vehicle speed in the street was fast. 4) The problems listed by the road administrators for the spread of vehicle speed information provision activities were the relations with other policies, the generalization of

the effects, and consideration for the trouble evasion.

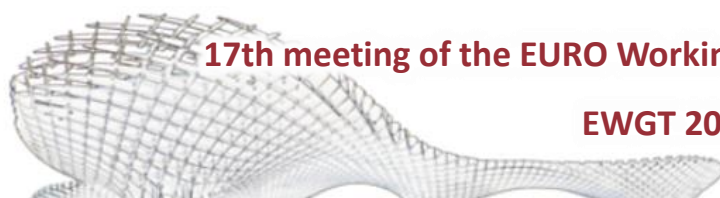
64. THE DYNAMIC INTERACTION BETWEEN PASSENGER FLOWS AND RAIL SERVICE

Campora S.^(a), Botte M.^(a), D'Acerno L.^(a*), Placido A.^(a), Montella B.^(a)

(a) "Federico II" University of Naples, Department of Civil, Architectural and Environmental Engineering, Naples, Italy

Abstract

Rail and metro networks are nowadays the backbone of public transportation systems especially in high density contexts. Due to the constant increase in travel demand, rail systems are more and more dense and service providers have the difficult task of planning a timetable which has to be robust and stable. Moreover, in order to increase customers' satisfaction, it is necessary to provide sufficient transport capacity avoiding train and platform congestion and guaranteeing a good level of service quality. To reach this target, an appropriate timetable evaluation, which expresses the interactions between train operation and passenger flows, is essential. In particular, the aim of the paper is to analyse the dynamic effect of dwell time at station on the service in the case of metro networks. In fact, above all in crowded situations, train can be forced to remain stopped in a station more time than what has been planned, causing a delay. As a consequence, the more a train is delayed, the more the passengers arrive at the station and get on the train further increasing the dwell time. The evaluation of this dynamic effect, known in the literature as "snowball effect", provides an analysis of the timetable which is as closely as possible to the real phenomenon and, above all, yields an estimation of the effective congestion of carriages. Hence, by adopting suitable indexes which reflect passenger experiences of the service, it is possible to establish an appropriate evaluation method for planning train operations. An application on a real metro line in the city of



Naples (Italy) has been applied in order to show the utility of the proposed approach.

65. A DECISION SUPPORT SYSTEM BASED ON ELECTRE III FOR SAFETY ANALYSIS IN A SUBURBAN ROAD NETWORK

Fancello G.^(a), Carta M.^(a*), Fadda P.^(a)

(a) University of Cagliari, Department of Civil and Environmental Engineering and Architecture (DICAAR), Cagliari, Italy

Abstract

The aim of this paper is to develop a methodological procedure for supporting decision makers in transport planning. The methodology is adopted for evaluating safety conditions in a road infrastructure. Public administrations need to reduce road accidents and injuries, so as to reduce the social costs of transport. However dwindling financial resources for road maintenance call for targeted interventions to achieve the best results, optimizing resources for the most critical sections. In this analysis, the multicriteria method Electre III is used, a ranking procedure applied in the specific case to a suburban road system. The analysis provides some indications for choosing and ranking the most critical sections of the network. The safety conditions of an infrastructure of roads can be determined as a function of accidents, injuries, fatalities and exposure to risk and depend on road and traffic characteristics. In this analysis safety conditions for each road section are measured on the basis of several criteria including number of accidents, state of road maintenance, curvature, grade, access-point density. Values of the criteria are obtained from on-site measurements. This analysis is based on a comparison of criteria and alternatives. It identifies priorities for safety interventions. The road sections have been hierarchically ranked, according to the priority of interventions for improving safety conditions.

66. DRIVER BEHAVIOR CHARACTERIZATION IN ROUNDABOUT CROSSINGS

Bastos Silva A.^(a*), Santos S.^(a), Vasconcelos L.^(c), Seco Á.^(a), Silva J.^(b)

(a) University of Coimbra, Coimbra, Portugal

(b) Polytechnic Institute of Leiria, School of Technology and Management, Leiria, Portugal

(c) Polytechnic Institute of Viseu, Viseu, Portugal

Abstract

Roundabouts are widely accepted for their safety, capacity and environmental advantages over other types of at-level intersections. Usually, a well-designed roundabout has the capability of reducing the approach speeds at all entries, regardless of their hierarchical rank. This often leads to the adoption of roundabouts as important instruments of traffic calming and speed management strategies.

Although it can be easily recognized that the approach and crossing speeds are mostly related with the roundabout geometry, there are few studies on this subject. A better understanding of the relation between geometry and driver behavior would help traffic engineers to choose the most appropriate layout under a multi-criteria approach, namely to account for safety, capacity, comfort and environmental aspects.

This paper presents a detailed characterization of the driver behavior while crossing three consecutive double-lane roundabouts in an arterial road of an urban network. The analyses are based on a database of field measurements, collected with an instrumented vehicle able to systematically gather a set of variables related to the vehicle kinematics. The work is based on a small sample of drivers and focuses on the crossing movements in free-flow conditions.

Driver behavior was described in three main levels: i) speed profiles along the circuit, ii) lateral acceleration profiles, iii) roundabout geometry. The data analysis was supported by

statistical techniques, namely ANOVA analysis hypotheses tests and regression techniques. It is shown that roundabouts can substantially reduce speed in the negotiation zone, but their ability to homogenize drivers' behavior is not clear. The roundabouts' upstream to downstream length influence, as well as the entry speed, depends on the desired speed in the upstream sections as well as on the roundabout geometric characteristics.

67. CALIBRATION OF MICROSIMULATION MODELS – THE EFFECT OF CALIBRATION PARAMETERS ERRORS IN THE MODELS' PERFORMANCE

Figueiredo M.^(a), Seco Á.^(a), Bastos Silva A.^(a*)

(a) University of Coimbra, Department of Civil Engineering, Coimbra, Portugal

Abstract

The need to safeguard a good level of service of the global transport system is one of the biggest challenges that transport authorities face. Simulation models can, in many situations, give an appropriate answer.

However, the capacity of a simulation model to represent the reality with a high level of accuracy depends significantly on the effort and resources used, particularly in the stages of data collecting and model coding, calibration and validation. Each one of these stages demands significant human and economic resources. The calibration efforts cannot be undervalued, because there is a risk of the modelling results being completely inadequate in practice.

Within this context, the current paper focus on the calibration phase. A sensitivity analysis is carried out to test how the expected accuracy of the traffic microsimulation models' outputs can be affected by different errors' types and degrees in the estimation of calibration parameters.

The methodological approach was based on the systematic introduction of errors in some of the most significant calibration parameters. The considered errors ranges were in accordance with typical errors in traffic modelling processes, but,

in some cases, extreme values were also used, in order to potentiate the search for patterns in the results. The study was supported by a traffic signal intersection case study and by the AIMSUN microsimulation software application. These analyses consisted in three separated but sequential steps: (i) evaluation of the level and pattern of the impact of individual errors in a limited set of calibration parameters; (ii) evaluation of the combined effect resulting from the simultaneous introduction of errors in several calibration parameters; (iii) evaluation of the errors' impact dependency on the road networks' saturation levels.

The results showed to be interesting and potentially useful in practice. It was possible to establish the different relations between the level of the calibration parameters errors, and corresponding errors in the simulated results. The significant importance of the parameters "reaction time" and "minimum distance between vehicles" was confirmed, while, at the same time, the parameter "maximum acceleration" showed to have only a residual importance in the quality of the results. A nearly additive effect of the errors introduced was also observed in the case study, when these were simultaneously introduced in more than one calibration parameter. Finally, as suspected, it was confirmed that calibration errors tend to have a bigger impact when the network saturation level is higher.

68. MULTI-OBJECTIVE OPTIMIZATION IN DIAL-AND-RIDE PUBLIC TRANSPORTATION

Guerriero F.^(a), Pezzella F.^(b), Pisacane O.^(b*), Trollini L.^(b)

(a) University of Calabria, Department of Mechanical Engineering, Energy Engineering and Management, Rende, Italy

(b) Polytechnic University of Marche, Department of Information Engineering, Ancona, Italy

Abstract

In the Dial-And-Ride public transportation systems, each customer requirement is specified

in terms of a pickup (origin), of a delivery (destination) and of a time window within it has to be satisfied. The aim is to find a set of routes, each assigned to a vehicle, in order to satisfy the set of requests, under capacity, time windows, precedence and pairing conditions. In fact, it is usually assumed that the service demand of a request, picked up at its origin, is exactly delivered at its destination (one-to-one service) and that the fleet of the vehicles is based at a single-depot. From a modeling point of view, the problem could be addressed as a one-to-one capacitated Pickup and Delivery Problem with Time Windows (PDPTW) and therefore, the mathematical formulation presents, beyond the traditional capacity constraints on the vehicles, also the pairing, the precedence and the time windows conditions. In particular, the pairing conditions guarantee that each couple (pickup, delivery) has to belong to the same route while the precedence constraints impose that each pickup has to be served before the associated delivery. The contribution of this paper mainly consists in addressing the problem with the aim of finding a set of feasible routes by optimizing, at the same time, two objectives such as the maximum ride time and the total waiting time. Therefore, a bi-objective time constrained PDPTW is proposed and solved by implementing a two-step approach. In particular, the first step heuristically determines a set of feasible routes, used by the second step based on a set partitioning mathematical formulation and the constraint method to generate efficient solutions. The control parameters of the heuristics, used in the first step, are properly set by adopting a F-Race based approach. Computational experiments on some benchmark instances are carried out to assess the behavior of the proposed approach in finding good quality Pareto Efficient solutions.

70. SMARTPHONE APPLICATION FOR ASSESSING VARIOUS ASPECTS OF URBAN PUBLIC TRANSPORT

Simonyi E.^(a*), Fazekas Z.^(a), Gáspár P.^(a)

(a) Institute for Computer Science and Control, Budapest, Hungary

Abstract

A smartphone application (i.e., an app) developed for facilitating the assessment of urban public transport services is presented and its applicability and versatility is demonstrated in the paper. The app was developed for the iOS platform and is being tested in conjunction with some concrete assessment tasks. The app takes spatiotemporal measurements of the motion of an individual vehicle with the help of the smartphone's built-in GPS and inertial sensors and logs the vehicle trajectory, velocity and acceleration data. The acquired vehicle data is then processed, visualized and analyzed according to the concrete requirements. Apart from establishing features like average vehicle speed over a particular route, duration of the service and average waiting time at stops, many other features can be derived from the vehicular motion data gathered by the app. The longitudinal acceleration data, for instance, can be used to detect strong braking events. If braking data is collected over a longer period of time, frequent braking events that occur at particular road/track locations mark dangerous locations. Braking data can also be used to assess driver behavior and passenger discomfort. The latter is particularly important for elderly people, people with certain health conditions, and for people with mental or physical disabilities. The collected vertical acceleration data can be used to identify road/track faults and can be used to assess the vibration load to passengers. The trajectory, speed and vibration data can be used to profile routes in geodesic sense, according to road quality and according to passenger/driver vibration load. Samples of the data collected and evaluated are presented in conjunction with public transport services in Budapest, Hungary.

75. ON THE ORIGIN OF STATISTICAL MICRO-DISTRIBUTIONS IN SOCIO-DYNAMICAL SYSTEMS

Krbalek M.^(a*)

(a) Czech Technical University (FNSPE), Czech Republic

Abstract

Statistical analysis of microscopic quantities detected inside of various socio-dynamical ensembles shows many common features. To be more specific, headway distributions measured among succeeding agents in such systems reflect both, a level of mutual agent repulsion/attraction and a level of stochasticity of the system investigated. To what extent are these distributions affected by the interaction rules? We will demonstrate (by means of Random Matrix Theory approaches) that a more important factor influencing the resulting statistics is a statistical nature of socio-dynamical systems. We will present a surprisingly general scheme of agent dynamics producing the same statistical micro-distributions as those being revealed in empirical data.

76. SUSTAINABLE TRANSPORT: USING DRIVER VERBAL PROTOCOLS TO IDENTIFY HIGHWAY DESIGN DEFICIENCIES

Ventsislavova-Petrova P.^(a), García-Fernández P.^(a), Castro C.^(a), Horberry T.^(b)

(a) University of Granada, Granada, Spain

(b) University of Cambridge, Cambridge, United States

Abstract

Road safety audits and related documents are often used to design a new road, assess a road before it is opened to the public, or to audit an existing highway. Whilst such road audits and design guidance are of critical importance, it is hypothesized that a driver-centred approach by means of ‘psychological road audits’ could be beneficial for the safe road design process. The aim of this ongoing research is to develop both a

psychological road auditing process and associated best practice human factors principles for roadway design. The methodology being developed currently consists of three main components: firstly, a naturalistic driving study, in which participants drive along the road being audited; secondly, experimenters perform an analysis of the main driving tasks, and finally, a driver workshop to identify road design deficiencies and develop user-centred design improvements. The project is a new Australian-Spanish-UK collaboration. Initial driver verbal protocol data have been collected using a newly-opened highway in Granada, Spain: this road had a mixture of driving tasks, such as intersections and multi-lanes, plus has a comparatively high accident rate. A range of experienced and novice drivers have driven the 10km route and had their verbal responses recorded. Although this research is still in its early stages, the approach used here, of providing a structured means of driver-centred safe highway design is producing potentially valuable results. The benefits of using driver verbal protocols to identify high design deficiencies will be fully discussed in this presentation.

77. SITUATION AWARENESS OF SPANISH DRIVERS: MEASURING THEIR ACCURACY ON THE HAZARD PERCEPTION TEST

Peña-Suárez E.^(a), Gugliotta A. A.^(a), Ventsislavova-Petrova P.^(a), García-Fernández P.^(a), Padilla J. L.^(a), Castro C.^(a)

(a) University of Granada, Granada, Spain

Abstract

Detecting traffic hazards is an essential task in driving and is the only specific driving ability that correlates with a lower crash risk. This work aims to developing a reliable Hazard Perception Test (HP-WHN) at the Spanish driving context and to explore the differences between drivers with different driving experience (learner, novice, short experienced and expert drivers) and

different record of driving offences: (non-offender and re-offender drivers, those who have lost their driver's license points partially or totally according to the current Spanish penalty point system). Our proposal is based on Endsley's (1995) Situation Awareness (SA) model, which is composed by three levels: perception of the elements in the environment, comprehension of their meaning and projection of their status in the near future. In our study, the level of SA was measured. It was obtained a score for the identification of the source of the hazard (e.g. a pedestrian); a score for the location of the source (e.g. on the left of the road); and a score for the prediction about the future (e.g. steps into the road in front of the car) (i.e., Jackson, Chapman and Crundall, 2009). The sample consisted of 121 participants from Granada, SPAIN (69 men and 52 women) and mean age was 27.52. Mean comparisons were used to measure mean total and mean question scores. The results confirmed that HP-WHN demonstrates an acceptable internal consistence ($\text{Alpha}=0.750$) with its eleven videos, whose discrimination index is greater than 0.30. In addition, it was found that learner drivers were significantly worse than experts in their hazard perception and when it was required to identify and locate the danger. No significant differences were found between novice and short experienced drivers (less than 8 years of driving experience) and not significant differences were found between the re-offender and non-offender groups. The highest scores were obtained on the question: What is the danger? Then, the medium scores were obtained on the question: Where is the danger? And the lowest scores were obtained on the question: What happens next? Therefore, we can conclude that the new test is reliable and it discriminates between different types of drivers. It was found that driving experience improves hazard perception. And further research should explore why re-offenders are not secure drivers, although they show an acceptable performance on the Hazard Perception Test.

78. IDENTIFYING PRIORITY AREAS FOR THE IMPROVEMENT OF URBAN TAXI SERVICE QUALITY

Wong R.C.P.^(a*), Szeto W.Y.^(a), Wong S.C.^(a)

(a) The University of Hong Kong, Department of Civil Engineering, Hong Kong

Abstract

For measuring customer satisfaction on service quality, a guideline had been introduced by Transportation Research Board in 1999 [1]. It recommended methods to public transit agencies for identifying the determinants of service quality from the customers' perspective. del Castillo and Benitez [2] further investigated and compared three different methods to determine the relationship between global satisfaction rating and specific satisfaction ratings on numerous service areas. However, most of these efforts were focused on evaluating the service quality of public transit modes. As far as the authors know, no comprehensive study was carried out for evaluating the service quality of urban taxis. Taxi operators could not adequately monitor their performances and effectively allocate their resources for improvements. To address these problems, this study aims to evaluate urban taxi service quality and hence identify priority areas for improvement. A customer satisfaction survey was conducted to interview 1,008 taxi customers from January to March 2013 in Hong Kong. The respondents were invited to give specific satisfaction ratings on ten service areas and a global satisfaction rating on overall taxi service quality, as well as to rank the importance of the service areas affecting the global satisfaction rating. The ten service areas were included but not limited to time consumptions of taking taxis, services and facilities provided for finding taxis, taxi internal environment, and personal services provided by taxi drivers. Based on the collected survey data, a multiple linear regression model was then developed. The model results demonstrate the average satisfaction and importance ratings on each of the ten service areas, and hence help us

identifying the priority areas for service quality improvement. The findings show that the highest priority should go to improving customers' waiting time for taxis, and facilities of taxi stands and difficulties of hailing taxis on streets should also be improved if resources are allowed. This paper also discusses the potential policy implications in Hong Kong, and those can also be applied for other international cities with similar urban taxi services provided.

References: [1] Morpace International, Inc., and Cambridge Systematics, Inc. (1999) TRCP Report 47: A handbook for measuring customer satisfaction and service quality. Transportation Research Board of the National Academies, Washington, D.C., United States. [2] del Castillo, J.M. and Benitez, F.G. (2013) Determining a public transport satisfaction index from user surveys. *Transportmetrica A: Transport Science*, 9 (8), 713-741.

79. REAL-TIME ESTIMATION OF CRITICAL ACCUMULATION IN PERIMETER FLOW CONTROL FOR MAXIMUM NETWORK THROUGHPUT

Ampountolas K.^(a*), Kouvelas A.^(b)

(a) University of Glasgow, School of Engineering, Glasgow, United Kingdom

(b) University of California, Partners for Advanced Transportation Technology, Berkeley, United States

Abstract

Perimeter flow control or gating has recently been found to be a practical and efficient control scheme in mitigating traffic congestion in urban road networks. This control scheme aims at stabilising the accumulation of vehicles (or a proxy of accumulation, e.g. average occupancy or density) of the macroscopic or network fundamental diagram near critical accumulation (set point) to achieve maximum network throughput. Nevertheless, the maximum throughput (capacity flow) in urban road networks may be observed over a range of accumulation-values in contrast to motorway traffic where capacity flow is deemed to occur for

a (more or less) specific density value. In this work, an extension of a previously proposed real-time feedback perimeter flow control strategy is proposed that allows the automatic monitoring of the critical accumulation to help maintain the accumulation near the optimal range of accumulation-values, while network's throughput is maximised. To this end, we design a Kalman filter-based estimation algorithm that utilise real-time measurements of circulating flow and accumulation of vehicles to produce estimates of the currently prevailing critical accumulation. The developed strategy may be valuable whenever the network fundamental diagram is not well defined and the critical accumulation cannot accurately be specified or is subject change due to traffic-responsive signal control, traffic composition (e.g. cars versus buses), or non-recurrent day-to-day traffic patterns. Preliminary results indicate good estimation accuracy and performance, and rapid tracking behaviour.

80. A NEW TAXONOMY OF SMART CITY PROJECTS

Perboli G.^(ab*), De Marco A.^(c), Perfetti F.^(a), Marone M.^(d)

(a) Polytechnic University of Turin, DAUIN, Turin, Italy

(b) Canada Research Chair in Distribution Management (CIRRELT), Montreal, Canada

(c) Polytechnic University of Turin, DIGEP, Turin, Italy

(d) Mondelez Italia Biscuits Production S.p.A, Italy

Abstract

City logistics proposes an integrated vision of freight transportation systems within urban area and it aims at the optimization of them as a whole in terms of efficiency, security, safety, viability and environmental sustainability. Recently, this perspective has been extended by the Smart City concept in order to include other aspects of city management: building, energy, environment, government, living, mobility, education, health and so on. Thus, Smart City proposes a holistic vision of future communities where new intelligent technological tools, services and applications are integrated in a unique platform,

providing interoperability and coordination between these several sectors. Furthermore, Smart City also involves the definition of new governance instruments as well as new public and private funding methods. These new requirements of innovations for cities lead to contemplate and undertake new initiatives. For this reason, last years have seen a significant number of Smart City Projects (SCPs) in all over the world. At the best of our knowledge, a classification of SCPs in the literature that provides a systemic and complete overview of these issues has not been created yet. The importance to have such a classification is the possibility to easily understand success factors and to extract and analyze new trends.

81. ASSESSMENT AND TRAINING OF HAZARD PERCEPTION: CREATING A TOOL ABLE TO EVALUATE DIFFERENT DRIVER PROFILES

**Gugliotta A. A.^(a), Ventsislavova-Petrova P.^(a),
Peña-Suárez E.^(a), García-Fernández P.^(a),
Padilla J. L.^(a), Castro C.^(a)**

(a) University of Granada, Granada, Spain

Abstract

Is it possible to prevent accidents by improving drivers' perception of hazards? There is empirical evidence that the skill of hazard perception is the only specific driving ability that correlates with a lower crash risk (Wells et al, 2008; Horswill, et al, 2010). Hazard perception is the skill of detecting, evaluating and reacting to events on the road that have a high probability of producing a collision (Crundall et al., 2012).

Our research aims to develop the Hazard Perception (HP) Test in the Spanish driving context by creating a tool that is able to evaluate different driver profiles, estimating its psychometric reliability, and carrying out an experimental exploration (Castro et al, 2012); analysing the situational awareness (perception, comprehension and predicting the situation); and the decision-making in dangerous driving

situations. Based on our previous work, we propose:

First, to create a tool that measures the skill of hazard perception and estimates its accuracy. In addition it would be crucial that the test will measure the reaction time and eye movements of participants, using video-based tests featuring real driving footage in a Spanish driving context, although, this measurement is still in its early stages in our lab.

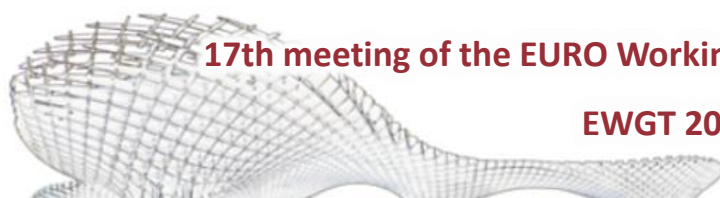
We will then calculate its psychometric reliability, expanding the sample size; refine it, so that all items are sensitive to the experimental manipulations and to the existing differences among the different groups of drivers (drivers with different experience –learners, novices, experts- and driving histories, i.e. re-offenders.

We will analyse the construct validity of the HP Test, exploring the relationship between its results and the accident rates, near misses and traffic offences reported.

We explore the characteristics of the traffic situation videos to work out why some of the videos discriminate better than others between drivers. Different traffic situations are analysed: those where the hazard appears gradually (predictable by relating environmental clues and prior knowledge) and those where it appears suddenly (direct detection), and compared the appearance of only one hazard in the traffic scene (focusing the attention) to the appearance of several hazards (dividing attention).

We analyse the effects of different experimental manipulations: using the commentary training after the What Happens Next assessment, i.e. using self-generated commentaries. We measure the training effect immediately post intervention, in order to explore the effectiveness of training for those groups with less ability to perceive hazards, such as learner drivers, novices and older drivers.

The results will be fully discussed in this presentation.



84. A STATED ADAPTATION APPROACH TO ASSESS CHANGES IN INDIVIDUALS' ACTIVITY-TRAVEL BEHAVIOR IN PRESENCE OF PERSONALIZED TRAVEL INFORMATION

Parvaneh Z.^(a), Arentze T.^(a), Timmermans H.^(a*)

(a) Eindhoven University of Technology, Urban Planning Group, Eindhoven, The Netherlands

Abstract

The rapid and inevitable growth of availability of travel information for travellers has increased expectations among policy makers about the benefits of travel information. It is increasingly expected that providing advanced travel information can trigger particular travel behaviors that would contribute to sustainable mobility. Currently, travel information is mostly descriptive and distributed to a group of travellers. This kind of information just provides information about different alternatives without emphasizing which alternative is better to choose. In addition, it ignores differences between individuals.

However, to induce travellers to behave in particular ways it may be more effective to recommend one best alternative, which is in line with their preferences and habitual activity-travel pattern. In that sense, the increasing availability of smart phones allows one to issue context-sensitive, personal advice. As a result, dedicated personalized recommendations could be provided, considering personal preferences and optimal control strategies. Such new technology, however, requires advanced data collection and a new generation of models about traveller strategic responses. In that regard, stated adaptation experiments are a proper approach to collect data when the technology still is not available to use in practice. In this paper, we evaluate effects of personalized travel information on individuals' activity-travel behavior. To identify those effects, we introduce an innovative stated adaptation approach to

assess possible behavioral changes in the presence of advanced forms of travel information. In the proposed SA approach, first, a detailed profile of individuals' activity-travel pattern for one day is collected. Second, different scenarios are given to subjects, who are asked how they would change their activity-travel pattern under information provision. The provided travel information to each individual is either descriptive or prescriptive. Four scenarios are assigned to each individual. Each scenario is based on attributes of four different variables namely information type, information objective and individuals' perception of travel time. Results of data analysis provide insights into the differential effects of descriptive and prescriptive travel information on activity-travel patterns. In turn, any induced change will provide keys to the effectiveness of travel information for transport demand management.

85. EVALUATION OF PROVIDING RECOMMENDED SPEED FOR REDUCING CO2 EMISSIONS FROM VEHICLES BY DRIVING SIMULATOR

Matsumoto Y.^(a*), Tsurudome D.^(a)

(a) Meijo University, Nagoya, Japan

Abstract

Idling time at a signalized intersection increases the amount of CO2 emissions from vehicles. If drivers would be informed of the signal change prior to the change of the signal ahead from green to amber/red, they could decelerate in advance and reduce their idling times at the intersection. In this study, we develop an information provision system with a 3D driving simulator. The system provides the recommended speed, which is calculated based on the distance from the signal ahead and the current vehicle speed, and the indication to release an accelerator pedal. If a driver follows the recommended speed or the accelerator-off indication, one can pass through the intersection ahead without stopping or reduce an idling time. By this driving simulator, we

verify the effectiveness of providing the information to a driver for reducing CO₂ emissions under some scenarios of the information provision. As a result of the experiments, it was found that the information provision reduced the amount of CO₂ emissions in comparison with the result of no information provided. The maximum reduction of the CO₂ emissions was 6.1% and 5.4% with the accelerator-off indication and the recommended speed, respectively. It indicates that providing the information is effective for reducing CO₂ emissions from vehicles approaching a signalized intersection.

86. INCORPORATING SYSTEMS ENGINEERING METHODOLOGIES TO INCREASE THE TRANSFERABILITY OF JOURNEY PLANNERS

Shoshany-Tavory S.^(a), Gal-Tzur A.^(b), Eden N.^(b)

(a) Technion - Israel Institute of Technology, Gordon Center for Systems Engineering, Haifa, Israel

(b) Anahuac University of North Mexico, School of Business and Economics, Mexico City, Mexico

Abstract

One characteristic that is highly desired in transportation-related applications, and particularly journey planners, is transferability – i.e., the capacity to be used with minimal modification in different locations. To achieve transferability, the initial design must take into account all factors that may diverge between locations, including existing modes of transport, the availability of required data, the technological habits of users, etc. In consequence, a highly transferable system is difficult and expensive to develop and maintain. A very flexible initial design, one ensuring low-cost adaptability of the system for different cities, regions, or countries, might not be cost-effective. On the other hand, a rigid design, tailored for a specific location, might act as a barrier to implementing the system elsewhere. This dilemma has motivated researchers to seek a

structured process for selecting the most promising design, one that will realize the benefits of transferability while minimizing development costs.

One of the fundamental building blocks of structured design in systems engineering is requirements-design exploration. This paper evaluates the use of Multi-Attribute Tradespace Exploration (MATE), a leading design exploration process, for the effective design of journey planners. MATE was chosen for its extended support for changeability evaluation.

We examine the process of changeability assessment (e.g., transferability) in light of the goals of journey planning from the point of view of different stakeholders: travelers, private developers, and transport authorities. The analysis demonstrates how tradespace exploration can also be used to identify specific designs that bridge the gap between the public and private sectors and provide value over time to all parties. Moreover, when specific concerns of public authorities are not met, tradespace exploration can reveal measures the public sector can take (financial or others) for making their preferred design attractive to the private sector as well.

88. ANALYSIS OF CONGESTION PHENOMENA ON THE ONE LANE DROPPED MOTORWAY MERGE WITHOUT RAMP-METERING IN ISTANBUL

Aksoy G.^(a*), Selçuk Ögüt K.^(a)

(a) Technical University of Istanbul, Department of Civil Engineering, Maslak, Turkey

Abstract

Motorway merges are typically congestion areas because of irregularities on lanes between upstream and downstream directions. At motorway merges, it is obvious that when the upstream and/or on-ramp flow is greater than the downstream (bottleneck) capacity, congestion arises. Therefore, queue will form and grow in relation with the demand and bottleneck

capacity. The aim of this paper is to analyze the effect of mainstream and on-ramp flows on the congestion phenomena. As there is no ramp-metering application in Istanbul, on-ramp flow has an excessive effect on the congestion. In this study, macroscopic merge behavior is analyzed at one crucial motorway merge in Istanbul. Traffic data is obtained by Remote Traffic Microwave Sensors (RTMS) operated by the Municipality of Istanbul. RTMS data consists of volume, speed, occupancy and heavy vehicle counts per lane while minimum data collection interval is 2 minutes. Examined motorway merge section, main stream and on-ramp flows are observed by separate RTMS. Whole year weekday data of 2012 is used for analysis. It is seen that upstream flow rate changes from 3360 pcph to 6210 pcph before congestion depends on the on-ramp flow rate that varies from 1755 pcph to 3060 pcph. In addition, on-ramp ratio is found between 0.23 and 0.43 which cause congestion on this motorway merge.

92. A QUANTITATIVE APPROACH TO RISK MANAGEMENT IN CRITICAL INFRASTRUCTURES

Sapori E.^(a), Sciutto M.^(b), Sciutto G.^(cd*)

(a) Italian Center of Excellence on Integrated Logistics (C.I.E.L.I.), Genoa, Italy

(b) SI-Consulting s.r.l., Genoa, Italy

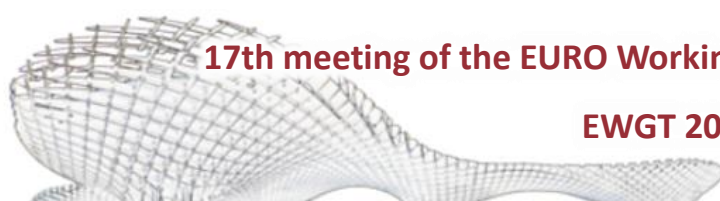
(c) University of Genoa, DITEN, Genoa, Italy

(d) National Interuniversity Consortium for Transport and Logistics (NITEL), Rome, Italy

Abstract

In the last ten years, an efficient Security Management System (SEMS) has acquired an important role for organizations working in transportation sector. In many cases, Critical Infrastructure legislation plans specific and mandatory quality requirements for the implementation of a security management system. The organizations are encouraged by the legislative requirements and the competitiveness to certify the SEMS in accordance with the current international standards (e.g. ISO 27001 and ISO 28000). As well known, certification can

be either a mandatory or a voluntary process but it is usually voluntary and qualitative. In the SEMS, as in other management systems, current certification uses a qualitative approach deriving from the ISO 9000. Normally in certification, quantitative assessment characterizes only some technological systems while every other application including human factor or procedures uses qualitative assessment. The development of security management system certification should bring to introducing risk-based and quantitative assessment methods. Benefits arising from the residual risk quantification of the SEMS can set certification a tool enabling to bargain with insurances, a warranty for the investments undertaken when facing stakeholders and shareholders; a proof to justify decisions during a legal action and last but not least a good publicity for company's image and hence company's competitiveness. This paper proposes the implementation of risk-based methodologies in use by process engineering to achieve a quantitative assessment of security management systems. The methodology will be exposed and apply to a railway case study. The first steps show how to analyze the system (study of macro operability functions, identification of subsystems, etc.) and how to integrate technological, human and procedural aspects by a flow chart. The later steps describe how to manage threats, vulnerability and criticality of Critical Infrastructure subsystems and how to identify "primary causes" and "Top Event consequences" drawing fault trees and event trees, and finally how to calculate the residual risk for security management system. In conclusion, the methodology is applied on a case study of one railway subsystem and the results of the quantitative risk analysis are exposed.



95. MODELS FOR THE HAZARDOUS GOODS RAILWAY TRANSPORTATION IN SPAIN CONSIDERING THE EFFECT OF THE CATCHMENT AREA OF THE STATION

Del Castillo J. M.^(a*), Caceres N.^(a), Romero L. M.^(a), Benítez F. G.^(a)

(a) University of Seville, Transportation Research Group, Seville, Spain

Abstract

The determination of the catchment area is an essential step when building a transportation demand model. The purpose of this work is the development of a generation and attraction model for the rail transport of hazardous goods in Spain. The observations for the model correspond to the volume of hazardous goods carried between the railway stations of ADIF, the Spanish rail network administrator. Another model has also been developed for those flows having origin or destination in the railway stations located in Andalusia, the southernmost region of Spain.

For the model at a national scale, several explanatory variables of economic type were selected from [1]. An additional detailed source of explanatory variables in the form of electricity consumption by different economical sectors was obtained from the Ministry of Industry, Energy and Tourism. These variables were all of them at a provincial level. When a model was fit using these variables, the relatively poor goodness of fit suggested that the area of influence or catchment area of each station could be substantially different from the province where it was located. Therefore, in order to improve the fit of the model it was assumed that the area of influence of each station was directly related to the distance to the province capitals. Specifically for each station a new set of explanatory variables was obtained by weighting the original province level variables according to the distance to the station and to a weighting exponent. This exponent was considered to be equal for all the stations and reflects the decay effect of the

catchment area with the distance from the station. The quality of the model fit with the new distance weighted variables is remarkably improved.

For the model of Andalusia, the explanatory variables were obtained at the municipal level. For this model, the determination of the catchment area of each railway station was done by weighting the explanatory variables by the distance from each town to the station with a similar weighting function specified by a decay exponent. The goodness of fit obtained by the weighted model improved the results dramatically. In conclusion, with both models, the national and the regional one, the transformation of the explanatory variables by means of a distance decay function allows to assess adequately the catchment area of the railway stations considered in the model.

[1] Anuario económico de la Caixa, 2012.

96. ENABLING A TWO-WAY CARSHARING SYSTEM TO PROVIDE ONE-WAY SERVICE

Jorge D.^(a), Barnhart C.^(b), Correia G.^(a)

(a) University of Coimbra, Department of Civil Engineering, Coimbra, Portugal

(b) Massachusetts Institute of Technology, Department of Civil and Environmental Engineering, Cambridge, United States

Abstract

One-way carsharing seems to be suitable for more trip purposes than two-way carsharing. Thus, the objective of this study is understanding if a carsharing system that is currently working as a two-way carsharing system is able to support one-way trips for specific origin-destination pairs profitably and determine how it should be planned and managed. For this purpose, a mathematical model is developed and applied to the case study of Zipcar, in Boston, MA, USA, in which one-way trips are allowed from all the existing stations in the city to the Logan airport and vice-versa. Through the results, it is concluded that this integrated approach can be profitable and the number and location of stations, pricing plan considered, and demand

forecasted are important variables to take into consideration in the implementation and operation of these services.

98. TRAVEL PATTERN OF THE ANDALUSIAN POPULATION, REGARDING TO DIFFERENT DAILY ACTIVITIES: TRAVEL TO WORK, STUDIES, HOUSEHOLD RESPONSIBILITIES AND LEISURE

Olmo Sánchez M. I.^(a*), Maeso E.^(a)

(a) University of Malaga, Transportation Management Unit, Malaga, Spain

Abstract

This paper analyzes the travel pattern of the Andalusian population. Specifically we study both the average number of journeys by different daily activities and the distances and average time spent on them. In order to establish to what extent the potential differential patterns observed, are conditioned by variables which can characterize different population segments.

So we have established mobility patterns by gender, age, size and density of the town, number of household members, educational level, employment status and household income. We have also worked to identify socioeconomic variables that may help explain the relative differences in the performance of journeys to different activities.

The results highlight that, overall, women perform more trips than men, regardless of the reason. Moreover, the difference between the number of trips made by women and men is significant, when the reason for the trip is about household responsibility. We also find that in working trips, men are who perform most of them, besides these trips are considerably longer than those by women, who generally opt for closest jobs to home, although time spent on these trips it is similar for both parties. As for journeys to leisure activities or household responsibilities, we have observed how in general women and men choose significantly closer to home destinations.

Regarding employment status and other socioeconomic characteristics analyzed (size and population density, household income, etc. ..). They condition significantly the number of trips and distance and time spent.

99. SIMULATING CARSHARING OPERATIONS THROUGH AGENT BASED MODELLING: AN APPLICATION TO THE CITY OF LISBON, PORTUGAL

Mendes Lopes M.^(a), Martínez L. M.^(a), Correia G.^(b)

(a) University of Lisbon, Instituto Superior Técnico (IST), Lisbon, Portugal

(b) University of Coimbra, Department of Civil Engineering, Coimbra, Portugal

Abstract

The increasing use of automobiles has had significant negative impacts on urban life: pollution, excessive energy use and time lost in traffic. The quick rise of auto externalities has policy makers facing the hard challenge of balancing demand for mobility on the one hand, and assuring sustainable urban life on the other. One strategy that can aid reducing these externalities is carsharing. Carsharing typically involves a fleet of vehicles in stations around a city, which clients may use on an hourly payment basis. Classical round trip systems only address a niche market of urban trips such as shopping and errands, and few companies have risked the one way carsharing option in the past due to vehicle stocks imbalance. Currently these systems are gaining new attention with important car builders investing in providing the one way market in many cities in Europe and the United States. Nevertheless, there is still great uncertainty on the financial and economic viability of this type of carsharing. This results from a lack of realistic modeling tools that allow testing several operational parameters of this transportation alternative. In this paper we present a very detailed and realistic model to assess the potential of one way carsharing systems done through the use of agent based simulation. The

simulation incorporates a stochastic demand model discretized in time and space and a detailed road network. It aims to assess the economic performance of the system both from the users' perspective and the carsharing operator. The performance is a function of several planning and operational decisions which are included in the model: vehicle relocation policies to support one way cars haring; station or free parking areas location decision; pricing policies; vehicle technology and electric mobility infrastructure. So me lower level configurations are also analyzed, such as an information system, vehicle reservation and maintenance operations scheduling. This paper focuses on the analysis of the spatial distribution and fleet size impacts on the demand for this transport option. This model was developed for the city of Lisbon, but its flexible architecture allows it to be adapted to different cities. Therefore this may become a tool that government authorities can use to rigorously estimate carsharing impacts and at the same time help private companies to manage their systems better.

101. OFFSET OPTIMISATION OF TRAFFIC LIGHTS IN URBAN ROAD NETWORKS ASSESSMENT OF ENVIRONMENTAL IMPACTS

Friedrich B.^(a*)

(a) Technical University of Braunschweig, Institute of Transportation and Urban Engineering, Braunschweig, Germany

Abstract

In order to reduce pollutant immissions the European Union introduced thresholds with respect to the concentration of air pollutants, which – in the recent version - were implemented into the national German legislation in 2010. However, for the achievement of the environmental objectives the public authorities dispose only over a limited number of effective instruments and although having introduced low emission zones for car traffic a number of German cities failed to meet the thresholds yet. Given this situation environment oriented traffic

management measures and in particular signal light control become more relevant. This paper presents the results of an analysis which investigated the environmental impacts of the coordination of signal lights in urban roads and gives an idea of the environmental benefits which could be achieved by a classical traffic management measure.

103. DECENTRALIZED SPATIAL DECOMPOSITION FOR TRAFFIC SIGNAL SYNCHRONIZATION

Adacher L.^(a), Gemma A.^(a), Oliva G.^(b)

(a) Roma Tre University, Department of Engineering, Rome, Italy

(b) Roma Tre University, Complex Systems & Security Laboratory, Rome, Italy

Abstract

The Traffic Signal Synchronization is a traffic engineering technique of matching the green light times for a series of intersections to enable the maximum number of vehicles to pass through, thereby reducing stops and delays experienced by motorists. Synchronizing Traffic Signals ensures a better flow of traffic and minimizes gas consumption and pollutant emissions. In this paper we provide a solution to the traffic signals problem via simulation. The objective function used in this work is a weighted sum of the delays caused by the signalized intersections, and it is calculated by platoon model. Urban signal timing is a non-convex problem and finding an optimal solution for not very small and simple networks may take long time, wherever possible. For this reason we propose a spatial decomposition of the network, it is obtained by the distributed consensus algorithms. In this paper we provide a distributed communication architecture for a network of smart traffic lights. Each semaphore shares information in a fully distributed way, only with its neighbors according to the topology of the communication network, hence avoiding to resort to a central authority. Given the subnetwork a surrogate method is applied to

solve the Traffic Signal Synchronization problem.

105. ROAD GRADE INFLUENCE ON EXHAUST EMISSIONS OF A SCOOTER FUELLED WITH BIOETHANOL/GASOLINE BLENDS

Prati M. V.^(a), Costagliola M. A.^(a*), Tommasino C.^(a), Della Ragione L.^(a), Meccariello G.^(a)

(a) National Research Council, Institute of Engine, Naples, Italy

Abstract

Recently, the International Agency for the Research on Cancer has assessed the evidence that the exposure to outdoor air pollution causes the lung cancer, being able to increase risk of bladder cancer. Since the air pollution in urban areas is mainly caused by transport, it becomes necessary to evaluate pollutant exhaust emissions by vehicles and scooters during their real use. Laboratory tests, besides the high repeatability of results, often cannot explain the influence of some parameters such as ambient conditions, traffic congestion and road gradient. With this aim an experimental activity was carried out in order to study the effect of road gradient on the exhaust emissions of a medium displacement scooter which represents a very used mean of transport in Southern Italy. First of all, the scooter was instrumented with a Global Positioning System (GPS) for acquiring speed profile and position along an urban route of Napoli city, characterized by a great change in the road gradient. The velocity profile has several missing points due to the loss of the GPS signal in some stretches of road with tall buildings. So the road gradient values was built with an algorithm to synchronize data missing through the Google elevation API based on a model of the same path with complete data. After that some representative values of slope for each kinematic sequence/driving cycle could be evaluated and these new variables could contribute to individuate real representative driving cycle. The

resulting real-world driving cycle was tested on chassis-dynamometer able to continuously simulate the exact road gradient. A series of experimental tests with and without road gradient simulation were performed in order to evaluate the influence of road gradient on the exhaust emissions of carbon monoxide, total hydrocarbons, nitrogen oxides and carbon dioxide. This analysis was realized by fueling the two-wheeler vehicle with a commercial gasoline and two blends with a maximum bioethanol content of 20%vol. Gaseous emissions were correlated with vehicle specific power (VSP), the most used parameter for taking into account the road gradient together with the kinematic characteristics of driving cycle and the vehicle characteristics. This kind of gradient analysis, through a multivariate statistical approach, can permit to correlate the emission profiles in a specific road position, and so it could be evaluated its influence on their behaviour. A strict dependence of carbon dioxide emissions and fuel consumption by VSP exists. Road gradient greatly increases the vehicle power demand, involving an increasing of fuel consumption for kilometer driven.

106. CALIBRATION FRAMEWORK BASED ON BLUETOOTH SENSORS FOR TRAFFIC STATE ESTIMATION USING CTM-V AND ENKF

Allström A.^(ab), Bayen A.^(c), Fransson M.^(ab), Gundlegård D.^(a*), Patire A.^(c), Rydergren C.^(a), Sandin M.^(a)

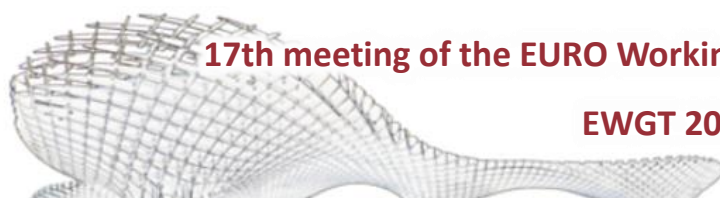
(a) Linköping University, Department of Science and Technology, Norrköping, Sweden

(b) Sweco TransportSystem, Stockholm, Sweden

(c) University of California, Berkeley, United States

Abstract

The velocity based cell transmission model (CTM-v) is a discrete time dynamical model that mimics the evolution of the traffic velocity field on highways. This model is used together with an ensemble Kalman filter algorithm for the purpose of velocity sensor data assimilation. The quality



of the output produced by this modeling system is highly dependent on the values of its parameters. Therefore, the model needs to be calibrated. In this paper we present a calibration framework for the velocity based cell transmission model (CTM-v) and ensemble Kalman filter. The framework consists of two separate techniques, one for calibrating the parameters of the fundamental diagram using a minimum square approach, and the other is based on a gradient free optimization method, for calibrating demand and filter parameters. The fundamental diagrams are calibrated based on stationary radar sensors of speeds and flows, and the demand and filter parameters are calibrated based on travel times collected from Bluetooth-based sensors. The CTM-v and Kalman filter constitutes the major parts of the Mobile Millennium Stockholm system. The calibration framework is evaluated, and the results from the calibrated model are presented for a highway stretch north of Stockholm, Sweden. The results from the calibration framework is a first step towards a travel time estimation model, which in the future, can be used in a travel time prediction framework.

107. COMPARISON BETWEEN VEHICLE SPEED PROFILES ACQUIRED BY DIFFERENTIAL GPS AND UAV

Salvo G.^(a), Caruso L.^(a), Scordo A.^(a*), Guido G.^(b), Vitale A.^(b)

(a) University of Palermo, Department of Civil, Environmental, Aerospace and Materials Engineering, Palermo, Italy

(b) University of Calabria, Department of Civil Engineering, Rende, Italy

Abstract

Traffic microscopic simulation models are able to represent traffic conditions and their evolution over time. They take into account the geometrical aspects of transport infrastructures, driver behavior and, step by step, the vehicles' movements on the road network. The most widespread applications of these models are referred to accident management, route guidance

problems (possibility of evaluating control strategies in real time), adaptive control of traffic-light and ramp metering (management and control of the ramps and flow).

To accomplish this goal observational data of vehicles' kinematic characteristics have to be acquired. These elements are not always easily available. In scientific literature there are several techniques for the detection of traffic flow characteristics that are generally classified in: 'infrastructure-based' techniques with fixed devices (intrusive or non-intrusive), and 'non infrastructure-based' techniques, that employ mobile devices such as probe vehicles or detection systems with cameras.

The aim of this paper is to compare speed profiles of probe vehicles acquired at the same time with two different 'non infrastructure-based' survey methods. The first one, commonly used in several scientific research, is based on positioning data recorded by a GPS unit. In this work, a differential GPS installed on board is used to improve data position accuracy. The second one is based on the assumption that it is possible to acquire kinematic characteristics of vehicles by a video camera mounted on an Unmanned Aerial Vehicle (UAV) that resumes study area from the nadiral point of view. Some Ground Control Points (GCP) are positioned inside the investigated area to minimize the errors of video processing analysis. Frames extracted from the video, and consequently georeferenced, are useful to obtain speed profiles of the analyzed vehicles. These last steps are essential to minimize position errors due both to wind and to rotors vibrations.

Further aim of this study is to determine the minimum number of GCP that minimizes the difference between speed profiles acquired by UAV and differential GPS.

108. A SEMANTIC-ENHANCED AUGMENTED REALITY TOOL FOR OPENSTREETMAP POI DISCOVERY

Ruta M.^(a*), Scioscia F.^(a), De Filippis D.^(a), Ieva S.^(a), Binetti M.^(b), Di Sciascio E.^(a)

(a) Polytechnic University of Bari, Department of Electrical and Information Engineering (DEI), Bari, Italy

(b) Polytechnic University of Bari, Department of Civil, Environmental, Planning, Construction and Chemicals Engineering (DICATECh), Bari, Italy

Abstract

The Augmented Reality (AR) is often said to have the potential for a revolution in the way we discover Points Of Interest (POIs) and experience our cities. Nevertheless, to date the AR promise has only partially become true, because the information content supporting location-based resource discovery is usually shallow. Semantic-based technologies allow expressing rich, accurate and meaningful descriptions of POIs, so helping in improving the quality of discovery.

Building upon a general framework for the semantic annotation of nodes in the crowd-sourced OpenStreetMap (OSM) cartography, a novel discovery tool in AR is proposed for mobile devices. Based on the user's personal profile, it shows markers for POIs in the field of sight upon the real-time device camera view. The tool performs automatically a semantic matchmaking between the user profile and the resource descriptions extracted from OSM. Both are expressed according to common reference ontology. The tool displays the results of matchmaking without user effort, by color-coding the markers. The user can select a marker to see the complete annotated description of the POI as well as matching, missing and conflicting elements with respect to her profile.

A fully functional tool prototype was developed for Android mobile devices. Its context-aware user interface makes advanced discovery practical and seamless. A case study was conducted in the city of Trani of the Apulia region in Italy to assess the effectiveness of the proposal.

110. REAL-TIME TRAFFIC SIGNAL SETTINGS AT AN ISOLATED SIGNAL CONTROL INTERSECTION

Vilarinho C.^(a*), Tavares J. P.^(a)

(a) University of Porto, Research Centre of Land, Transport and Environment - Department of Civil Engineering, Porto, Portugal

Abstract

In this paper, we present a method for signal traffic control including simultaneously signal plan design and signal timing optimization with real-time information on the network dynamics. The problem is formulated so as to find the signal plan design, the duration of green time and inter-green time for each signal group in response to recurrent traffic flow fluctuation at an intersection. The approach used was the group-based Akçelik method for determining critical path, cycle length and green time split for each possible signal plan design. The signal plan design selection was formulated to minimize the total delay.

The resulting algorithm was coded in Java and used TraSMAPAPI to dynamically link it to Aimsun's API, which allows an automatic change of the signal settings at an isolated signal control intersection.

A theoretical three arms intersection with a changing Origin-Destination demand example is tested to demonstrate the proposed method.

The paper contributes to the development of integrated design of signal plan design and signal timings. The proposed method aims to be sufficiently general for its application in the different networks, with few inputs dependent on the local geometry layout. This strategy is able to react to non-schedulable events or unpredictable events without requiring human manipulation.

111. FLOW RATE EFFECTS ON VEHICLE SPEED AT TWO WAY-TWO LANE RURAL ROADS

Rossi R.^(a*), Gastaldi M.^(a), Pascucci F.^(a)

(a) University of Padova, Department of Civil, Environmental and Architectural Engineering, Padova, Italy

Abstract

The flow characteristics of a cross-section are identified by time headway and vehicle speed distributions over time. Knowledge of both headway and speed distributions plays a significant role in several fields of traffic flow analysis and simulation. In particular, we refer to operative analysis of road facilities in interrupted and uninterrupted flow conditions.

This work identifies typical vehicle speed probability density functions (pdf's), for two-way two-lane road segments. The scarcity of empirical findings on these distributions in the literature (particularly for two-way two-lane roads) was one of the reasons for the study.

The endogenous traffic parameters considered to affect speed distributions, flow rate and flow composition were taken into account.

Mixture models for vehicle speeds were estimated. The data used for statistical analysis of headway and speeds came from traffic observations carried out on the rural road network of the province of Verona (north-east Italy). In the case in question, regardless of traffic conditions, the Skew-T single model turned out to be the one which best fitted the observed phenomena.

The effect of flow rate in both directions (analysed and opposite) on vehicle speed distributions was also analysed. As expected, in all traffic conditions, the curves move to the left and become narrower as the flow rate increases. This effect seems to be less pronounced, where we measure the effect of the opposite flow rate.

112. EVALUATION OF AIR POLLUTION IMPACTS OF A SIGNAL CONTROL TO ROUNDABOUT CONVERSION USING MICROSIMULATION

Gastaldi M.^(a*), Meneguzzo C.^(a), Rossi R.^(a), Della Lucia L.^(a), Gecchele G.^(a)

(a) University of Padova, Department of Civil, Environmental and Architectural Engineering, Padova, Italy

Abstract

Traditionally, the comparison between alternative types of road intersection control has focused on efficiency and safety. In recent years, the increasing importance of air pollution produced by vehicular traffic has suggested that environmental considerations should be added to the above aspects as a criterion for intersection design. Situations in which a conversion of traffic control type (e.g. signal to roundabout) is applied to an existing intersection are frequent in real networks, and it is interesting to evaluate how pollutant emissions may change as a result. The increasing availability of micro simulation software and emission models makes it now possible to conduct such detailed analyses at an operational level. The research described in this paper focused on a comparison of a roundabout and a signal-controlled intersection in terms of environmental performance. A real road intersection where a roundabout has replaced a fixed-time traffic signal has been analyzed. S-Paramics® software was used to extract detailed vehicle data required as inputs for instantaneous emission models. Microsimulation model parameters were calibrated for obtaining reliable outputs in terms of traffic pollutant emissions. Emissions of NO_x, PM₁₀ and total carbon were considered. It was found that the roundabout, generally, outperformed the fixed-time traffic signal in terms of vehicle emissions, although the difference between the two types of control was smaller in terms of environmental impacts than in terms of operational traffic performance

113. THE INFLUENCE OF ACCUMULATION AREA AND THE LENGTH OF PEDESTRIAN ROUTE ON FUNCTIONING OF ROUNDABOUTS WITH TRAFFIC SIGNALS

Guminska L.^(a), Kustra W.^(a)

(a) Gdansk University of Technology, Gdansk, Poland

Abstract

The paper presents selected issues concerning functioning of storage areas on roundabouts with traffic signals under high traffic volumes. This kind of intersection is commonly used in urban areas of Polish cities and fairly common on multilane cross sections with tram lines. With high traffic volume of vehicles turning left or U-turn roundabout with traffic signals becomes the intersection which is very hard to operate. Small storage area around central island is neuralgic place, which significantly influences the capacity of this kind of intersection. Usage of multiphase traffic signals causes lengthening crossing time by pedestrians what results in delay times on this kind of intersection. For conducted analysis, microscopic model performed in PTV Vissim, Transyt programs were used. They allowed to regenerate the conditions of traffic and few important issues during indicating their capacity.

114. PUBLIC TRANSPORT SYSTEMS' CONNECTIVITY: SPATIOTEMPORAL ANALYSIS AND FAILURE DETECTION

Hadas Y.^(a*), Rossi R.^(b), Gastaldi M.^(b), Gecchele G.^(b)

(a) Bar-Ilan University, Department of Management, Ramat Gan, Israel

(b) University of Padova, Department of Civil, Environmental and Architectural Engineering, Padova, Italy

Abstract

Public Transport (PT) plays a major role in passenger flow as an affordable and efficient mode contributing for sustainable transportation by way of traffic congestion and air pollution reduction. Those advantages are impaired if the PT system does not provides a continuous

accessibility and connectivity for all prospect passengers. Hence, it is imperative to assess the performance of PT systems based on the system's spatial and temporal properties. This assessment is comprised of four components: a) spatiotemporal analysis, b) sensitivity analysis, c) PT failure detection, and d) recommendations for the decision maker. PT system consists of various features such as roads, railways, routes, stops and time-tables, which are represented by a complex network of spatial and temporal data. The demand is characterized by generators and attractions, realized by spatiotemporal O-D matrices. For the failure detection, three connectivity indicators are being used: a) transportation network coverage (direct and indirect); and b) stop transfer potential. These indicators are used for the identification of connectivity issues and flaws. Each indicator provides the means to identify the causes in terms of network coverage, routes structure and coverage, stops locations, frequencies, and transfers synchronization. Different spatiotemporal properties are then assessed and compared, in such a manner that the decision maker can objectively decide on the right course of action. A case study of Dolo area, which is part of Veneto region (Italy), is introduced. The analysis is focused on the hospital connectivity. The current PT system is analyzed, followed by identifying connectivity failures, and improvements recommendations. Results show that connectivity to the hospital by PT is characterized by long ingress and egress distances, low frequencies, and lack of fast and efficient transfers. The local authorities can easily use the tool to pinpoint stops to be relocated, as well as time-tables change, all in order to increase the connectivity by PT to the hospital.

115. HOW VARIES OPTIMAL WELFARE PRICING WITH INCOME DISTRIBUTION? THE CASE OF THE UNTOLLED ALTERNATIVE

Ortega A.^(a*), Vassallo J. M.^(a), Pérez J. I.^(b)

(a) Technical University of Madrid (UPM), Department of Civil Engineering - Transport, Madrid, Spain

(b) Technical University of Madrid (UPM), Department of Civil Engineering - Hydraulic and Energy, Madrid, Spain

Abstract

In some countries, such as Spain, it is very common that in the same corridor there are two roads with the same origin and destination but with some differences. The most important contrast is that one is a toll highway which offers a better quality than the parallel road in exchange of a price. The users decide if the price of the toll worth to pay for the advantages offered. This problem is known as the untolled alternative and it has been largely studied in the academic literature, particularly related to economic efficiency and the optimal welfare toll. However, there is a gap in the academic literature regarding how affects income distribution to the optimal toll. The main objective of the paper is to fill this gap.

In this paper a theoretical model in order to obtain the optimal welfare price in a toll highway that competes for capturing the traffic with a conventional road is developed. This model is done for non-usual users who decide over the expectation of free flow conditions. This model is finally applied to the variables we want to focus on: average value of travel time (VTT) which is strongly related with income, dispersion of this VTT and traffic levels, from free flow to congestion.

Aside from the introduction to the problem of pricing, the present paper is divided into four sections. In section 2, a literature review about the topic of pricing and efficiency with the untolled alternative is done. In section 3 we describe the methodology carried out and the hypothesis adopted to develop the model. In section 4 the methodology is applied and the

effect of the variables previously mentioned (average VTT, dispersion of VTT and traffic levels) over the optimal price is analyzed. In order to know what should be the prices in a European region, a particular case study with a set of conditions similar to the case of Spain will be done. Finally, in section 5, we offer, derived from the results, a set of conclusions and lessons for policy makers.

116. ESTIMATION OF THE NETWORK FUNDAMENTAL DIAGRAM (NFD) INDICATOR: AN URBAN APPLICATION IN EMERGENCY CONDITIONS

Musolino G.^(a*), Vitetta A.^(a)

(a) Università Mediterranea di Reggio Calabria, Department of Information, Infrastructure and Sustainable Energy Engineering (DIIES), Reggio Calabria, Italy

Abstract

The control of urban road networks by means of traffic signals has been an area of intensive research for decades. Several models, algorithms and tools have been developed and implemented to support the management and design of urban networks. Nevertheless, researchers are still working in this field proposing new methods to improve mobility on urban networks in saturated (ordinary and emergency) traffic conditions.

According to the recent literature, the global traffic conditions of an urban road network in ordinary conditions may be measured with good approximation by an asymmetric inverse-U shaped diagram called Network Fundamental Diagram (NFD). More specifically, the NFD puts in relation the number of vehicles present in the network with the (link-length weighted) total network traffic flow, in accordance with the fundamental diagram used for motorway links.

As a case study, the methodology is applied to the urban network of Melito Porto Salvo (Italy), where a forthcoming disaster is simulated during the morning rush hour of a working day in accordance with the emergency plan drawn up by the Civil Protection Department. The evacuation phases of population from the area with

motorized modes are simulated by means of a dynamic assignment model, previously calibrated and validated. The NFD is compared with the objective function of an optimized network design approach.

The objective of the paper is to verify if a global indicator, as it is the Network Fundamental Diagram, could be able to reflect the evolution of traffic conditions and to estimate the effects of control decisions of urban road networks (e.g. by means of traffic signals) during an evacuation phase, as the one described in the application.

117. AN AGENT-BASED APPROACH TO SCHEDULE CRANE OPERATIONS IN RAIL-RAIL TRANSSHIPMENT TERMINALS

Heshmati S.^(a), Kokkinogenis Z.^(b), Rossetti R.^(b), Oliveira J. F.^(a), Carravilla M. A.^(a)

(a) University of Porto, INESC TEC, Porto, Portugal

(b) University of Porto, Laboratory of Artificial Intelligence and Computer Science, Porto, Portugal

Abstract

Transportation of freights by rail is seen as one of the alternatives to road freight transport by the European Union (EU). The great capacity of rail transport, its high level of security, and low level of environmental pollution, when compared to road transport, led the EU to aim at transferring freight traffic from road to rail. In this context, modern rail-rail transshipment terminals (RRTT) are becoming a faster alternative to traditional shunting yards.

Traditional shunting yards, where wagons are exchanged via shunting hills and switches among trains, considerably slow down the transshipment process and, therefore, may be the cause for delays in deliveries. Modern RRTTs consist of a number of rail tracks, where freight trains are positioned in bundles to be served (one train per track). Rail-mounted gantry cranes move containers between different freight trains, without exchanging wagons. This is a complex system with sophisticated operations which

requires good schedules and collaboration of resources.

We are aiming at analyzing container transshipment processes in RRTTs from an operational point of view. The policies concern the decision on the positions of containers on outbound trains and assigning container moves to cranes by considering either disjoint working areas or predefined overlapping areas for the cranes, while minimizing the total transshipment time are going to be tackled.

These complex challenges make it hard to model the problem using standard simulation approaches. The usage of agent-based simulation is growing considerably to simulate and analyze various transportation problems, from traffic flow to seaport container terminals.

The study introduces an agent-based approach for the container transshipment processes in RRTTs where intelligent crane agents decide and plan their own schedule. Using the agent concept allows us to come up with solutions in highly dynamic scenarios, while fixed dispatching rules don't have the same capability.

The policies are evaluated with respect to a number of aspects, such as, total makespan which is defined as the time needed to place all containers on their allocated train, transshipment time of each train, and empty moving time of the cranes as an efficiency measure.

The expected contributions, focused on the optimization and planning of the crane operations are three-fold:

- Implementation of an agent-based model for RRTTs.
- Systematically analyzing cranes' behavior by implementing different policies and assessing the overall performance of the system.
- Comparison of the agent-based system with more traditional approaches for real-time transport planning based on OR algorithms.

118. OPTIMAL DESIGN AND REAL-TIME TRAFFIC SIGNAL CONTROL USING LATEST DATA COLLECTION TECHNOLOGIES

Chandan Kancharla K.^(a), Seco Á.^(a), Bastos Silva A.^(a)

(a) University of Coimbra, Coimbra, Portugal

Abstract

With increasing traffic volumes in urban areas, the demand for accurate and real-time traffic information covering the complete road network is rising. Inductance loop detectors are the most widely used traffic data collection instruments. However, they have limitations in capturing wide range of traffic and cannot directly provide the real-time data in a geographically continuous way, but only in specific and limited road sections. Recent advances in information and communication technology, such as Global Positioning Systems (GPS), has shown its potential as a valuable real-time traffic data source.

An application of real-time traffic information focus in the detection of traffic incidents. Incidents like accidents, illegal parking, loading/unloading, problems with bus stops, etc., disturb vehicle's traffic flow and arrival patterns. Existing state-of-the-art signal controlling systems like SCOOT, SCATS, and MOVA etc. detect data in real-time, but the quantity of information that they capture is limited and restricted to the sections where the detectors are located, which leads to insufficient capacity to detect in real-time the occurrence of incidents. At such situations, vehicles equipped with GPS can collect more information in blockage stream and pass the same to the signal controller at every time step. Thus signal timings can be optimized more efficiently with more timely reactions to the occurrence of normal or unexpected traffic disturbances. The main objective of current research is to evaluate whether there is an opportunity of utilizing latest technological advancements to obtain more detailed real-time

information of the traffic streams at an intersection, than current norms, and then use it to optimize existing traffic signal systems.

In this paper, an “omniscient” traffic control scenario was developed for an isolated intersection considering that its traffic signal settings would, in each moment, be set knowing exactly the traffic demand and flow characteristics over time, thus allowing to define absolute optimum settings. These optimum settings, which, obviously, are ideal, non-achievable in real life. The solutions, are then used to define reference (“ideal”) intersection control performance levels, against which different state-of-the-art data collection strategies are compared and evaluated. Three of these cases are tested. In the first two cases, traffic information in each approach is collected using either two or three detectors, and in the third case, only GPS information is used. The performance of all three cases are compared with the results of “omniscient” scenario, with each one being tested using the VISSIM micro-simulation software.

120. PERFORMANCE ANALYSES ON FOUR-LEGGED SIGNALIZED JUNCTIONS: A CASE STUDY

Javanshour F.^(a*), Berk Celikoglu H.^(b)

(a) Technical University of Istanbul, Transportation Engineering Graduate Programme, Istanbul, Turkey

(b) Technical University of Istanbul, Department of Civil Engineering, Istanbul, Turkey

Abstract

Traffic signals play a significant role in transportation networks. When set without the aim of optimizing them, traffic signals might cause inefficient use of transportation systems. The side effects of such circumstances could be the increase in travel times, fuel consumption, air pollution, frustration for the public and so forth. The aim of this study is the modeling and performance evaluation of signalized junctions with specific reference to a case study in Istanbul city of Turkey. For this purpose, two four-legged

signalized junctions with similar geometric but different traffic flow characteristics have been analyzed. Traffic flow measures at sites are derived from camera recordings collected within 7:00-10:00, 12:00-14:00 and 16:30-19:30 time periods on weekdays. Peak hour volumes for conflicting flows are obtained accordingly. In order to figure out the considerable effect of heavy vehicle composition, the relevant percentages have been computed for all approaches.

In the purpose of modeling signal control for the selected junctions two approaches, i.e., the conventional method of Webster and the dynamic method of VISSIM software, are utilized in the analyses. Differences between the obtained results of these two separate methods have been considered. The performances of incorporated signaling approaches are comparatively evaluated following the calibration of selected junctions' models with site data.

121. MARKET SHARE MODELLING IN AIRLINE INDUSTRY: AN EMERGING MARKET ECONOMIES APPLICATION

Babic D.^(a*), Kuljanin J.^(a), Kalic M.^(a)

(a) University of Belgrade, Faculty of Transport and Traffic Engineering, Belgrade, Republic of Serbia

Abstract

The process of liberalization and deregulation of the aviation sector in Europe was not equally conducted across all the markets. Analyzing the current situation in Europe, one can conclude that operational and financial performances are mixed: some airlines are struggling to survive on the market, while others are very successful in spite of the current circumstances. The most growing market is certainly the low cost market. In the last decade, low cost carriers have had dominant growth in the intra-European routes, opening up new markets and increasing competition in the market. For an airline, the ability to accurately predict market share of its competitors at specific airports could be crucial

for an efficiently tailored business strategy in the future. The model developed in this paper deals with the issue of airline market share at specific airport. In order to determine airline market share, several explanatory variables, such as: number of carriers already present at the airport, frequency of flying, membership to specific alliances are only some among many that have been considered by the model. Traditional techniques, as well as fuzzy logic, have been applied to estimate the model. The approach allows making an estimate of market share for any airline that operates at an airport in the emerging markets. Finally, the model is illustrated with real data and is applicable to demonstrate how the model developed could be used for calculating an airline's market share with corresponding values of selected variables.

123. EMISSIONS IMPACT OF ROAD TRAFFIC INCIDENTS USING ADVANCED TRAVELLER INFORMATION SYSTEMS IN A REGIONAL SCALE

Fontes T.^(a*), Lemos A.^(a), Fernandes P.^(a), Pereira S.^(a), Bandeira J. M.^(a), Coelho M.^(a)

(a) University of Aveiro, Centre for Mechanical Technology and Automation - Department of Mechanical Engineering, Aveiro, Portugal

Abstract

Advanced Traveller Information Systems (ATIS) have been used worldwide to mitigate different road traffic impacts such as traffic congestion. However, the impact of these systems in fuel use and emissions is still an important research topic, due to their non-linear behaviour. Therefore, this paper aims to evaluate the impact of traffic incidents on a regional scale on energy and emissions levels. To achieve these objectives, several scenarios that assess different degrees of information (through the use of ATIS) were analysed. To model both traffic operations and emissions a mesoscopic traffic model (DTALite) and a road emissions methodology (EMEP/EEA) were used.

The data related to the characterization of the road network was collected between Oporto and Aveiro, in Portugal. To ensure reliable results, the traffic model was calibrated and validated taking into account statistical methods that compare observed traffic flows and travel times with the values estimated by the model. The simulation platform was used to assess the impact of traffic incident when it occurs in two different road types (a motorway and a highway), in order to evaluate the impact of usage and availability of information on emissions and fuel consumption.

The results show that in a regional road network for each occurred incident, the use of ATIS can allow a maximum reduction of emissions and energy consumption on those routes where they occurred to up 2%. Nonetheless, a global analysis of the network shows different results depending if the incident occur in a motorway or in a highway. In both cases, drivers tend to choose a route with similar costs to the previously selected. Furthermore, a non-linear trend between the availability of information and the impact on emissions and energy consumption was found.

124. ASSESSING THE IMPORTANCE OF VEHICLE TYPE FOR THE IMPLEMENTATION OF ECO-ROUTING SYSTEMS

Bandeira J. M.^(a*), Fontes T.^(a), Pereira S.^(a), Fernandes P.^(a), Khattak A. J.^(b), Coelho M.^(a)

(a) University of Aveiro, Centre for Mechanical Technology and Automation, Aveiro, Portugal

(b) University of Tennessee, Civil & Environmental Engineering Department, Knoxville, United States

Abstract

Air quality policies implemented at the European level have over time led to lower pollutant concentrations across Europe for certain pollutants. However, road transport activities are still contributing to significant amounts of air pollution. The urban sprawl and the barriers to penetration of new technologies have contributed

to a success rate in reducing emissions below the desirable. Therefore, European institutions assume that it is imperative to improve the efficiency in the transportation network through the improved use of the existing road infrastructures. Nowadays, several methods to promote a more sustainable distribution of traffic flows are available. In response to rising energy costs and increased environmental concerns, eco-friendly route choices can be provided individually by means of smart navigation tools that allow several vehicle routing options designed to minimize air pollutant emissions and fuel consumption. Simultaneously, the use of intelligent road pricing systems and the use of variable message signs can change the route choice process of drivers (and thus network equilibrium), by varying the perceived attributes of competing routes. However, the eco-friendliness of various routes may change, depending on vehicle characteristics. This fact might cause problems on the efficiency of these systems. To address this issue empirically, more than 13,330 km of data were collected using GPS equipped-vehicles in six different Origin-Destination (OD) pairs and 9 different routes. Specifically, data were collected in diverse locations: a large metropolitan area of Hampton Roads, VA, USA, an intercity region of Oporto–Aveiro, Portugal, and an urban area, in the city of Aveiro. Simultaneously, two different approaches for estimating emissions were tested: a) second-by-second vehicle dynamics, using the Vehicle Specific Power (VSP) concept to extract the (CO₂, HC, CO, NO_x) emissions of different vehicle types and categories; and b) route average speed using the EMEP/EEA methodology. The analysis shows that depending on the characteristics of the routes associated with a certain OD pair the eco-friendly route may differ according to the vehicle model and the emissions estimation method. Innovative approaches to provide accurate emissions and eco-routing information are needed.

125. A SIMULATION BASED APPROACH FOR EVALUATING THE IMPACT OF MARITIME TRANSPORT ON THE INVENTORY LEVELS OF AN OIL SUPPLY CHAIN

Carotenuto P.^(a*), Giordani S.^(b), Zaccaro A.^(b)

(a) National Research Council, Institute for Applied Mathematics "M. Picone", Rome, Italy

(b) University of Rome "Tor Vergata", Rome, Italy

Abstract

One of the most important objectives of a manufacturing company is the optimization of the distribution of the produced goods considering the whole value chain. Unfortunately, in many companies the performance of the supply chain depends on many uncertain factors that are difficult to predict. The only way to face them is to adopt innovative solutions and tools that allow a swift response to the market changes. This paper analyzes the distribution processes managed by the logistic department of a large company producing and distributing petroleum products through the following main steps: crude oil's transportation typically from many countries to a refinery; refining process; maritime transportation from the refinery to three coastal depots; road transport from depots to gas stations. The analyzed process is the primary supply, consisting in the maritime transport from the refinery to the coastal depots, liable to stochastic activities and event as weather condition. Through simulating the primary supply, we study the effects that the ship traffic generates on the overall variance of inventory levels at the coastal depots with respect to specific inventory level targets, and analyze the impact of different tactical decision choices on the variance reduction. Reducing inventory's variance, through a better control of the distribution, allows the company to reduce the inventory target level and hence to reduce the inventory costs in term of capital stock, while keeping the same risk level of stock out. The project is made of many phases: map all relevant processes to

have a complete vision of transport's structure; conduct a statistical analysis to identify specific statistical distributions of every ships' process (delay, mooring, loading, etc.); model and simulate the primary supply using simulation software; use the model to make a "what-if" analysis. Within this project, it has been possible to realize a model that presents stochastic elements. All these phases are supported by six-sigma methodology, which focalizes on defects' process reduction by the control of its mean square deviation and following the stages of the DMAIC (Define Measure Analyze Improve Control). One of the what-if analysis which has been done consists in simulating the opening refinery's jetties h24, because currently these are closed during the night. Opening the jetties, will increase the capacity of some of the bottleneck resources for the oil distribution process, and thanks to the simulation model we can estimate quickly the effects on the oil transport system

126. IT BASED ATTEMPT TO EVALUATE AND PROMOTE INTERMODAL TRANSPORT SOLUTIONS IN CENTRAL AND SOUTHEAST EUROPE

Haider C.^(a), Aschauer G.^(a), Schmidt C.^(b)

(a) University of Applied Sciences Upper Austria, Steyr, Austria

(b) Technical University of Applied Sciences Wildau, Research Group in Transport and Logistics, Wildau, Germany

Abstract

The paper addresses an IT based attempt to evaluate and promote intermodal transport procedures between Central and Southeast Europe. Through the assessment of the relative importance of intermodal transport nodes the described tool is a useful instrument to demonstrate the most important advantages for environmental friendly transport solutions. In combination with a knowledge sharing attempt stakeholders have full information available when preparing several transport plans due to transparent strengths of rail and inland waterway transports.

130. A SIMULATION/OPTIMIZATION MODEL FOR DETERMINING OPTIMAL BUS STOP SPACING IN URBAN PUBLIC TRANSPORTATION NETWORKS

Baskan Ö.^(a*), Dell'Orco M.^(b), Ottomanelli M.^(b), Marinelli M.^(b)

(a) Pamukkale University, Department of Civil Engineering, Denizli, Turkey

(b) Polytechnic University of Bari, Bari, Italy

Abstract

In the last few decades, efficient use of public transportation systems has received much more attention because of increasing trend of private car use, which is one of the main reasons of traffic related problems. In order to provide lower rate of car usage, public transportation systems need to be much more attractive and accessible for public transport users. As known, the fleet size, routes, timetables and frequencies are key factors in order to manage public transport systems efficiently. Similarly, a correct placement of bus stops has crucial importance to improve the accessibility of bus transit systems to users. In many countries, the placement of bus stops is determined on the basis of experts' foresight, subject to space constraints, or minimizing the interaction with private traffic. When bus stops are closely spaced, the accessibility of the system to users is increased, but at a higher cost for the operator. On the other hand, when the distance between bus stops increases, operation is less expensive, but the walking time to and from the bus stops increases. This work develops a simulation/optimization model in order to balance these conflicting issues by minimizing the cost of both travelers and operator. The proposed model is applied to the real public transportation network of Denizli, a medium-sized city of Turkey, consisting of 80 traffic zones. In the study area, bus and paratransit modes serve to meet the public transport demand, and three types of bus vehicles with 19, 26 and 36 seat capacity are used to carry a maximum of 50, 70 and 100 passengers, respectively. A bi-level programming approach

is considered, in which the upper level aims to minimize the total cost function of public transportation system, while lower level simulates public transport assignment using VISUM traffic analysis software. In order to solve optimization problem in the upper level, Differential Evolution algorithm is combined with VISUM because of its recent successful applications for solving complex optimization problems. Results obtained by performing the proposed model are compared with those of currently used bus stop placements. Furthermore, the sensitivity of cost parameters and their effects on the placement of bus stop are analyzed. Results show that the application on a real case improves the existing public transportation service by means of optimizing bus stop spacing.

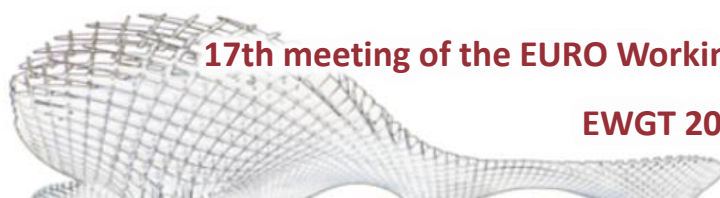
131. THE IMPACT OF VEHICULAR NETWORKS ON URBAN NETWORKS

Khoshyaran M.^(a)

(a) Economics Traffic Clinic (ETC), Paris, France

Abstract

The objective of this paper is to study the impact of vehicular network on a physical (road) network consisting of several intersections controlled by traffic lights. The vehicular network is considered to be a random graph [1],[2] superimposed on a regular Hamiltonian graph (road network). The two graphs are connected by hyperlinks. Each hyperlink signifies the interaction between the random graph (vehicular network) and the Hamiltonian graph (road network). The interaction is defined as the driver being at an intersection and talking to someone on their cell phones or is connecting to Internet while idle waiting for the green light; Each hyperlink is characterized by (0,1). (0) signifying waiting at the intersection without using cell phone, (1) signifying waiting at an intersection using cell phone. The variables that link the two graphs are queue lengths and delays at intersections. Both the queue length and the delay are functions of the physical position of the



vehicle (intersection characteristics, traffic light duration, and any random event) and the state of the connectivity to the communication network or the internet. It is assumed that connection to the communication network is random. The methodology used to analyze the state of an urban traffic network is to establish the controlled system assuming no telecommunication possibility, and then introduce the communication network and find out how the system is different from the initial state. The simulation method used for the before and after analysis is called “Reflexion Triangles”, [3], [4], [5].

138. IPET (INDIVIDUAL PERSUASIVE ECO-TRAVEL TECHNOLOGY): A FIRST PILOT TEST

Meloni I.^(a*), Delogu G.^(a), Sanjust Di Teulada B.^(a), Sottile E.^(a)

(a) University of Cagliari, CRIMM, Cagliari, Italy

Abstract

Nowadays, because of the increasing traffic congestion and pollution in urban centers, sustainable travel behaviour has come to play a key role in the attempt to reduce these externalities. This paper presents the architecture of a technology platform constructed for the purpose of conducting personalised campaigns for promoting sustainable transportation. In particular, the proposed platform is designed to automate phases and activities of a VTBC programme, with a view to extending it to the large scale, reducing the resource commitment. A VTBC pilot test on a small convenience sample is also presented that aims to better define some features such as form and content of Personal Travel Plans and reinforcing messages provided to participants with a view to encouraging sustainable travel behaviour. Results show that the procedure adopted was considered acceptable by participants. The personalised information provided is clear, easy to understand and particularly appreciated (i.e.

maps, form and colors of PTP). The same can be said of the reinforcing messages, that proved to be easy to read on the smartphones.

These findings confirm that the work done so far contributes to reducing the "barriers" to listening and to the advice given in the programme (VTBC) and therefore also to the "transmission" of VTBC information. So, this constitutes an improvement in the presentation of the information (personalised travel plan) provided.

139. GRID SIZE OPTIMIZATION FOR POTENTIAL FIELD BASED MARITIME ANOMALY DETECTION

Osekowska E.^(a), Johnson H.^(a), Carlsson B.^(a*)

(a) Blekinge Institute of Technology, Karlskrona, Sweden

Abstract

The intention of this study is to improve the potential field based maritime data modelling method, developed for extracting traffic patterns and detecting anomalies in a clear, understandable and informative way. The method's novelty lies in employing the concept of a potential field for AIS vessel tracking data abstraction and maritime traffic representation. Unlike traditional equipment such as radar and GPS, the AIS data incorporates seamen's experiences in estimating the changing traffic and operating environment conditions, for it is the effects of decisions, based on the skills of a human expert, being registered.

In the data modelling process, every vessel generates potential charges, which value represent the vessel's behaviour, and drops that charge at locations it passes. Each AIS report is used to assign a potential charge at the reported vessel positions. The method derives three construction elements, which define, firstly, how charges are accumulated, secondly, how a charge decays over time, and thirdly, in what way the potential is distributed around the source charge. The collection of potential fields represents a model of normal behaviour, and vessels not conforming to it are marked as anomalous. In the

anomaly detection prototype system STRAND, the sensitivity of anomaly detection can be modified by setting a geographical coordinate grid precision to more dense or coarse. The objective of this study is to identify the optimal grid size for two different conditions—an open sea and a port area case.

A noticeable shift can be observed between the results for the open sea and the port area. When examining the detection rates for way point, course and speed, the port area plots converge towards an optimal ratio for smaller grid sizes (60-200 meters) than in the open sea case (300-1000 meters). The effective outcome of the potential filed based anomaly detection is filtering out all vessels behaving normally and presenting a set of anomalies. In a subsequent examination, a human expert may interpret the detections and decide upon reactions to identified incidents, using the STRAND prototype as an information visualization tool.

140. A ROLLING STOCK CIRCULATION MODEL FOR RAILWAY RAPID TRANSIT SYSTEMS

Canca D.^(a*), Sabido M.^(a), Barrena E.^(b)

(a) University of Seville, School of Engineering, Seville, Spain

(b) Canada Research Chair in Distribution Management (CIRRELT) and HEC Montreal, Montreal, Canada

Abstract

Rolling stock is one of the key operational issues for a railway transportation company. In fact, rolling stock and infrastructure maintenance suppose about 75% of total cost for a typical railway network. Rolling stock circulation consists of defining individual train paths over the network accomplishing pre-defined passenger's services and fulfilling certain design criteria such as minimizing train costs. The maintenance of the train is an important aspect to be considered in the planning of rolling stock circulation. Typically, railway operators follow maintenance policies in which rolling stock must be revised every certain number of kilometers.

In this paper we propose, in the context of railway Rapid Transit Systems (RTS), a mixed integer programming model to develop rolling stock circulation plans considering a rotating maintenance scheme. The model can be applied to any medium size RTS considering a variable number of parking facilities. Train circulation is obtained by following a weekly pattern to include weekend train schedules. This approach minimizes train empty movements whereas equilibrates the weekly number of kilometers covered by every train unit. The rotating schema ensures a long-term maintenance policy that minimizes the train units reserve and balances the workload of the maintenance operation. Finally, as illustration, the modeling approach is applied to the Seville commuter railway network in order to design a rotating rolling stock plan.

141. ESTIMATING TRAVEL TIME DISTRIBUTION UNDER DIFFERENT TRAFFIC CONDITIONS

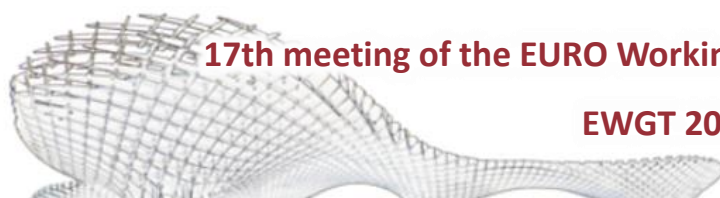
Guessous Y.^(a), Aron M.^(b*), Bhouiri N.^(b), Cohen S.^(b)

(a) Ecole des Ponts ParisTech, Marne-la-Vallée, France

(b) University of Paris-Est, IFSTTAR/COSYS/GRETTIA, Marne-la-Vallée, France

Abstract

Increasing mobility and congestion result in an increase in travel time variability and in a decrease in reliability. Reliability becomes an important performance measure for transportation facilities. A variety of performance measures have been proposed to quantify it. Many of these indicators are based on percentiles of travel time. The knowledge of the distribution of travel time is needed to properly estimate these values. Congestion distorts the distribution and particular statistical distributions are needed. Different distributions have been proposed in the literature. In a previous paper, we presented a comparison of six statistical distributions used to model travel time. These six distributions are the Lognormal, Gamma, Burr,



Weibull, a mixture of two Normal distributions and a mixture of two Gamma distributions.

In this paper a probabilistic modeling of travel time which takes into account the levels-of-service is given. Levels of service are identified, then travel time distributions are modeled by level of service. This result in a very good fit between the empirical and modeled distributions. Moreover, the adjustment was improved, thanks to the calibration of “Bureau of Public Roads” functions, linking the travel time to the traffic flow by level of service.

The superiority of the Singh-Maddala distribution appears in many cases. This has been validated, thanks to travel time data from the same site at another period. However the parameters of the distributions vary from one year to another, due to changes in infrastructure. The transferability of the approach, not performed, will be based on travel time data on another site.

145. A NEURAL NETWORK BASED MODEL FOR REAL ESTATE PRICE ESTIMATION CONSIDERING ENVIRONMENTAL QUALITY OF PROPERTY LOCATION

Chiarazzo V.^(a), Caggiani L.^(a*), Marinelli M.^(a), Ottomanelli M.^(a)

(a) Polytechnic University of Bari, Department of Civil, Environmental, Planning, Construction and Chemicals Engineering (DICATECh), Bari, Italy

Abstract

This paper applies Neural Network (NN) technology to real estate appraisal and compares the performance of NN models in estimating the sale price of residential properties with a traditional hedonic model based on multiple regression techniques. The hedonic studies relating real estate prices with transport conditions have complemented the theories on urban economy and tested their hypotheses through multiple case studies. Artificial Neural Networks (NNs) has the advantage that there is no need to assume explicit functions between

input and output of the problem because a NN learns directly from observed data and this opportunity is very useful in the case of complex system as the real estate where motivations, tastes and budget availability often do not follow rational behaviours. In particular, this study explores also the impacts of such key environmental condition that is a problem that affects many industrial cities where pollution and landscaping consequences affect the real estate market and then the residential location choice. The study is based on a set of asking price's houses collected in the metropolitan area of Taranto (Southern Italy) where the biggest steel factory in Europe and the 2nd industrial port is located.

146. STRATEGIC DETERMINANTS OF TERMINAL OPERATING SYSTEM CHOICE: AN EMPIRICAL APPROACH USING MULTINOMIAL ANALYSIS

Acciaro M.^(a), Serra P.^(ab*)

(a) The Kühne Logistics University, Department of Logistics, Hamburg, Germany

(b) University of Cagliari, CIREM, Cagliari, Italy

Abstract

Container terminal (CT) operators have at their disposal several operational options for performing both the transfer and the handling of containers. In choosing which operating system (OS) to adopt, a CT operator has to decide among a variety of possibilities: manned or automated layouts, RTGs, RMGs, pure SCs, etc. A question arises: which factors are determinant for the decision of an OS rather than another? Traditionally, the determinants of the choice of OSs have been investigated almost exclusively from a technical point of view, while limited research has been performed in the area of the strategic determinants of such choice. Furthermore, if at a first stage technical constraints lead to exclude (or include) some handling options, in a second stage other determinant factors come into play in the choice of the most suitable OS. These strategic

determinants can range from the price of industrial lands to the labour regime existing in the area, from the typology of the operator who runs the CT to the level of innovation that characterizes the country. Notwithstanding their importance, these factors are often overlooked because they are more difficult to research for the lack of data or their high sensitivity.

This study investigates the strategic determinants of the OS choice from an empirical perspective. Special attention is paid to understanding in which measure restrictive and limiting labour regimes can explain the preference for emerging automated models or, more in general, for less labour intensive concepts. A sample consisting of 65 European CTs is built. For each CT taking part in the sample the major determinants of the operations concepts are quantified. Data collected for each CT include terminal information, concerning demand and supply characteristics, and boundary information, concerning the business environment. The use of logistic regressions provides interesting insights on what strategically motivates the choice of an OS with respect to another, in order to investigate and discuss important managerial and policy implications.

148. POTENTIAL IMPACTS ON ACCESSIBILITY AND CONSUMER SURPLUS OF IMPROVEMENTS OF THE EUROPEAN RAILWAY SYSTEM

Rotoli F.^(a*), Christidis P.^(a), Vannacci L.^(a), López Ruiz H. G.^(a), Navajas Cawood E.^(a), Ibáñez Rivas N.^(a)

(a) European Commission, Joint Research Centre – Institute for Prospective Technological Studies (IPTS), Economics of Climate Change, Energy & Transport Unit (ECCET), Seville, Spain

Abstract

It is widely accepted that "transport infrastructure endowment influences competitiveness of a Region; the provision of investment in transport infrastructure entails positive effects on productivity and growth, even if on the other side, heavy infrastructures (as railway lines)

could affect negatively on the environment" (5th Cohesion Report, 2010).

This article aims to explore the potential impact of improvements of the passenger rail network in order to evaluate how these could potentially increase accessibility and consumer surplus in EU regions; it summarizes the results of the model simulations carried out with a combination of the TRANSTOOLS rail network and the assignment module of Traffic Analyst. Four different scenarios are tested: two scenarios simulating increases of all speeds to 90 km/h and 200 km/h, one scenario assuming a decrease to 45 km/h and the last one hypothesizing to increase train frequencies by 20%. The post-processing analysis is carried out with utilities developed in Matlab, while the results for each zone (at NUTS3 level) are also reported in easy-to-read ArcGIS maps. The outcomes provide insight into how the demand for passenger rail transport would react and where the higher benefits and costs, in terms of accessibility and consumer surplus gains, can be expected. This information, in turn, can be useful for the prioritization of investment needs and the identification of parts of the rail passenger market where new demand may be generated.

149. COMBINING RAMP METERING AND HARD SHOULDER STRATEGIES: FIELD EVALUATION RESULTS ON THE ILE DE FRANCE MOTORWAY NETWORK

Haj-Salem H.^(a*), Farhi N.^(a), Lebacque J. P.^(a)

(a) University of Paris-Est, IFSTTAR/COSYS/GRETTIA, Marne-la-Vallee, France

Abstract

The paper is focused on the field trial description and the evaluation results of the implementation of the ramp metering and hard shoulder simultaneously on the Ile de France motorway network. The overall site includes 24 controlled on-ramps where the ramp metering strategy ALINEA is applied in operational way. With respect to hard shoulder, the common part of the

A4 and A86 motorway are equipped with variable message signs indicating the state of lane: Open or Closed. The hard shoulder is used as an additional live traffic lane during congestion periods. When traffic builds up road users will be instructed to use the hard shoulder as an extra traffic lane, increasing the motorway's capacity, reducing congestion and keeping traffic moving. In this paper, the evaluation will be focused on both axis of the motorway where ramp metering and lane shoulder are applied simultaneously. These field trials were conducted during two years (2008-2009).

154. LEVEL OF SERVICE ESTIMATION BASED ON LOW-FREQUENCY FLOATING CAR DATA

Axer S.^(a*), Friedrich B.^(a)

(a) Technical University of Braunschweig, Institute of Transportation and Urban Engineering, Braunschweig, Germany

Abstract

Systematic and network-wide estimation of traffic quality is an essential requirement for a long-term strategic traffic management. Collecting traffic information based on conventional sensor techniques becomes an economical challenge when road authorities are faced with wide-area road networks. With respect to nowadays strictly limited resources, the cost-efficient analysis of driving speed based on mass floating car data (FCD) is getting more and more important in a modern traffic management. Therefore, the objective of this paper is to present a four stage semi-automatic method for a network-wide level of service estimation based on mass FCD. The paper starts with a brief introduction of the used floating car data source and the applied digital roadmap based on OpenStreetMap. During the first stage, the method establishes an easy to use referencing process between the digital road network and the traffic message channel system (TMC). Based on the road network separation with respect to the TMC-system, the second stage employs a FCD

matching algorithm, which allows the detection of driving direction especially for low-frequency floating car data and small TMC-segments. The third stage of the method deals with the systematic and statistical analysis of driving speeds. Therefore, the paper analyzes the statistical significance of derived average driving speeds in a high spatiotemporal resolution. Finally, the fourth stage of the method describes a self-calibrating level of service calculation process which uses speed indices.

156. A FLEXIBLE TRANSPORT SERVICE FOR PASSENGERS

Carotenuto P.^(a*), Paradisi L.^(b), Storchi G.^(c)

(a) National Research Council, Institute for Applied Mathematics "M. Picone", Rome, Italy

(b) University of Rome "Tor Vergata", Department of Enterprise Engineering, Rome, Italy

(c) University of Rome "La Sapienza", Department of Statistical Science, Rome, Italy

Abstract

The realization of innovative passengers transport services requires more and more often a greater flexibility and inexpensiveness of the service. To answer this request in many cases the physical solution is to realize a demand responsive transportation system (DRTS). A DRTS require the planning of travel paths (routing) and customers pick-up and drop-off times (scheduling) according to received requests, respecting the limited capacity of the fleet and time constraints (hard time windows) for each network's node, and the service time of the system. By the modelling point of view a DRTS can be effectively represented with a Dial-a-ride problem (DaRP). A DaRP derives from the Pick-up and Delivery Problem with Time Windows (PDPTW) and may operate according to a static or to a dynamic mode. In the static setting, all customers' requests are known beforehand and the DaRP returns the vehicles routing and the passengers pick up and drop off time scheduling. The static setting may be representative of a phase of reservation occurred the day before the execution of the service. But,

if the reservation requests must be processed on-line, even during the booking process there may be a certain level of dynamism. In fact, if the algorithm works online, it manages each and every incoming request separately, and accepts or refuses it immediately, without knowing anything about the following. The operative program is constantly updated after each received request without refusal to carry out previous accepted services. In the dynamic mode, customers' requests arrive when the service is already running and, consequently, the solution may change whilst the vehicle is already travelling. In this mode it is necessary that the schedule is updated when each new request arrives and that this is done in a short time to ensure that the potential customer will not leave the system before a possible answer. In this work, we describe a flexible people transport system capable of managing incoming transport demand in dynamic mode, using a solution architecture based on a two-stage algorithm to solve Dial-a-Ride Problem instances. In the first stage, a constructive heuristic algorithm quickly provides a feasible solution to accept the incoming demand. The algorithm in the second stage tries to improve the solution evaluated at the first stage by using the time between two consecutive transportation events. The algorithm, unlike most of the works in the literature, uses an objective function that optimizes the service punctuality.

161. PREDICTION OF ROAD ACCIDENT SEVERITY USING THE ORDERED PROBIT MODEL

Garrido R.^(a), Bastos Silva A.^(a), De Almeida A.^(b), Elvas J.^(c*)

(a) University of Coimbra, Department of Civil Engineering, Coimbra, Portugal

(b) ISCTE - IUL University Institute of Lisbon, Department of Information Science and Technology, Lisbon, Portugal

(c) University of Coimbra, Department of Mathematics - Lab. of Geomatic Engineering, Coimbra, Portugal

Abstract

In 2012, almost 28,000 people died on European Union (EU) roads due to road traffic accidents.

Portugal, regardless the remarkable progress in the last decades, is still well above the EU average number of road fatalities. As a result, the country established an ambitious target – “to reach 62 deaths per million inhabitants by 2015”. Practitioners involved in road safety management are encouraged to contribute to the fulfilment of that target. An effective road safety management requires a good insight in the factors that are believed to be related to road traffic accidents. Based on this framework, several research studies have been conducted over the years aiming at identifying factors that may influence both the frequency and the severity of road traffic accidents. However, additional research is still pertinent for the Portuguese road network conditions. This study intends to contribute for a better understanding of the factors affecting the occurrence of accidents and, in particular, those that affect its severity at a national level. Firstly, a summarized state-of-the-art is presented aiming at identifying the more appropriate methodologies and the most significant explanatory variables affecting the road accident severity. Lastly, supported by accident data collected from an official accident statistics database, the ordered probit model is applied to examine the influence of a number of factors on the injury severity faced by motor-vehicle occupants involved in road accidents. The model estimation results suggest that some types of road accidents, namely the rollover-type, run-off-road, collisions against fixed objects and head-on collisions, appear to be the major contributors for the most severe injury level. Also, those who travel in a light-vehicle, at a two-way road and on dry road surface injuries tend to suffer more severe injuries than those who travel in a heavy vehicle, at a one-way road, and on a wet road surface. In contrast, the driver's seat is clearly the safest seating position, urban areas seem to originate less serious accidents than rural areas, and women tend to be more likely to suffer serious or fatal injuries than men.

162. A CONCEPTUAL ALGORITHM TO LINK POLICE AND HOSPITAL RECORDS BASED ON OCCURRENCE OF VALUES

Amorim M.^(a*), Ferreira S.^(a), Couto A.^(a)

(a) University of Porto, Research Centre for Territory, Transports and Environment, Porto, Portugal

Abstract

Road safety research, in particular road and traffic safety evaluation research, is highly applied and carried out mostly to help reducing the number of road accidents and the injuries resulting from them. This subject has been continuously studied, and in developed countries road safety is improved in a way that, more and more, new measures have less visible impact. Although measures are usually taken directly in the source, which makes all the sense, it is possible to reduce the accident impact if improvements are made “a posteriori”; this is, improving the emergency system to minimize the socioeconomic impact of the accident.

In order to study accidents impact it is necessary to merge two different datasets – police and hospital. This process is known as data linkage and besides a manual linkage process there are three main numerical methodologies: deterministic record linkage, fuzzy matching and probabilistic record linkage. Because these types of datasets are usually protected by anonymity, unique identifiers are not possible to achieve, thus the probabilistic record linkage is usually the chosen method.

This paper presents a concept for an algorithm based on the databases’ demographics. By analyzing the various demographic fields it is possible for the algorithm to calculate individual weights that depend on the occurrence of each fields’ values among a specific dataset. The demographics are based on the case of Gaia’s city road record accidents.

163. DYNAMIC ASSIGNMENT WITH USER INFORMATION IN MULTIMODAL NETWORKS

Atmani D.^(ab), Lebacque J. P.^(a), Bhourri N.^(a), Haj-Salem H.^(a*)

(a) Land Transport and Advanced Computing Engineering (IFSTTAR / GRETIA), Marne-la-Vallee, France

(b) University of Paris-Est, Marne-la-Vallee, France

Abstract

The dynamic assignment of users has been widely studied for the road network while it is less considered for multimodal networks. In this article, we investigate the dynamic assignment of users in multimodal transportation systems while differentiating between informed and uninformed users. The problem is modelled as a multiagent system where we consider all of the modes that share the road infrastructure (private vehicles, taxis, buses, tramway, electric car sharing services), thus the users and vehicles of each mode are represented by an agent.

As mentioned in the above, we consider two types of users: informed and uninformed. Our objective is to assess the impact of the presence of informed users on the dynamic assignment on the network.

To do so, we provide an analytical study on the Braess paradox where we explore the possibility of improving the assignment of users through the information that is provided to them.

The simulation model is cellular automata based and was executed on a multilevel network that includes a Braess paradox in order to validate the analytical results.

164. UPPER BOUNDS FOR THE TRAVEL TIME ON TRAFFIC SYSTEMS

Farhi N.^(a*), Haj-Salem H.^(a), Lebacque J. P.^(a)

(a) University of Paris-Est, IFSTTAR/COSYS/GRETIA, Marne-la-Vallee, France

Abstract

A key measure of performance and comfort in a road traffic network is the travel time that the

users of the network experience to complete their journeys. Travel times on road traffic networks are stochastic, highly variable, and dependent on several parameters. It is, therefore, necessary to have good indicators and measures of their variations. In this article, we extend a recent approach for the derivation of deterministic bounds on the travel time in a road traffic network (Farhi et al. 2013 [1]). The approach consists in using an algebraic formulation of the cell-transmission traffic model on a ring road, where the car-dynamics is seen as a linear min-plus system. The impulse response of the system is derived analytically, and is interpreted as what is called a service curve in the network calculus theory (where the road is seen as a server). The basic results of the latter theory are then used to derive an upper bound for the travel time through the ring road.

We consider in this article open systems rather than closed ones. From two elementary systems (an uncontrolled and a controlled road section), and a system composition operator, a whole controlled road network can be build easily by the composition of a number of sections. The composition of systems consists in giving a service guarantee of the resulting system from service guarantees of the composed systems. We illustrate this approach with a numerical example, where we compute an upper bound for the travel time on a given route in a urban controlled network.

167. EFFICIENCY OF NETWORKS OF COLLECTIVE TRANSPORTATION LINE SYSTEM

Barrena E.^(a), De los Santos A.^(b), Laporte G.^(a), Juan A. Mesa J. A.^(b*)

(a) University of Seville, Department of Applied Mathematics II, Seville, Spain

(b) Canada Research Chair in Distribution Management (CIRRELT) and HEC Montreal, Montreal, Canada

Abstract

Collective transportation line networks have been considered as a type of complex network.

Since last years of the past century, several measures and indicators have been introduced to evaluate the functioning and organization of these systems from the topological point of view. In this paper, these measures are extended with the aim of taking into account the most relevant characteristics of transportation systems.

168. THE CONTRIBUTION OF SCIENTIFIC PRODUCTIONS AT THE BEGINNING OF THE THIRD MILLENNIUM (2001 - 2014) FOR HUMANITARIAN LOGISTICS: A BIBLIOMETRIC ANALYSIS

Zary B.^(a), Bandeira R.^(a), Campos V.^(a)

(a) Military Institute of Engineering, Rio de Janeiro, Brazil

Abstract

The humanitarian logistics is a branch of logistics that aims to plan, schedule and control inventories of goods in an efficient and low cost way, beyond monitor the flow of goods from point of origin to point of consumption in order to meet and alleviate human suffering in vulnerable communities affected by natural disasters and complex emergencies. Humanitarian logistics plays a key role in any aid effort. Nonetheless, in case of relief operations, it is the most costly part, corresponding to approximately 80% of the total costs. Therefore, considering the importance of humanitarian logistics to the success of disaster response operations, this paper aims to capture the state of art in this field of knowledge using bibliometric methods and techniques of social network analysis.

The paper presents a comprehensive analysis of the studies in the field of humanitarian logistics, between the beginning of the XXI century (2001) and the present day (2014). This study aims to develop a literature review on the subject of the Humanitarian Logistics, rising information, scientific and technological knowledge,

capturing the state of the art in this field of knowledge.

The term bibliometrics refers to the mathematical and statistical analysis of patterns that appear in the publication and use of documents. There are two techniques widely used in bibliometrics: Citation and co-citation. The analysis of the technique in question is based on the premise that authors cite articles that are important in the development of their research. Thus, studies often cited has probably the greatest influence on the area surveyed than those who are poorly cited.

This work is carried out by analyzing the citation and co-citation of articles leadership in humanitarian logistics research and seeks to provide valuable information about the knowledge network among studies in this area. Through the application of this statistical analysis, relevant theories, concepts and the research methods used in the area were identified, as well as topics for future research. This will enhance understanding of the subject, serving as a guide to the growth, development and dissemination of this scientific knowledge to better respond to humanitarian problems

169. SUSTAINABLE TRAFFIC SAFETY MANAGEMENT AT ACCIDENT BLACK SPOTS COMBINED WITH DRIVERS' PSYCHOLOGY AND VEHICLE ENGINEERING USING EYE MARK RECORDER

Wakabayashi H.^(a), Ando M.^(b), Kawaguchi T.^(c), Horie Y.^(d), Hotta K.^(a*)

(a) Meijo University, Kani, Japan

(b) Nagoya Expressway, Nagoya, Japan

(c) Token C.E.E. Consultants Co. Ltd., Nagoya, Japan

(d) Marukyo Shiki Inc. Co. 3-58 Tokudanishi, Gifu, Japan

Abstract

This paper proposes an integrated approach for sustainable traffic safety management at accident blackspots, including a mechanism that tracks the occurrence of accidents from the moment of

drivers' vision to actual accident occurrence, via vehicle behavior. An accident black spot can become a "vicious circle" of accident occurrence and safety countermeasures, where a safety countermeasure is repeatedly performed, but its effect soon fades each time. For such a spot, implementation of a safety countermeasure from only the highway point of view has no sustainability. Therefore, to be effective as one of the next-generation safety countermeasures, the method must integrate considerations from traffic engineering, drivers' psychology, and vehicle behavior. This paper proposes a next-generation, integrated traffic safety management method and an explanation of a mechanism that tracks accident occurrence where drivers watch first and then how vehicles behave and lastly what accident risk increases as the series of event.

170. THE ELECTRIC VEHICLE ROUTING PROBLEM WITH INDUSTRY CONSTRAINTS

Anagnostopoulou A.^(a), Boile M.^(a), Theofanis S.^(b), Sdoukopoulos E.^(a), Margaritis D.^(a)

(a) Centre for Research and Technology Hellas (CERTH), Hellenic Institute of Transport, Greece

(b) Rutgers University, Piscataway, United States

Abstract

This paper presents and analyzes the one-to-many-to-one vehicle routing and scheduling problem with electric vehicles. Initial focus is given on the problem formulation and the restrictions imposed in practice. The Electric Vehicle Routing Problem (EVRP) is NP-hard in the strong sense since it is natural extension of the well-known Capacitated Vehicle Routing Problem and requires substantial computational effort for determining optimal or near optimal solutions for medium and large scale problem instances. A comprehensive mathematical formulation is developed in order to model the EVRP and the multiple constraints appeared due to capacity limitations, time window restrictions and the predefined charging level of the vehicles.

In addition, recent trends for the EVRP are analyzed producing valuable insights for future research regarding extra operational constraints, real-life data sets and solution frameworks that embody approximation algorithms for an efficient and effective search of the solution space.

171. PROBLEMS ABOUT TURKISH PARKING REGULATIONS

Bilgic S.^(a*), Yaliniz P.^(b), Vitosoglu Y.^(b)

(a) Eskisehir Osmangazi University, Department of Civil Engineering, Eskisehir, Turkey

(b) Dumlupinar University, Department of Civil Engineering, Kutahya, Turkey

Abstract

Turkey is a rapid developing country whose population growth is considerably large. The rate of young people in total population is also very high. Therefore, the number of motor vehicles has increased significantly in the last 20 years. Most of the Turkish cities do not have enough roads and parking lots in city centers to meet the demand created by motor vehicles whose numbers is increasing day by day. Furthermore, Turkish Parking Regulations (1993) is not enough for increasing vehicle numbers. Consequently, many vehicle owners use on street parking, and as a result, effective road widths are decreasing in many Turkish cities.

According to the Turkish Parking Regulations (1993), one parking lot is required for every 4 apartment or 50 m² of office buildings, or 30 seats of sport arenas. In addition, there is no regulation for cycle parking. These parking lot regulations are very inadequate when compared with the developed countries. The parking problem is inherently triggered by the fact that the predictions about the future in urban development plans are often made wrong. Besides, contractors do not have to construct any parking lot if they pay very low fees to municipalities for consuming regional parking lots created by municipalities. So, many new buildings constructed during recent years have

no parking lots and residents of these buildings use on street parking.

In this study, some suggestions have been made for new parking regulations.

172. CURRENT OVERVIEW OF WATERWAY TRANSPORTATION IN BRAZIL, FOCUSING ON THE PORTS OF RIO GRANDE DO SUL

Huber A.^(a*), Schmitz A.^(b*)

(a) HUBER, Estrela, Brazil

(b) SCHMITZ, Porto Alegre, Brazil

Abstract

Transportation can be understood as the activity of moving people or cargo from one place to another. Since the beginning, transportation played an important role in the development of humanity. With the globalization and the increasingly competitive market, efficient transportation is one of the bases for the development of the economy, because the movement of people and goods favors the integration, the growth of more remote regions and generates wealth for the country. Therefore, the act of transporting is the fundamental means for the progress of any economy, since the origin of barter to globalization. Transportation alone is not an economically significant sector, but is behind the success or failure of almost all other sectors. An efficient freight transportation is compatible the merchandise, the distance to be traveled and the time of delivery to the choice of modal, and is fundamental to the development of a nation, therefore, the shuttle service should be thought of in terms of quality, efficiency and cost. The transport matrix of a country should be defined taking into account these terms, but this is not the reality of Brazil, which despite major territorial dimensions, favors road transport in the internal movement of loads. The inland waterways has high transport capacity, lower fuel consumption per ton handled, cheaper freight compared to road and rail modal and lower maintenance costs of roads but does not receive encouragement and appropriate investments in

the country. Therefore, the objective of the research is to portray the reality of the inland waterway modal in Brazil, focusing on the major ports of Rio Grande do Sul. The development will be based on the method of bibliographic research that seeks to unite current references through the surveyed works, obtaining knowledge, data and information from various domestic waterways, as well as an overview of the current transport situation in the state of Rio Grande do Sul. Some of the obstacles faced by inland waterway transportation in Brazil are the diffuse legislation, various government agencies responsible for the same industry, conflicts with the energy sector, disintegration of projects and even the watercourses with the greatest potential for water transport pass through areas of little economic development.

173. CONVERSION OF A SEMI-TWO LANE ROUNDABOUT INTO TURBO ROUNDABOUT: A SAFETY ANALYSIS

Gallelli V.^(a*), Luele T.^(a), Vaiana R.^(a)

(a) University of Calabria, Rende, Italy

Abstract

Roundabouts have become a common type of intersection in different countries because they contribute to improve traffic safety and to reduce environmental impacts. Moreover, among all types of intersections and with respect to conventional roundabouts, turbo-roundabouts have been proven to offer higher safety levels in particular traffic conditions by reducing the number of potential conflicting points, without compromising efficiency.

A turbo-roundabout is a specific kind of spiraling roundabout characterized by many advantages primarily related to the lower speed of passing vehicles and to the bounding of traffic flows by means of lane dividers. The center island is not traversable or partially traversable and no lane-changing can occur on circulatory carriageway because drivers have to choose direction before entering the intersection.

In the light of the abovementioned facts, this paper focuses in the analysis of safety performance after a geometric and functional conversion of an existing semi-two lane roundabout into a turbo-roundabout. Micro-simulation scenarios were set using experimental data on traffic flows, accepted gaps, approaching delays and queue length measured on the case-study roundabout placed in the city of Cosenza (Italy). The parameters of safety performance were obtained by using the micro-simulation tool VISSIM and then analyzed by the software SSAM.

Results highlighted that the conversion determines benefits for both safety and operational conditions improvement. Furthermore, the comparison carried out in this study can be helpful for both practitioners and administrators in selecting the most adequate geometric design of a roundabout for the specific needs in terms of safety conditions.

174. THE SPEED DEPENDENT HVRP WITH ENVIRONMENTAL CONSIDERATIONS

Molina J. C.^(a), Racero J.^(a), Eguía I.^(a*), Guerrero F.^(a)

(a) University of Seville, School of Engineering, Seville, Spain

Abstract

This paper proposes an eco-efficient speed dependent model based on a realistic variant of the VRP with time windows constraints, backhauls nodes and heterogeneous fixed vehicle fleets, in which vehicles are characterized by different capacities, costs and emission factors. The tackled problem presents a more realistic objective function that accounts not just for internal costs, but also for externalities in transport activities such as CO₂ emissions, pollutants emissions, noise and accidents. The EMEP/CORINAIR model equations are used for estimating fuel consumption, CO₂ and pollutants emissions based on the assigned vehicle speeds.

Finally, this paper presents a case study analyzing the results on the choice of speed dependent eco-efficiency routes, which can help to reduce the emissions of air pollutants, noises and greenhouse gases, without losing competitiveness in transport companies.

181. DECISION SUPPORT SYSTEM FOR CITY LOGISTICS: LITERATURE REVIEW, AND GUIDELINES FOR AN EX-ANTE MODEL

Bozzo R.^(a), Conca A.^(a*), Marangon F.^(b)

(a) University of Genoa, DITEN, Genoa, Italy

(b) D'Appolonia S.p.A., Genoa, Italy

Abstract

The world is inexorably becoming urban. Since 2008, urban population is higher than the rural population. Cities are assuming, therefore, increasingly importance, especially in terms of their central role. Phenomena such as urbanization, and globalization, have contributed to make urban centers more and more complex. One of the most important aspects is characterized by urban freight transportation, which is affected also by the spatial distribution of activities, and residences. It follows that role of decision makers is increasingly difficult because of limited economic resources, and space problems that concern the urban areas. Besides, recent trends promoted by European Commission in the field of sustainable development require a profound reflections concerning the choice of transportation policies, and infrastructures design. On the path towards sustainability for the urban, local authorities make decisions that affect freight transport.

This paper describes the first phase of a two-year research project called "SIPLUS-Systems for Sustainable Urban Planning of Logistics". The goal of the SIPLUS project is "development of an ex-ante model for evaluation of actions and investments in urban goods distribution, in favor of the municipalities". It is a decision support system for the authorities, and for decision-makers. At the end of the project, there will be a

pilot actions with the application of the proposed model in at least one city. In particular, this paper describes the first results, which mainly concern state of the art, analysis of European best practices in city logistics, and the general framework of qualitative model.

183. A METHODOLOGY TO PROMOTE SUSTAINABLE MOBILITY IN COLLEGE CAMPUSES

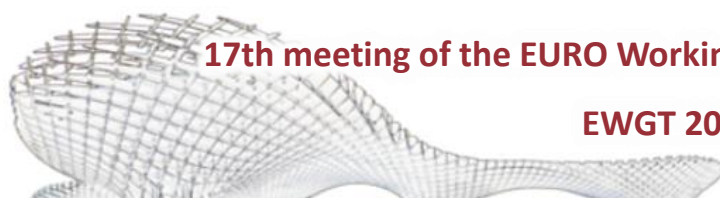
Dell'Olio L.^(a), Bordagaray M.^(a*), Barreda R.^(a), Ibeas Á.^(a)

(a) University of Cantabria, Santander, Spain

Abstract

Like any large company, college campuses generally have serious mobility problems as a result of the increase in private vehicle travel. This study proposes a set of mobility policies aimed at promoting the use of more sustainable alternatives to private vehicles at and around the campus. The study has been applied to the case of Las Llamas Campus at the University of Cantabria in Spain. Using the data collected at the various stages of the methodology, the mobility alternatives in this research consider the management of the parking spaces, a bike-sharing system and a shuttle bus to specific destinations from a stadium car park located on the limits of the campus, thereby making the most of such a big but often empty city infrastructure.

An essential point to be highlighted in terms of the methodology is the design of the Stated Preferences survey (SP) in which a number of "hypothetical" scenarios are presented to analyze the user's response as a result of changes in the transport system and the influence of different parking policies at the university. This collection procedure has provided the data to model the individuals' behavior using discrete choice models. The model and the results obtained throughout this research must be taken into account in future analyses concerning fee



scenarios for cycling and parking inside the campus.

The results of this study provide interesting conclusions for predicting the demand for sustainable transport patterns and assist in the design and quantification of parking policies.

184. TRAVEL TIME OF PUBLIC TRANSPORT VEHICLES ESTIMATION

Birr K.^(a*), Jamroz K.^(a), Kustra W.^(a*)

(a) Gdansk University of Technology, Gdansk, Poland

Abstract

Effective prediction of travel times is central to many advanced traveler information and transportation management systems. On the average speed of public transport vehicles is affected by many external factors, which result from the traffic volume, organization, infrastructure and many others. Literature presents the issue of methods for estimating travel time on sections of transport network and vehicle arrival to a stop, often making use of the AVL (automatic vehicle location). The aim of authors of this paper is to identify these factors and their impact and significance on the average speed of public transport vehicles in selected sections of the transport network. The paper presents the results of field studies involving the measurement of travel time of public transport vehicles in the main streets of the Tri-City Agglomeration (Gdansk, Sopot, Gdynia). The study was carried out in the framework of the project urban traffic control system TRISTAR - before start-up the system. Based on the collected data the authors built a model of the relationship between the average speed of public transport vehicles, and these external factors. The results will be used to calibrate the macroscopic transport model in Tricity agglomeration.

186. SIMULTANEOUS FREQUENCY AND CAPACITY SETTING IN UNCAPACITATED RAILWAY LINES IN PRESENCE OF A COMPETING MODE

De los Santos A.^(a*), Laporte G.^(b), Juan A. Mesa J. A.^(a), Perea F.^(c)

(a) University of Seville, Department of Applied Mathematics II, Seville, Spain

(b) Canada Research Chair in Distribution Management (CIRRELT) and HEC Montreal, Spain

(c) Politechnic University of Valencia, Department of Applied Department of Statistics and Operations Research and Quality, Valencia, Spain

Abstract

Given the set of lines representing a railway network, and other parameters such as costs, speed, origin/destination matrix, etc., the goal of this paper is to fix the frequency of each line and the capacity of each train so that the net profit of the network is maximized. To introduce the net profit, a rigorous analysis for the calibration of different concepts that appear in its definition is needed. We introduce an exact algorithm and a heuristic approach. Both procedures are compared over a set of randomly generated instances.

189. A MULTI-OBJECTIVE TIME-DEPENDENT ROUTE PLANNER: A REAL WORLD APPLICATION TO MILANO CITY

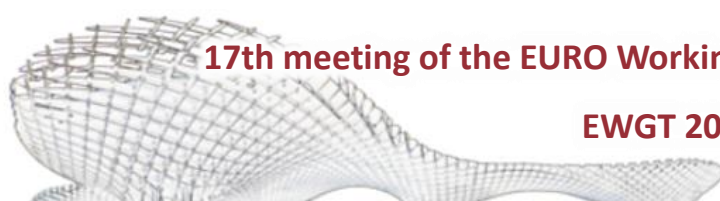
Bruglieri M.^(a*), Colorni A.^(ab), Lia F.^(b), Luè A.^(ab)

(a) Polytechnic University of Milan, Department of Design, Milan, Italy

(b) Poliedra - Polytechnic University of Milan, Milan, Italy

Abstract

The past decades have seen a great deal of research on algorithms for shortest path problems. However, real-world systems like route planners and mobile navigation systems require to take into account some additional conditions. Our work concerns a truck route planner for real-time navigation developed for an Italian firm and tested on real world data of



Milano road network (about 61,000 nodes and 106,000 arcs). Given the vehicle GPS position and its wished destination, the route planner allows to find in a few seconds a path between them which minimizes simultaneously travel time, travel cost and risk. Beside the multi-objective optimization and the CPU efficiency, other challenging features faced by the algorithm that supports the route planner are the time-dependency of some attributes (e.g. the travel costs due to the congestion charge ruling the access to limited traffic zone in the Milano centre) and the presence of forbidden turns. Results on the real network of Milano are obtained and discussed.

190. DISCRETE CHOICE MODELS TO DETERMINE HIGH SPEED PASSENGER STOP UNDER EMERGENCY CONDITIONS

Sañudo R.^(a*), Bordagaray M.^(a), Dell'Olio L.^(a), Ibeas Á.^(a)

(a) University of Cantabria, Santander, Spain

Abstract

High Speed railways are one of the most reliable means of transport. Security and reliability are important so the system has to be prepared to take action in case something goes wrong. It is crucial for a railway management plan to have emergency procedures for a quick response in case of incident or accident. In this paper a model is presented that locates the stop of a train in a certain area during an incident or accident using discrete choice models. This model will support future decision making protocols.

Random utility theory assigns utility to each corner of the railway network to calculate where the most suitable place to stop the train is depending on variables such as train speed, place of failure, or type of accident or incident, among others.

A minimum computational cost model provides results which support decision-making

procedures on high-speed trains during emergency situations.

This paper presents a methodology to determine the most suitable place to safely stop a train in the minimum time and the procedure could be included in future safety standards and emergency protocols.

Both external and internal data from the railway are calibrated to predict the most likely place to stop. Not only the stop is predicted but the model also considers timetable effects, meaning the methodology can also be applied to schedule-based railway systems, a characteristic that endows the method with great potential since it considers minimal impacts on schedules.

192. COMPARING URBAN MOBILITY INDICATORS ON THE IMPLEMENTATION OF NON MOTORISED VEHICLES STRATEGIES IN URBAN AREAS

Duarte Sastre A. L.^(a), Mendoza Muro M. S.^(b), Rodríguez Estévez S.^(b), Fernández de Valderrama Aparicio L. M.^(b), Duarte Sastre J. A.^(b), Berazain M.^(c), Pineda Gamarra P.^(c)

(a) Polytechnic School of Algeciras, PAIDI TEP-024 Intelligent Systems Modeling, Algeciras, Spain

(b) University of Seville, PAIDI TEP-238 Research on Generation of Territories, Seville, Spain

(c) The University of San Simón, Research Institute of Architecture and Habitat Science, San Simón, Bolivia

Abstract

The lack of resources and funding to start the implementation of Sustainable Urban Mobility Plans (SUMP), is one of the main problems that nowadays affects local administration both in metropolitan areas and smaller towns. As a tool of assessing the efficiency of the actions to be taken to start the implementation of the SUMP, some urban mobility indicators has been described in them. The different options and levels of complexity depending on the available data, ease of implementation, its schedule on transport modes and infrastructure affected, attracts us to conduct this study. In this paper, a comparative analysis about the urban mobility

indicators in the development of non motorized private vehicles strategies in urban Areas are reported focusing in those variables allowing to initiate the implementation of the measures contained therein in an austere form, on a basis of the SUMP developed in a group of municipalities surrounding metropolitan areas in the province of Cádiz (Spain), and the Sustainability Indicator Panel of the Urban Territorial Observatory of the metropolitan area of Cochabamba (Bolivia).

197. ANALYSIS OF THE DIFFERENCE BETWEEN THE EUCLIDEAN DISTANCE AND THE ACTUAL ROAD DISTANCE IN BRAZIL

Gonçalves D.^(a), Gonçalves C.^(a), Assis T.^(a), Da Silva M.^(a)

(a) Military Institute of Engineering, Rio de Janeiro, Brazil

Abstract

Soybean is a commodity that has an important influence on the Brazilian economy because it accounts for the largest share among the grains in the export market. Its main production centers excel in regions far from major consuming centers, requiring long commutes especially in road transport. The distance is the most influential factor in transport costs and is directly related to the freight. To define actual road distances, particularly in unfamiliar roads, it is necessary to use a correction factor. In addition to estimating a better correction factor, the paper aims to contribute by developing a procedure to identify this factor. This paper will analyze the relationships between existing Euclidean distances in numerous points, the producing centers and Brazilian's ports, performing comparisons between the correction factor obtained by calculation in this article with the factors obtained by other authors, also seeking to relate the road distances calculated based on intervals and freight. The advantage of obtaining a more accurate factor k is to allow the results of different location, such as punto- median be more

accurate. The result was satisfactory when comparing with the existing literature.

199. MACROSCOPIC MODELING OF VERY LARGE NETWORKS

Lebacque J. P.^(a), Khoshyaran M.^(b)

(a) University of Paris-Est, IFSTTAR/COSYS/GRETTIA, Marne-la-Vallee, France

(b) Economics Traffic Clinic (ETC), Paris, France

Abstract

Modeling and simulation of large networks is increasingly important for applications. These include applications involving long-range inter-vehicular communication, the development of new modes of transportation (electrical vehicles, autolib), large scale traffic management schemes, and the evaluation of transportation externalities.

Traffic information is either very localized (detector data), or approximate and difficult to obtain (OD data, trip/path choice, activity chains), or cheap, unlocalized and abundant but biased (GPS-based data). It is thus difficult to acquire quality data for a complete large network. The model proposed in the paper describes traffic with precision wherever sufficient data is available, and describes it approximately everywhere else.

The model combines a GSOM (generic second order model) [4] on the network of major streets and arterials where data is easily available, with a bidimensional approximation of traffic on dense networks of smaller streets [5], where traffic data is not readily available. The GSOM model combines the kinematic features of the LWR model with dynamics of driver specific attributes and can thus take into account inter-vehicular communication. The bidimensional model is based on the idea of dividing the dense network into zones, the in-and outflows of which behave like the in- and out-flows of intersections [3]. From the modeling point of view the challenge to be addressed is to couple a system of conservation equations on a graph (the GSOM

model) with a system of conservation equations on a bidimensional medium.

An application of the model to the estimation of traffic emission of pollutant (hot engine and cold start engine [1], [2]) will be presented.

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203. TECHNIQUES IN MULTIMODAL SHORTEST PATH IN PUBLIC TRANSPORT SYSTEMS

López Flores D.^(a*), Lozano A.^(a)

(a) National Autonomous University of Mexico (UNAM), Engineering Institute, Mexico City, Mexico

Abstract

Advances in the use of real-time multimodal transport networks are based on space-time networks, these networks grow very fast if applied to real transport systems dimensions, so it is necessary: pre-calculate some or all paths between any pair of nodes, reduce the size of the

network or use techniques to accelerate algorithms in order to find shortest paths in reasonable times. In this paper four techniques used to find shortest paths are discussed. These are good candidates for future implementation in a data structure that allows us to calculate shortest paths with real-time information. The first technique stores the pre-computing of all possible paths between any two points within the subgraph containing those arcs that are time dependent. These paths are stored in a database that can be updated in real-time when the user performs a query on the network (Jariyasunant et al., 2010). The second paper uses a set of rules to build an abstract graph (considering only transfer nodes) from a directed multimodal time-dependent graph. Every time the user makes a query, the abstract graph and the direct graph are used to build a third type of graph called relevant graph where the shortest path requested by the user is easily found (Ayed, et al., 2011). In the third technique the authors point that given a starting time, the optimal path for a given source and destination may vary, however, the paths are in general topologically similar. They use this property to simultaneously update all topologically similar paths entering a given node in an instant of time. In order to update all the topologically similar paths they associate to each node the optimal time path of all paths entering to the node. So the goal is to find the optimal time of all paths entering any node. This structure allows that the complexity of the algorithm does not be dependent on the number of modes and the time intervals (Ziliaskopoulos & Wardell, 2000). Finally, Wang, Zhang, Hong, Guo, & Yu (2009) build a transport network using a database with a hierarchical structure, where the street network belongs to the highest hierarchy while networks specific to each mode are in the lower hierarchies. Through relationships between databases and using a transfer matrix the authors can find paths between any two points efficiently. The four techniques are illustrated and compared by means of a test network.

204. DYNAMIC LOCATION OF DISTRIBUTION CENTRES, A REAL CASE STUDY

Segura E.^(a), Carmona Benítez R. B.^(b),
Lozano A.^(a)

(a) National Autonomous University of Mexico (UNAM), Department of Systems and Transportation, Mexico City, Mexico

(b) Anahuac University of North Mexico, School of Business and Economics, Mexico City, Mexico

Abstract

A review of literature indicates that a problem related with Designing Distribution Networks (DDN) involves several decisions to be optimized, such as location, allocation, inventory, and routing. In this paper, we focus only in the location decision, proposing and exemplifying the following hypothesis: the location of Distribution Centres (DCs) changes whether the product demand at each demand node has extremely high and unexpected variability through time and investment costs for the location of DCs are low (mobile infrastructure). Three levels of planning can be distinguished depending on the time horizon: strategic (more than 1 year), tactical (more than a day but less than a year) and operational (days, hours, or even minutes). In this paper we show that the decision of location of DCs can be tactical and not necessarily strategic for products with unexpected extremely high demand and with low investment costs for the location of DCs (mobile infrastructure). A real study case to validate the hypothesis is presented. The study case is about a company that transports a hazardous material. The location of DCs problem is solved by applying the myopic algorithm to the p-median model. Then, the hypothesis is probed through a sensitivity analysis, by changing the values of the demand in each demand node through time, in a realistic way for this product. We conclude that the variability of the product demand directly affects tactical and strategic decisions and therefore affects the ability to find a good solution for the long term. This analysis gave a better understanding of the significant

impact of the variability of the product demand in Problems of DDN.

205. A BILEVEL OPTIMIZATION PROGRAM WITH EQUILIBRIUM CONSTRAINTS FOR AN URBAN NETWORK DEPENDENT ON TIME

Londono G.^(a*), Lozano A.^(a)

(a) National Autonomous University of Mexico (UNAM), Engineering Institute, Mexico City, Mexico

Abstract

We study the possibility of combining bilevel network design problems, time dependent user equilibrium assignment and suitable link performance functions. We are setting up a time dependent-bilevel traffic assignment model, expressed as a mathematical program treated as a mathematical program with equilibrium constraints (MPEC). In addition, we suggest an objective function to minimize the total travelled time on the network, which depends on link flow and arc queue length that recognizes the Wardrop user equilibrium, where time travel is flow dependent on the arc. We found that there is a gap between theoretical and practical developments, which must be approached with new ideas and theorems.

206. THE INVESTMENT DECISION PROCESS: HOW TO FORMULATE PRIORITIES IN THE TRANSPORT SECTOR?

Venezia E.^(a*)

(a) University of Bari, Departement of Economics, Bari, Italy

Abstract

How to formulate priorities for government's policy? Sometime there is not a proper coincidence between government's priorities and the final users of those investments (i.e. the demand side of the market and operators who have to use infrastructures). This is normally due to the fact that the project cycle is not properly structured in the sense that social needs are not

investigated in a preliminary phase of the investment procedure analysis.

The problem is that much of the decision-making about infrastructural investments, including the prioritization of projects – and their implementation – still occur a correct procedure in order to reduce the risk of failure or inappropriate resource allocation. This is because public investment planning is highly politicized and it generally results in “wish lists” which fits budgets parameters and, for Europe for example, tends to obtain the maximum amount of resources from European funds. So there is a wide degree of political discretion or of other non-economic factors (Tsamboulas (2007), Flyvbjerg (2007), Flyvbjerg-Holm –Buhl (2004)).

The basic idea is that project appraisal is weak, not for methodologies but for the lack of a proper assessment cycle. Good public investment planning and evaluation processes are key elements to ensuring successful infrastructures investments. The suggestion, therefore, is to analyse the market by acquiring information and then drawing a “plan of needs”. Only then investments can be selected on the base of priorities which can increase the economic welfare into two different ways: directly by affecting those who will use those investments, and indirectly by generating positive externalities to other social groups. It is like to have a transport investment needs assessment (TINA) but , in this case, based on real needs of population. Each project will then go through a normal procedure of assessment, respecting budget limitations.

The primary purposes of the paper are: to identify an effective prioritization process which has as a “core variable” real needs of the society, regardless budget constraints and to run an assessment process, based on those needs, which ends with a risk analysis that gives useful indications of possibilities to fail or not with that project. This final step should be enforced in terms of currently tools used. Project implementation and monitoring arrangements could therefore be strengthened and procurement techniques could be used more effectively.

207. THE MULTI-PATH TRAVELING SALESMAN PROBLEM WITH STOCHASTIC TRAVEL COSTS. BUILDING REALISTIC INSTANCES FOR CITY LOGISTICS APPLICATIONS

Maggioni F.^(a), Perboli G.^(bc*), Tadei R.^(b)

(a) University of Bergamo, Department of Management, Economics and Quantitative Methods, Bergamo, Italy

(b) Polytechnic University of Turin, DAUIN, Turin, Italy

(c) Canada Research Chair in Distribution Management (CIRRELT), Montreal, Canada

Abstract

One of the main issues related to routing problems applied in an urban context with uncertainty related to the transportation costs is how to define realistic instances. In fact, the instances present in the literature are often too much artificial to really reflect the peculiarities of urban transportation, and the freight transportation in particular. In this paper, we overcome this issue, providing a standard methodology to extend routing instances from the literature incorporating real data provided by sensors networks.

In order to test the methodology, we consider a recently introduced routing problem specifically designed for City Logistics and Smart City applications, the multi-path Traveling Salesman Problem with stochastic travel costs. Given a set of nodes, where each pair of nodes is connected by several paths and each path shows a stochastic travel cost with unknown distribution, the multi-path Traveling Salesman Problem with stochastic travel costs (mpTSPs) aims at finding an expected minimum Hamiltonian tour connecting all nodes. The mpTSPs arises in City Logistics when one has to design tours to provide services such as garbage collection, periodic delivery of goods in urban grocery distribution, and periodic checks of shared resources as in bike sharing services. In these situations, the decision maker must provide tours that will be used within a time horizon, which spans from one to several weeks. In this case, the different paths connecting pairs of nodes in the city are affected by the uncertainty due to the different time-dependent

travel time distributions of the paths. Moreover, in many cases even an approximated knowledge of the travel time distribution is made difficult by the large size of the data involved and the high variance of the travel times.

New instances representing a medium-sized city derived from the speed sensor network of the city of Turin are introduced and the corresponding results discussed, showing benefits and limits of the methods presently available in the literature.

209. ANALYTICAL FORMULATION OF TRIP TRAVEL TIME DISTRIBUTION

Chen X.^(a), Osorio C.^(b)

(a) University of Coimbra, Department of Civil Engineering, Coimbra, Portugal

(b) Massachusetts Institute of Technology, Department of Civil and Environmental Engineering, Cambridge, United States

Abstract

The objective of the present work is to derive an analytical tractable approximation of trip travel time variability from link travel time distribution. The main challenge is to incorporate spatial dependencies between links in a tractable manner. To achieve this, we derive a tractable extension of Little's law for finite capacity Markovian queueing networks. We then use this approximation to the path travel time variance in a general queueing network, and a general urban road network.

210. OPTIMIZATION OF CYCLE PATHS WITH MATHEMATICAL PROGRAMMING

Liñan R. J.^(a), Gaspar I.^(a), Bordagaray M.^(a), Moura J. L.^(a*), Ibeas Á.^(a)

(a) University of Cantabria, Research group in Transport Systems, Santander, Spain

Abstract

The recent evolution and development of urban areas has dramatically transformed the layout of cities and has had a significant impact on mobility. Decision makers have become aware of the problem and have begun to take measures to

manage the changing demand for mobility through the diversification and promotion of less aggressive and more efficient transport modes: walking, cycling and using public transport. New standards in sustainable mobility are being incorporated into this new scenario to encourage a reduction in car use. These standards form the basis for the design of planning tools and more efficient management systems, among them, encouraging the use of bicycles as an everyday mode of mobility in urban areas.

There are a number of programs aimed at the promotion of cycling in cities. One in particular is for the planning and design of cycle paths through the establishment of networks that allow the use of bicycles in preferential paths with high safety guarantees. This paper presents a mathematical programming model for the optimal design of a network intended for cyclists. Specifically, the model determines which type of infrastructure (type of bike lane) is most appropriate on each link of a road network, based on criteria of cost to users and the investment cost of the infrastructure itself.

As an application of the proposed model, several experiments are presented on a testing network based on the known Sioux Falls network. As a result of these experiments a number of useful conclusions are obtained for the design of cycle networks from a social and operational perspective within a pre-defined cost.

The model has been developed to be highly versatile and to allow any type of change (different network, different levels of demand, etc ...) and to assure the least consumption of computational resources.

212. USERS' PREFERENCES TOWARDS AUTOMATED ROAD PUBLIC TRANSPORT: RESULTS FROM EUROPEAN SURVEYS

Alessandrini A.^(ab), Alfonsi R.^(a), Delle Site P.^(ab*), Stam D.^(a)

(a) University of Rome "La Sapienza", Research Centre for Transport and Logistics (CTL), Rome, Italy

(b) University of Rome "La Sapienza", Department of Civil Architectural and Environmental Engineering (DICEA), Rome, Italy

Abstract

Collective automated road transport systems (ARTS) are the subject of current research in Europe. The paper reports on the results of the investigations about users' attitudes towards ARTS and conventional buses that have been carried out in twelve cities where the implementation of an ARTS service is being planned within the Citymobil2 project. A common stated preference questionnaire has been used. The econometric analysis has been based on the estimation of a logit model which has considered the choice for two alternatives: ARTS and minibus. The observed attributes are: waiting time, riding time and fare. Of particular interest, is the estimation of the alternative specific attribute (ASA) of the ARTS, because this represents the mean of all the unobserved attributes of the automated system that affect the choice. With a common specification of the systematic utilities of ARTS and minibus, the observed attributes being the same, a positive value of the ASA is indicative of a relatively higher preference for the ARTS. The results show a relatively higher preference for ARTS across the cities where the ARTS is implemented inside a major facility. In other application contexts, commonalities in attitudes across cities are not found. The impacts on attitudes of the socio-economic attributes of the users are heterogeneous across cities.

213. UPDATING TRIP MATRICES USING HETEROGENEOUS DATA SOURCE UNDER CONFIDENCE INTERVAL CONSTRAINTS AND HIGH CONVERGENCE ASSIGNMENT

Benítez F. G.^(a*), Reyes A.^(a), Romero L. M.^(a), Caceres N.^(a), Del Castillo J. M.^(a)

(a) University of Seville, Transportation Research Group, Seville, Spain

Abstract

This communication deals with the classical problem of trip matrices estimation from observed data based within the framework of bi-level codes implementing traffic equilibrium assignments. However, the present approach offers several novel contributions to the development of practical implementations from a threefold point of view: first, the observed data are not the widely-used (aggregated) link counts but those inferred from various heterogeneous sources (i.e. disaggregated volumes attending to the origin and destination of every trip, aggregate data from macro-zones), which provide a more detailed and consistent O-D basis to modify the global O-D trip matrix; second, the imposing of an upper-level optimization schema subject to constraints inferred from the technique of bootstrapping; and third, the model formulation pays careful attention to a bi-level high convergence assignment methodology to cope with large networks subjected to congestion.

The distortion of the information contained in a prior matrix at several levels of aggregation (individual O-D pairs, zone productions and attractions, and total number of trips) by imposing a set of variable bounds and functional constraints defined, either in absolute or relative increments, according to those values of the initial estimate, guarantees a nonempty feasible region. Moreover, the side constraints never become redundant as long as the bounds imposed to the O-D matrix to be estimated become more restrictive as higher the level of aggregation is. The constraints imposed are inferred using the technique of "bootstrapping", which allows

generating confidence intervals of travel between origin-destination pairs defined by each cell of the OD matrix derived from a transport survey. This result is basic to define the dimensions of variability in the cells of said matrices and subsequent adjustment by updating techniques based on aggregate data (i.e. traffic counts, cordon survey, aggregate link counts, observed paths, etc.).

To address this study a data set from a statistically reliable metropolitan transport study conducted in Spain has been used. The outcome of this research concentrates in the OD matrices at the inter-zone level derived by the application of the bootstrapping approach. The study shows the usefulness of this approach in terms of mathematical simplicity and accuracy. The results are very stimulating for engineers and practitioners involved in transport research, particularly in demand modelling.

214. BILEVEL PROGRAMMING BASED ALGORITHM FOR THE O/D MATRIX ADJUSTMENT

Reyes A.^(a*), Romero L. M.^(a), Benítez F. G.^(a)
(a) University of Seville, Transportation Research Group, Seville, Spain

Abstract

Obtaining O/D matrices through surveys is a very expensive process that usually has low statistical reliability. This research analyzes the O/D matrix adjustment using data collected from traffic volume counts. Traffic data is a cheap and reliable source of information that it is automatically collected in a considerable number of locations.

To perform the O/D matrix estimation process, a bilevel programming methodology that implements high traffic assignment convergence is provided. The main feature of the proposed methodology is a new method to calculate the descent direction at the upper level. This is obtained using a numerical procedure based on finite difference method.

A set of algorithms that perform the O/D matrix adjustment has been designed employing the proposed methodology. These algorithms differ mainly in the high convergence traffic assignment method implemented. Using high convergence traffic assignment methods is essential because the finite difference method works with solutions that differ infinitesimally and assignment algorithms should be able to appreciate the resulting flow deviations.

This study shows the results obtained when proposed algorithms are applied to medium and large scale networks.

215. A MANAGEMENT MODEL FOR AUTOMATED RAILWAYS MAINTENANCE

Cores Prieto F. J.^(a*), Caceres N.^(a), Benítez F. G.^(a), Escribá Marín S.^(b), Jiménez-Redondo N.^(b)

*(a) University of Seville, Transportation Research Group, Seville, Spain
(b) CEMOSA, Malaga, Spain*

Abstract

ACEM-Rail is a project funded by the European VIIFP for the organization and control of the maintenance of railway infrastructure. The project aims the development of new technologies for the automation of the maintenance management with the goal of reducing costs, time and resources required for maintenance activities and, therefore increasing the availability of infrastructure.

ACEM-Rail project is based on five pillars: i) development of several technologies for the automated and cost effective inspection of the track, ii) development of algorithms for assessing the state of the infrastructure and estimating the evolution of defects, iii) development of optimization algorithms and techniques for planning and scheduling the maintenance tasks in short, medium term, iv) development of an effective Infrastructure Management Subsystem that supports the decision-making process and is responsible of the management of the railways maintenance, v) development of technologies

and tools for monitoring the proper execution of maintenance tasks.

In this paper we set the focus on the ACEM-Rail IMS (Infrastructure Management Subsystem). This system is a modular architecture built as a composition the project subsystems (algorithms and data) with software specialized in the management of assets maintenance. The main component of the system is a commercial CMMS (Computerized Maintenance Management System) that implements LAM (linear asset management). In ACEM-Rail, the railway infrastructure is decomposed into track segments that represent the smallest unit to be treated. These assets are characterized with the information required for the automation of management like classification and hierarchy, track composition, geometry, speed, breaking degree, etc. The train services are included into the system in order to provide with information about the operation in the railway network, availability time windows for maintenance and loads over the infrastructure.

This database receives automated information about the state of the track and the location of warnings with its corresponding defect type and severity level. The warnings can be generated by the inspection sensors, the maintenance technician or by the preventive maintenance planning. These warnings are managed by the PMU (Process Management Unit) that determines the workflow that is required for maintenance of each problem. The system provides with different workflows depending on the detection system, the defect type, the location and the severity level. A warning may require a visual inspection to determine the type and severity of a defect, can require periodic inspections to have control on the degradation process or may need a corrective maintenance operation.

217. ANALYSIS OF DISAGGREGATED TRAFFIC COUNT OF DANGEROUS GOODS THROUGH ANPR SYSTEMS

Morales F. J.^(a*), Benítez F. G.^(a)

(a) University of Seville, Transportation Research Group, Seville, Spain

Abstract

Currently, the available information to conduct traffic studies involving dangerous goods is included on the Traffic Map annually published by the Spanish Ministry of Public Works. This information does not indicate the type of hazardous material and it is obtained by manual count carried out only 6 times a year (on weekdays and only for six hours).

However, this study allows, using ANPR systems (Automatic number plate recognition), obtaining information 24 hours a day, 365 days a year and in a disaggregated way. The system is able to identify the hazardous substance by reading the UN code that identifies the substance. This code is included in the orange plate that the vehicles must carry if they transport this kind of material.

The system interprets the substance carried and the associated risk, as well as the position and direction of the vehicle, recording the information on a central server.

The system consists of a distributed set of counting stations located at strategic points of observation. These observation points have been located according the following criteria:

- Points with high traffic flow
- Monitorised of the largest possible number of origin-destination pairs.
- Accessibility of the facility.
- Proximity of a traffic count station to calibrate the system (including manual traffic count of dangerous goods).

Once the information is obtained with this automatic system, a comparison between the two sources of information is made. In this way, conclusions about the published information may be obtained.

As disaggregated information is obtained, many studies such as classification of materials according to their importance in terms of volume transported, identifying areas with high environmental risk, updating origin-destination matrices, etc. may be performed

218. POTENTIALS FOR THE MODAL SHIFT FROM ROAD TO RAIL IN THE TRANSPORT OF DANGEROUS GOODS

Caceres N.^(a*), Romero L. M.^(a), Benítez F. G.^(a), Del Castillo J. M.^(a), Sastre J.^(b)

*(a) University of Seville, Transportation Research Group, Seville, Spain
(b) ALOMON, Civil Engineer, Seville, Spain*

Abstract

Dangerous goods or hazardous materials (also referred to as “hazmat”) are substances or items that pose a danger for people, property or the environment in contact with them due to their chemical or physical properties. The transport of hazmat is an important concern due to the inherent risks of cargo. These materials can be transported by various means or modes (maritime, road, railway, inland waters, aviation and pipeline) but road transport is the most commonly used mode. In 2011 approximately 4% of the goods moved by road for most European countries were dangerous substances, although in countries like Spain the rate exceeded 5%. However, the transport of hazmat by road involves risks to the drivers of trucks, the road users, the population and the environment that cannot be underestimated. It is therefore highly important to identify any action which can reduce the carriage of dangerous goods by road.

Existing studies reveal that rail transport could certainly contribute to this aim. Rail freight transport can reduce significantly highway congestion; one intermodal train can haul around 280 trucks. Moreover, rail is statistically the safest method of moving large quantities of chemicals over long distances. However the share of rail transport is very small compared to road, only 4.5% of total tonne-kilometres of hazmat were transported by rail in Spain for the

year 2011. This low share is probably due to a mix of factors such as the lack of flexibility and interoperability, especially over shorter distances. Given their nature, road and rail freight transport perform on different markets, but there are still substantial overlaps in the segment associated with hazmat.

This communication reviews and evaluates the case of the transportation of hazmat in Spain by analyzing historical data in terms of volume and tonne-kilometres (by rail and truck). This research also examines the problematic from the point of view of the different actors involved in the transport of these substances, including shippers, carriers and logistics service providers. The communication describes the advantages and disadvantages of rail movements of hazardous materials in order to explore the modal shift from road to rail. Finally, the communication investigates general barriers and operational issues, legal and technical requirements that can be considered necessary to perform such modal shifting.

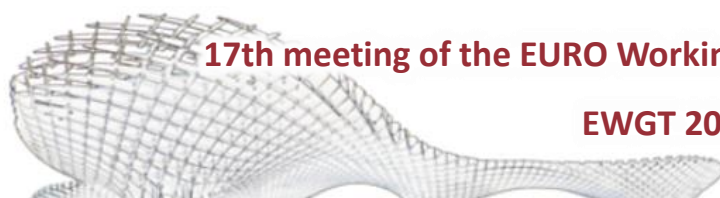
219. DEMAND MODELS FOR THE TRANSPORTATION OF DANGEROUS GOODS BY ROAD IN ANDALUSIA

Romero L. M.^(a), Caceres N.^(a), Benítez F. G.^(a), Del Castillo J. M.^(a)

(a) University of Seville, Transportation Research Group, Seville, Spain

Abstract

In the modern society, a huge amount of products classified as Dangerous Goods (DGs) is consumed. The transportation of these materials, despite being subject to strict regulations, may present risks to health and safety and cause environmental pollution in the case of accidents. A reliable estimate of flows of vehicles carrying dangerous goods provides valuable information for transport researchers. Different issues can be analysed by means of these models, such as the definition of alternative routes to relieve the points of the highest concentration of DGs, or the optimal location of new Logistics Centre for



these substances. Additionally, in the same line of work, vulnerable areas can be determined using this tool and taking into account the amount, frequency and characteristics of the materials transported through the road network. In addition, the estimates of the DG movements can also help set priorities for emergency actions in the event of an accident.

This paper presents a system for estimating the flow of vehicles in each road section of the region of Andalusia in southern Spain. One of the most novel aspects of the developed methodology is based on ANPR systems (Automatic number plate recognition). This approach identifies the hazardous substances transported in the monitored road sections by reading the UN codes and identifier risks in the ADR orange plates of the vehicles carrying this kind of substances .

The system consists of a distributed set of counting stations located at strategic points of observation over the road network. This set of points is defined by a procedure of optimal location based on criteria of flows, the possible origin - destination pairs observed and the accessibility of the facility.

Demand models developed from the information collected by this system are presented in this communication. A new adjustment process of origin-destination matrices has been designed to consider the observed values of volume in the links of the network of different nature: a) categorized flows for each substance - Type of DG (ANPR system) and b) values aggregates for all types (manual DG traffic counts conducted by the Spanish Ministry of Public Works). Finally, Generation-Attraction and Distribution models were inferred from socioeconomic and energy consumption variables at municipal levels, which are also presented in this communication.

220. MULTIPLE CRITERIA EVALUATION OF DIFFERENT REDESIGN VARIANTS OF THE PUBLIC TRAM SYSTEM

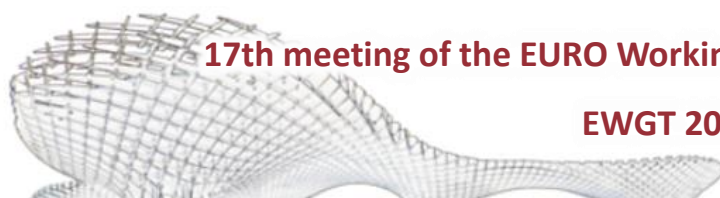
Kiba-Janiak M.^(a), Zak J.^(b*)

(a) Wroclaw University of Economics, Jelenia Gora, Poland

(b) Poznan University of Technology, Poznan, Poland

Abstract

The paper presents a multiple criteria evaluation of ten redesign variants of the public tram system in one of the medium sized cities in Poland. The variants have been constructed heuristically, based on “common sense”, best practices and authors’ expert knowledge in the field. Multiple criteria evaluation of the proposed variants has been performed with the application of a consistent family of criteria that includes social, economic, technical and environmental aspects. It also represents the interests of the Decision Maker (DM) – local authorities (government) and different stakeholders, such as: passengers, operator and local community. The authors have defined different models of preferences to express subjective expectations of the DM and stakeholders. The decision problem, formulated as a multiple criteria ranking problem has been solved with the application of selected Multiple Criteria Decision Making/ Aiding MCDM/A methods, such as: AHP and ELECTRE III/IV. The authors have carried out a series of computational experiments and have compared their results with intuitive decision making process carried out in the local Town Hall. Since in many countries local governments are responsible for public transportation planning and control the proposed methodology can be viewed as a decision support tool for governmental officers and local administration.



222. INTEGRATION OF THE URBAN PUBLIC TRANSPORTATION SYSTEM WITH THE APPLICATION OF TRAFFIC SIMULATION

Solecka K.^(a*), Zak J.^(b*)

(a) Cracow University of Technology, Cracow, Poland

(b) Poznan University of Technology, Poznan, Poland

Abstract

The paper presents the overall methodology of designing and assessment of transportation solutions that result in the integration of an urban public transportation system. The proposed approach is based on the application of heuristic – expert design of an integrated urban public transportation system, its simulation with the use of a computer-based macro-simulation system VISUM and its multidimensional–multiple parameter comparison with the existing solution. The article describes in detail all the steps to be taken when applying the proposed procedure that leads to the development of an integrated public transportation system. While designing the transport integration solutions the authors focus on the following dimensions of integration: spatial, infrastructural, organizational, economical and informational. The comparison between the proposed variant of integration and the existing public transportation system is carried out.

223. THE SELECTION OF THE LOGISTICS CENTER LOCATION BASED ON MCDM/A METHODOLOGY

Zak J.^(a), Weglinski S.^(a)

(a) Poznan University of Technology, Faculty of Machines and Transportation - Logistics Division, Poznan, Poland

Abstract

The paper presents the first stage of the MCDM/A-based two-stage procedure resulting in the selection of the most desirable location of the logistics centre. In the first stage, the macro-analysis of the regions is carried out and multiple criteria evaluation of their technological,

infrastructural, economic, social and environmental potential is performed. The decision problem is formulated as a multiple criteria ranking problem. The considered variants – regions are ranked from the best to the worst – in terms of their suitability for locating the logistics centre within their boundaries – with the application of the MCDM/A method, called Electre III/IV. The variants and a consistent family of criteria are defined, the DM's preferences are modelled and the results of computational experiments are demonstrated.

224. APPLICATION OF AHP METHOD FOR MULTI-CRITERIA EVALUATION OF VARIANTS OF THE INTEGRATION OF URBAN PUBLIC TRANSPORT

Nosal K.^(a*), Solecka K.^(a*)

(a) Cracow University of Technology, Cracow, Poland

Abstract

Transport policy, implemented in cities, should lead to obtaining sustainable transport system, allowing fulfilling residents' travel needs, improving transport accessibility, as well as simultaneously meeting the criteria of environmental protection, economic efficiency and equal access for the society. These objectives can be achieved through the implementation of solutions that are aimed on travel demand management and the promotion of sustainable mobility modes. One of the instruments that allows to shape mobility patterns is an integration of urban transport system, leading to increasing public transport use. Integration brings benefits to both, public transport passengers and to local authorities, as well as to public transport operators, city units responsible for transport management, passengers and others users. This article discusses possible tools of integration of urban public transport and presents basic concepts of urban public transport integration. The process of striving for integration of urban transport requires detailed analysis of tools to assess the activities. The cities often offer

different variants of the integration of urban public transport, but it is difficult to determine which option is the best. This choice can be easier by making an assessment of variants of the integrated system of urban public transport (ISUPT) by using multi-criteria decision aid methods (MCDA). The article presents the main elements of the methodology of multi-criteria decision aid (MCDA), and then the possibility of applying the MCDA methods to assess variants of ISUPT. To assess variants of ISUPT, the AHP ranking method was used. Special attention was paid to the complexity of the considered problem, where it is necessary to take into account many aspects of it, such as: economic, technical, environmental and social, as well as the interests of stakeholders of the considered problem: the city authorities, urban public transport operators, the managers of public transport, passengers and other road users. In order to show the practical application of the proposed methodology, the example of Cracow was used. Traffic simulations were carried out for 8 variants of ISUPT in Cracow (W0, W1, W2, W3, W4, W5, W5A, W6), where W0 variant represents the current state of the transport system in Cracow, while variants W1 - W6 are proposals of variants of ISUPT in Cracow. To assess the variants, a set of 10 criteria was adopted. As a result of computational experiments, a final ranking of the analysed variants (from best to the worst) was obtained.

226. DESIGNING OPTIMAL ROUTES FOR CYCLO-TOURISTS

Cerna A.^(a), Cerny J.^(a), Malucelli F.^(b), Nonato M.^(c*), Polena L.^(a), Giovannini A.^(d)

(a) University of Economics in Prague, Faculty of Management, Prague, Czech Republic

(b) Polytechnic University of Milan, Department of Electronics, Information and Bioengineering (DEIB), Milan, Italy

(c) University of Ferrara, Department of Engineering, Ferrara, Italy

(d) University of Milan, Department of Mathematics, Milan, Italy

Abstract

Bicycles are becoming an increasingly popular mean of transport. Being healthy and affordable,

they provide a sustainable alternative way of movement, both for leisure and for work commuting. In both cases, demand increases when bike devoted tracks are available. Providing bike trails that connect touristic spots is a cheap way of increasing the appeal and promoting the development of those regions that feature beautiful landscapes, strong cultural traditions, and historical monuments all concentrated within a small area, which is the case of many regions of Europe. In this paper we are concerned with designing cyclo-tourist routes in the Trebon zone of South Bohemia, whoselocal administrators are faced with the problem of optimally investing scarce resources to set up a network of cycle-de dicated tracks, either exploiting existing trails or by reconstruction works, turning gravel or unsurfaced field and forest roads into paved bike trails.

As a first step of this study, we address the problem of designing a non necessarily elementary, resource-constrained, optimal path on a directed graph between a given origin-destination pair of nodes, which maximizes a utility function related to the attractiveness of arcs and nodes along the path. Attractiveness depends on several features, such as the presence of a restoring facility providing shelter and technical assistance, a restaurant serving typical food of the local regional cuisines, a monument, a castle, an historical village, or a scenic landscape to be enjoyed along the way. Two kinds of resource constraints bound the solution. A limit on the maximum duration of the path, which depends on how many times each arc is traversed, and a maximum budget for setting up the infrastructure, which depends on which arcs are selected.

This problem shares features with few, well-studied, network-based, combinatorial optimization problems, but its main peculiarity is the fact that a cyclist may be willing to traverse an arc more than once - think, for example, of a detour from the main way to be travelled back and forth to reach a point of interest - yielding cycles in the route. The attractiveness function is

concave and may decrease after reaching its maximum at a few traversals. Such features make the problem new and challenging, especially when real instances need to be solved.

We investigate the potentials of an integer linear programming model. The model is validated by an experimental campaign on realistic data for the Trebon zone in South Bohemia.

227. EVALUATING FACTORS OF THE WILLINGNESS TO PAY TO MITIGATE THE ENVIRONMENTAL EFFECTS OF FREIGHT TRANSPORTATION CROSSING THE PYRENEES

Lera-López F.^(a), Faulin J.^(b*), Sánchez M.^(c), Serrano A.^(b)

(a) Public University of Navarre, Department of Economics, Pamplona, Spain

(b) Public University of Navarre, Department of Statistics and Operations Research, Pamplona, Spain

(c) Public University of Navarre, Department of Business, Pamplona, Spain

Abstract

All logistic activities generate environment costs such as noise and air pollution (externalities). One well-known method to study those externalities is the use of surveys in which people are asked about their willingness to pay (WTP) to compensate the caused damage. In this paper, we use both Double-Hurdle and Moulton's models in order to estimate the willingness to pay of the population living next to the roads crossing the Pyrenees in Navarre (Spain). That population suffers from the environmental impact, in terms of noise and pollution, of the freight transportation traversing those mountains and it is prone to pay to avoid the negative externalities associated to merchandises fluxes.

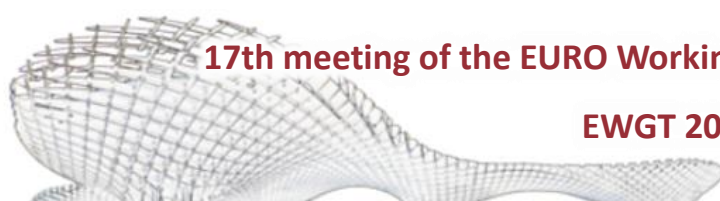
228. REVERSE ASSIGNMENT FORMULATION IN EVACUATION SIMULATION

Polimeni A.^(a*), Vitetta A.^(a)

(a) Università Mediterranea di Reggio Calabria, Department of Information, Infrastructure and Sustainable Energy Engineering (DIIES), Reggio Calabria, Italy

Abstract

To evaluate the performances of a transport system, more works in literature use traffic data (i.e. flow counts) achieved with technological tools, placed on representative links of the transport network. Nevertheless, often the corrections in the costs are not accompanied by a corresponding correction in link flows and demand values in a whole methodology. In this paper, we propose a formulation to calibrate the parameters of cost functions and demand parameters at the same time. The data input are a (knew) demand matrix, the link cost function (i.e., a function for each link set), the model to simulate the users choices. The output are a corrected demand matrix, the parameters of cost functions and the link flows. Our formulation is able to correct the cost functions and update the demand values when, in a particular situation, the transport system is subject to a sudden load, as happens in the case of an evacuation. The flows and costs measurement on some characteristic links (with cameras and probe vehicles equipped with GPS) allows to correct the demand matrix and the parameters in the cost functions: in this paper, the procedure is extended to take into account the evacuation of an urban area. An application on the route performance of a fleet of vehicles that evacuates some users is reported.



230. ISSUES ON BRAZILIAN PUBLIC TRANSPORT POLICY: BRASILIA METROPOLITAN AREA CASE STUDY

Aveni A.^(a*)

(a) University of Brasilia, Brasilia, Brazil

Abstract

Across the globe, but especially in the great cities of emerging countries as Brazil, we are facing crisis in transports, mobility and accessibility. Low road safety levels, low infrastructure investments, problems of freight movement are, among others, the causes for that crisis. However public transport is recognized as the backbone of urban mobility especially for low income individuals, still a few metropolitan areas in Brazil have reasonably well-developed, institutionalized public bus services and even in those, private and informal operators dominate largely unregulated. Waiting for metropolitan areas institutional planning, and funds for mobility the Brasilia metropolitan area – the capital city of Brazil locate in the center of Latin America continent - is still a cluster of few urban public lines and inter urban institutionalized private operators without integration between cities inside and outside the Brasilia Federal District (Distrito Federal de Brasília) or the urban center of the metropolitan area. Brazil is still trying developing infrastructure focusing in Public transport with the main goal to reduce transport matrix dependence on cars and trucks and increase railroads. Walking and cycling too are considered form of transport to be strengthened for pro-poor planning strategy and sustainable environment safe. Railroad transport and new public transport systems as Bus rapid transit (BRT) are planned all over metropolitan areas for the next years as sustainable solution. So recently Urban policies in Brazil are moving from a focus on transportation and developed, instead, focused plans on the human right to “equitable access to opportunities”. With the Lei nº 12.587, de 3 de Janeiro de 2012, or Política Nacional de Mobilidade Urbana (Urban Mobility

National Policy) it is now mandatory to be developed within three years urban mobility plans for human settlement of more than 20.000 inhabitants. The article aim to explain the transportation modeling, planning, design, and policy of Brasilia metropolitan area, having temporal focus in the last 4 years. It's an analysis of what was the last transportation plan (Plano Diretor de Transportes Urbanos - PDTU) decided in 2009 and the future plan implied because of the new policy. The last plan - PDTU - must be upgraded in 2014 but must be organized as well as Mobility Transportation Plan because of the law 12.587 / 2012 above mentioned. In addition an international firm based in Singapore, was appointed by the government of the Brasilia Federal District to develop part of the analysis.

231. SOLVING AIR TRANSPORT CONTINGENCIES BY USING GENETIC ALGORITHMS – RUCCMAN

Rísquez Fernández J. M.^(a*), Redondo Sánchez M.^(a), Gómez Lorenzo J. J.^(a), Timón Reina S.^(a)

(a) Ineco, Madrid, Spain

Abstract

Transportation networks are dynamic systems that suffer continuous unexpected events. People in charge of managing them in an efficient way usually make their decision by using their great expertise and related data. However, the cognitive capacity of the human brain is limited, and therefore the design of the solution cannot take advantage of those extensive data. Despite this paper deals with a specific transportation network i.e. Airport management, the demonstrated excellences and virtues of the application of Genetic Algorithms to support the decision-making process can be extended to any transportation domain. This paper, as it has been already slightly explained, addresses an airport management scenario, in particular, the management of changing runway configuration.

When e.g. wind forecasts lead to think that it is necessary, sooner rather than later, changing the existing runway configuration usage, the person in charge of making that decision has to do his best stating when and how to execute the change. At that time, there are flights approaching to airport, other flights taxiing to the runway thresholds to take off shortly, other flights are still off-blocked at their gates. The better the decision is, the less the related delay will be. Nevertheless, delay is not the unique performance indicator that may interest an Airport Manager, e.g. fuel consumption, safety, capacity, predictability and so on. This fact introduces a new set of parameters to take into account when making the decision. In order to support this complex decision, it has been designed and validated an automated tool based on genetic algorithms to deal with the extremely high number of solution alternatives (i.e. RUCCMAN).

233. COMPARISON OF LIGHT RAIL SYSTEMS IN TURKEY WITH THE METHOD OF COMPARATIVE STANDARD DETERMINATION

Vitosoglu Y.^(a*), Ozden R.^(b), Yaliniz P.^(a), Bilgic S.^(c)

(a) Dumlupinar University, Department of Civil Engineering, Kutahya, Turkey

(b) Governorship of Kutahya, Provincial Directorate of Environment and Urbanization, Kutahya, Turkey

(c) Eskişehir Osmangazi University, Department of Civil Engineering, Eskişehir, Turkey

Abstract

In today's urban structure, the selection of public transport systems that can respond to the demands for people to travel more comfortable and faster is essential. Considering the comfort and speed at issue, the demand for rail systems in urban public transport is increasing day by day. Due to their characteristics such as high capacity, speed, safety and comfort, rail systems play an important role in meeting the transport demands of large cities. All of these features give the rail systems ample opportunities. In this study, the

five large cities in Turkey (Ankara, Bursa, Adana, Kayseri and Samsun) have been considered, and by using the Method of Comparative Benchmarking, it has been determined how efficiently the light rail transit systems actively operated in these cities were used. It has been also discussed how the systems which were below the average could increase their performances by following the operation policies of other systems that work efficiently. The systems to be analyzed with the method of comparative standard determination are evaluated by taking into account a process that consists of four stages. These four stages are Self-Assessment, Selection of Similar Systems, Determination of Indicators, and Comparison and Determination of the Threshold Values for Efficiency, respectively. As a result of the study carried out with the method of comparative standard determination, it has been concluded that the Bursa Light Rail System is the most efficient system. The Bursa Light Rail System having the longest line among the five systems has proven to be made with a proper planning study, remaining above the average in terms many indicators. The most surprising result of the study has been the Adana Light Rail System. It has been seen that the Adana Light Rail System planned to be converted into the rail rapid transit system in the future is the most inefficient system.

234. MODELLING THE PROPENSITY IN ADHERING TO A CARSHARING SERVICE: A BEHAVIORAL APPROACH

De Luca S.^(a*), Di Pace R.^(a)

(a) University of Salerno, Department of Civil Engineering, Fisciano, Italy

Abstract

Although carsharing has become a consolidated transport alternative in many urban contexts, carsharing behaviors have been mainly investigated through ex-post analysis and in terms of vehicle usage and/or ownership rate. In this paper carsharing behavior was investigated

with regard to a different and little investigated aspect of users' behavior was addressed: modeling the propensity in adhering to a carsharing service. The propensity was modeled within the random utility framework through a Binomial Logit model starting from a stated preferences survey. The main focus was on the investigation and estimation of a set of attributes able to interpret and measure the propensity. In particular, together with socio-economic and activity related attributes, the satisfaction variable (expected maximum utility) was tested in order to interpret the interest towards carsharing in light of the level of service supplied by the other transport modes and of the users' socio-economic and activity-based characteristics. Satisfaction variable was specifically calibrated on actual mode choice behavior starting from revealed preferences data. Elements of originality are twofold: (i) methodological: the propensity/interest has not yet been explicitly investigated in literature, the analyses were based on stated preferences and taste variation among users was investigated; (ii) operational: some useful insights to support decision makers were drawn.

235. A SENSITIVITY ANALYSIS OF TOTAL COST OF OWNERSHIP FOR ELECTRIC PUBLIC BUS TRANSPORT SYSTEMS IN SWEDISH MEDIUM SIZED CITIES

Nurhadi L.^(a), Borén S.^(a), Ny H.^(a*)

(a) Blekinge Institute of Technology, Karlskrona, Sweden

Abstract

To reach Swedish national climate change reduction targets, organizations collaborate for a sustainable development, to improve energy efficiency and reducing pollution and noise in public bus transport. The cost for energy usage is much lower in electric buses than in fossil fuelled buses. Nevertheless, the current relatively high initial purchase price of the electric bus becomes an obstacle in the procurement of public

transport. However, the authors have in a previous study made life cycle emissions and total cost of ownership comparisons between electric buses, diesel buses, and several other alternatives in Swedish medium-sized cities. The preliminary result implied that electric drivetrains with renewable electricity was more preferable from both an economic and sustainable perspective.

This follow-up study continues to strengthen the previous study by deepen the economic comparisons of two electric buses with different driving range and different type of chargers, also including a sensitivity analysis for the total cost of ownership to identify which factors of interest that most likely cause the estimated cost values for the electric bus. For the sensitivity analysis, the study uses "what if" analysis and captures this in a spider plot graph to understand the responsiveness of each factor on the outcome of the total cost of ownership. Then a tornado graph is used to show the pair analyses where the effect of each factor is compared to all others – two by two. The initial result shows that the percentage change of line distance (km/year), operational years and investment cost would be some of the most significant factors that influence the total cost of ownership. Potentially as the next step, the sensitivity analysis can be expanded to include data from a planned real life testing of electric buses in several Swedish cities.

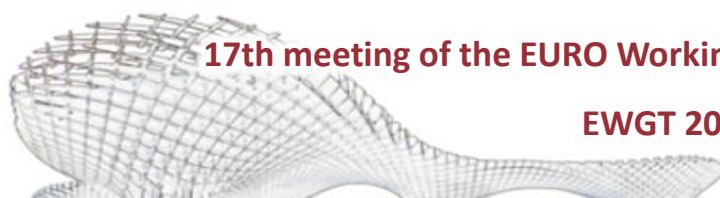
237. FEATURES SELECTION BASED ON FUZZY ENTROPY FOR DATA ENVELOPMENT ANALYSIS APPLIED TO TRANSPORT SYSTEMS

Bray S.^(a*), Caggiani L.^(a), Dell'Orco M.^(a), Ottomanelli M.^(a)

(a) Polytechnic University of Bari, Department of Civil, Environmental, Planning, Construction and Chemicals Engineering (DICATECh), Bari, Italy

Abstract

Recently, great attention has been paid to the data envelopment analysis (DEA) for the analysis of efficiency of transportation systems. In real



world applications, the data of production processes cannot be precisely measured or can be affected by ambiguity. This is particularly worrying when assessing efficiency with frontier-type models, such as Data Envelopment Analysis (DEA) models, since they are very sensitive to possible data errors. Many research works have faced the problem of using DEA models when the inputs and outputs are uncertain. Fuzzy Theory based methods are one of the approaches that have been recently proposed even without a determined (or unique) framework. In this work we have defined a fuzzy version of the classical DEA models, and, in particular, a feature selection analysis has been developed to investigate the effects of uncertainty on the efficiency of the considered transport services. The feature selection method developed in this paper is based on fuzzy entropy measures and it can be applied to DMUs (Decision Making Units) on the entire frontier. Having identified the efficient and inefficient DMUs in fuzzy DEA analysis, the focus is on the stability of classification of DMUs into efficient and inefficient performers. A numerical example is then presented, considering as DMUs a set of international container ports with given number of inputs and outputs properly modified.

239. DEVELOPMENT OF AUTONOMOUS DRIVE AND PLATOONING FOR TOYOTA COMS USING DIGITAL MAP, GPS AND WIRELESS SENSOR NETWORK

Kanchwala H.^(a), Ogai H.^(b), Wideberg J.^(c*)

(a) Indian Institute of Technology Kanpur, Kanpur, India

(b) Waseda University Japan, Graduate School of Information, Production and Systems, Japan

(c) University of Seville, Transportation Research Group, Seville, Spain

Abstract

Japan is suffering from the problem of ageing society. In Kitakyushu city there are a quarter of people older than 65 years. The road in this residential area has specific characters including very narrow road, steep slope and vulnerable

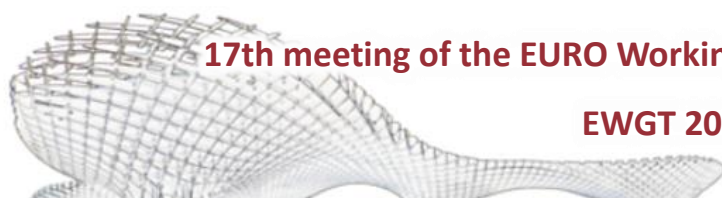
roadbed. Especially a large proportion of elder people are living on their own. These characters make it unsuitable for general vehicle driving. The problem is exaggerated because of infrequent public transportation.

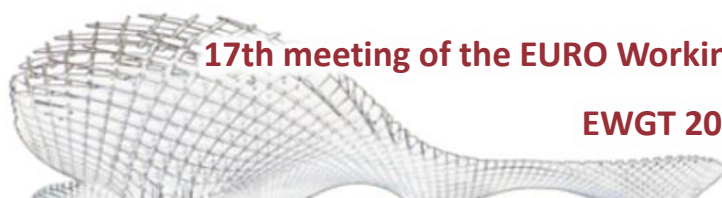
A need assessment of small electric vehicle at a community event was done. Based on the survey result and topographical features, the small electric vehicle for elder was designed and automatic driving system was built. Automatic driving and platooning using Zigbee to exchange driving data between vehicles was built and tested.

Automatic driving system is developed for this intelligent transport system (ITS) using predictive control of non-linear model to control three variables including brake, speed and steer angle. Stereo camera and ultrasonic sensors were used to make a judgment of obstacle and provide the obstacle position information for control model. Digital maps, Google earth and GPS were used to generate the target path using Bezier curve method and optimized route is selected. IMU is used for calculation of own position for make a compensation about the route information. White line recognition adopts the camera to realize.

Platooning is realized by driving information exchange based on Zigbee communication. The conventional control method improved power consumption by shortening the distance between vehicles. In contrast, the proposed method improves it by controlling the velocity at the time of acceleration gently as the vehicle is meant for elderly people requires better ride comfort.

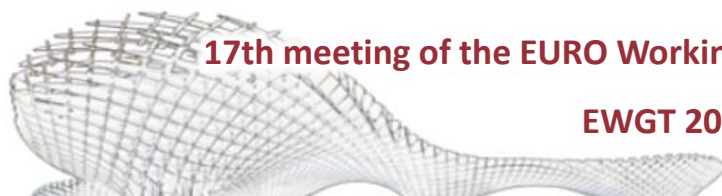
The velocity is controlled by generating the desired value of inter-vehicular distance corresponding to the leading vehicle velocity. Another method which is planned to realize a highly efficient arterial traffic distribution system includes reducing aerodynamic drag by minimizing the distance between vehicles to allow drafting. In this paper, the two degrees-of-freedom control system is applied for it. These proposed methods were evaluated by simulation using CarSim and some experiments.



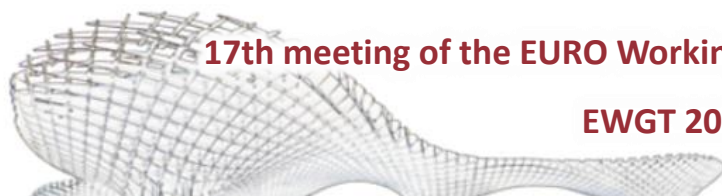


List of Authors

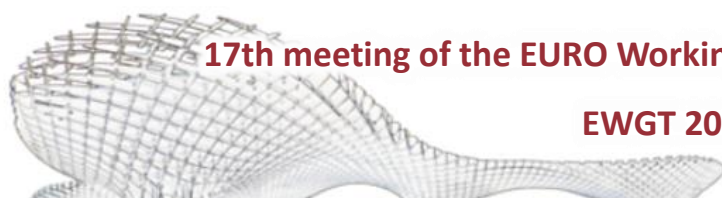
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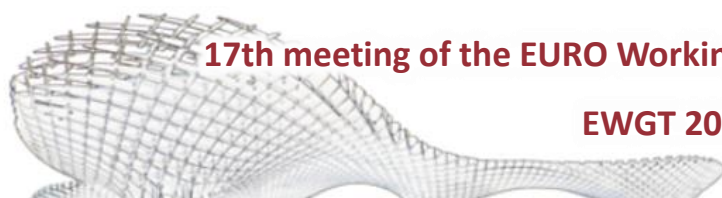
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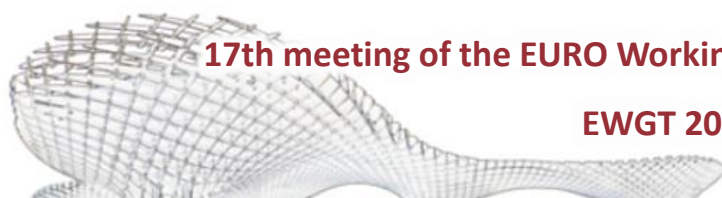
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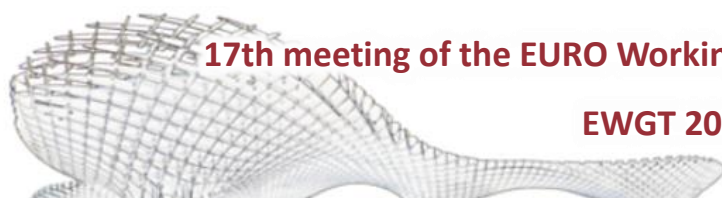
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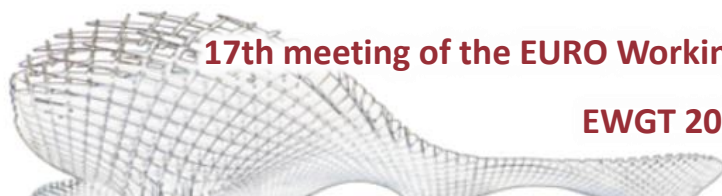
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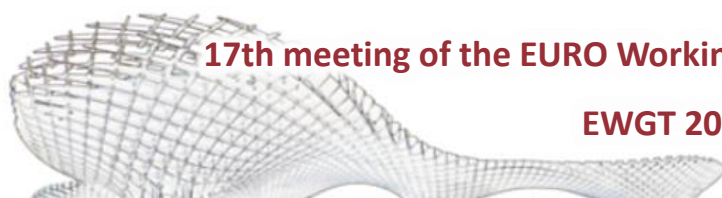
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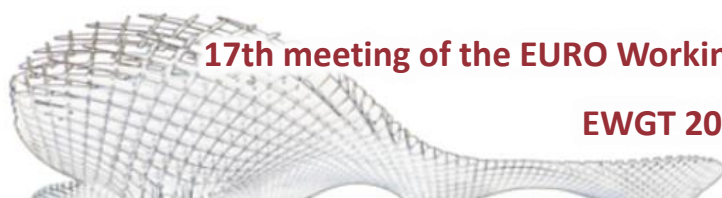
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