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(Abstract)

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# Table of Contents

Optimization of The Distribution Density of the Shared Bicycle in the Case of Paid Occupancy of Public Space ................................................................. 1
Research on Influencing Factors and Forecasting Methods of Public Bicycle Passenger Flow ...2
Study and Traffic Simulation on Electric Bicycle Lanes and Signal priority ......................... 3
Signal Timing for Isolated Intersections Based on Shared Cost Model .......................... 4
Development of an Effective Truck Route Signage Program ....................................... 5
Design and Development of a Mobile-phone APP- based Travel Survey System .......... 6
Study on Rail Transit Training Resource Audit and Configuration Management System Based on Safety Considerations ................................................................................. 7
A Trip Generation Forecasting Method Based on Point of Interest Data Mining from Internet.8
Application of Big Data Analysis Concept on Flexible Pavement Deflection Prediction Modeling ......................................................................................................................... 9
Three-dimensional Geometric Continuity of Expressway Alignment and its Influence on the Characteristics of Typical Accidents ................................................................. 10
Study of the Serviceability of the Bridge During the Deck-Replacement Staged Construction 11
Application of Generalized Local Information Entropy Based on Deflection in Damage Identification .................................................................................................................. 12
Portable Electronic Friction Coefficient Instrument ...................................................... 13
Missing and Improvement Sequence of Roadway Pavement Markings ...................... 14
Systematic Optimization of Comprehensive Transfer Centers in Jiangsu Province in China....15
Trip Characteristics Analysis of the Elderly in Guangzhou Based on Big Data ................. 16
Subway Route Planning Based on Maximized Benefit of Investment ............................. 17
A study on the Key Influential Factors of Subway Traffic Dispatcher’s Error Issues ........ 18
Study on the Evolution of Regional Rail Transit Network in Beijing - Tianjin - Hebei Region...19
User Behavior Analysis of Car Sharing under Urban Traffic Conditions ...................... 20
A Data Driven Method for Delay Duration Estimation of High Speed Train .................. 21
Customer Service Considerations for High Speed Railways ........................................ 22
Enhancing Anticipatory Traffic Signal Control with Metamodelling and Iterative Learning Optimization ................................................................................................................. 23
Analyzing the Real Bus Route Planning Using Trip Characteristics of Urban Public Transit .....24
Planning of Elderly Exclusive Bus Line: A Case Study of Fuzhou ................................................25
Identifying Spatial Distribution of Residents’ Public Transportation Travel with Smart Card Data ..........................................................................................................................26
Optimization of Cross-line Bus Stations with the Influence of Railway Network .....................27
Naturalistic Bicycling Behavior Pilot Study ................................................................................28
Research on Allocation of Capacity/flow and Optimization of Runway Configuration Based on Dynamic Capacity ..........................................................................................29
Terminal area Approach Route Short-time Utilization Rate Model Based on Space-time Occupation Analysis ........................................................................................................30
Keywords: Short Time, Airspace Utilization Rate, Approach Route Utilization Rate, Space-Time Occupation Analysis, Assessment Mode ........................................................................30
Influence of Talking Speed on Dialogue Quality Between Pilots and Land Controllers ..........31
The Impact of the Reimagination of New Bus Network on METRO Rail’s Ridership in Houston ..................................................................................................................................32
A Simulation Approach for Assessing Passenger Flow Dynamic Loading Capacity of Platform in Urban Rail Transit ........................................................................................................33
The Fusion Evaluation Method of Two Networks Based on The Cloud Model - Fuzzy Comprehensive Evaluation Method ..................................................................................................34
Passenger Transfer Conflict Delay in Large Passenger Transport Hubs ........................................35
Attitudes of Jordanian Drivers Toward Specific Road Safety Issues ..............................................36
Scheduling Bus Arrival Timetable Based on Service Reliability ...................................................37
Highway Safety Evaluation at the Operation Stage: An Overview ...............................................38
Analysis of the Service Quality of Bus Transit Stops ..................................................................39
Incident Management ..................................................................................................................40
Assessment of Leading Pedestrian Interval Suitability and Effectiveness - Before-after Pilot Study in Florida ..............................................................................................................41
Research on Methods of Freight Safety Evaluations ..................................................................42
Research on Risk Analysis Methods of Freight Transport .............................................................43
Quantitative Evaluation of the Development of Suburban Center in Shenzhen from the Perspective of Transportation ..........................................................................................44
A Method for Determining Main Channel of Regional Logistics Network Based on Bi-level Optimization Model..............................................................................................................................................45
Research on Optimization Model of Order-Picking Path for Comprehensive Cargo Lost and Handling Cost .............................................................................................................................................................................46
A New Method for Vision-based Fatigue Driving Detection and Assessment .............................................................................................................................................................................47
Research on Key Technologies of Traffic 30 Video Smoke Detection Based on Multi-feature Fusion ........................................................................................................................................................................48
Analysis of Driver’s ECG Index Under Poor-viewing conditions ........................................................................................................................................................................................................49
Effectiveness Evaluation of Infrastructure -to-Vehicle Messages in Work Zone Advance Warning Area ..................................................................................................................................................................................................50
The Influence of Bus Driver’s Sex on Vehicle Operation during Parking at Harbor Bus Station51
Smart Bus Travel Patten Studies under High Density Urban Environment with an Example of Mauco Bus System................................................................................................................................................................................................52
Non-motorized time analysis consumed by passengers at ground bus stations ................................................................................................................................................................................................53
Modeling and Solving the Bus Bridging Evacuation Problem as a Dynamic System ..................................................................................................................................................................................................54
Entropy Model of Dynamic Bus Dispatching Based on Prediction of Back-Station Time ..........55
Abstract

The increase of distribution density of shared bicycles in one hand raises users’ convenience, while in other hand worsens the conditions of public space. As many operators competing on the market, in many cities the public spaces are crowded with the shared bicycles and the pedestrians have been greatly affected. In order to optimize the distribution density of the shared bicycles and alleviate the disorderly occupancy of city’s public space, we firstly select a sample city to do questionnaire survey on the users to determine the relationships between the distribution density and users’ utility. Secondly, based on to attributes of pedestrian traffic flow and the theory of the formation and evolution of the risk of crowding accidents, we fit the impacts function of the distribution density on the reduction of public space, comfort and safety of the pedestrians on public space. Finally, we build a programming model of the distribution density of the shared bicycles in the case of paid occupancy of the public space to determine the distribution density according to the factors such as operators’ profit, users’ utility, public space occupation cost and the risk of safety accident of the pedestrians.

Keywords: Shared Bicycle, Bicycle Density, Public Space, Optimization Model, Pedestrians
Research on Influencing Factors and Forecasting Methods of Public Bicycle Passenger Flow

公共自行车站点客流影响因素及预测方法研究

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Abstract

In order to maximize the usage of public bicycles in urban traffic, this paper establishes a public bike passenger flow model from the perspective of optimization setting of public bicycle station. This paper selected the rental data of public bicycle in Wuhan in March 2017 and the 2013 construction census data. In this paper, regression analysis and naive Bayes classification are used to predict the passenger flow. Regression analysis optimizes the influencing factors of passenger flow, but not suitable for passenger flow forecast. The model established by Naive Bayes method has a precision of 90.2%, which can meet the predicted demand. The analysis results show that the public bicycle network has the most influence on the passenger flow, followed by the commercial scale, the metro stations, the public service scale, the road network density and the location of the station. The above points need to be prioritized when optimizing the station choosing. The data of influencing factors mentioned in this article is relatively easy to obtain, model established has high accuracy and have a certain degree of practicality. The next step is to extend the analysis of how to improve the site operating efficiency and to guide the parking of shared bicycles.

Keywords: Public Bicycle, Passenger Flow Forecast, Multiple Regression, Naive Bayes
Study and Traffic Simulation on Electric Bicycle Lanes and Signal priority

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Abstract

In recent years, Electric bicycle has become an important transportation tool for the small urban residents in short distance travel. However, the problem of mixed traffic between electric bicycles and motor vehicles has not been well solved. According to the driving characteristics of the electric bicycle, this paper studies the management strategy of the electric bicycle lanes and the signal priority of the intersection. Then we build a driving behavior model of electric bicycles in the VISSIM micro simulation software, and design and simulate the electric bicycle lane and signal priority programs in Nanning Dong Ge Road, to verify the effectiveness of the various programs. The results show that the management strategy of electric bicycle dedicated lanes and green light phase electric bicycle priority can achieve the optimization effect of improving traffic order and ensuring traffic efficiency.

Keywords: Electric Bicycle, Electric Bicycle Lanes, Signal Priority, Simulation
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Signal Timing for Isolated Intersections Based on Shared Cost Model

基于成本分摊模型的孤立交叉口信号配时研究

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摘要
交叉口是城市交通的重要组成部分，对交叉口信号配时方案进行研究可以尽可能的运用交叉口的通行资源，从而提升城市整体的交通运输能力，对提升城市交通系统性能有重要意义。本文针对孤立交叉口，将博弈论的思想运用进孤立交叉口配时这一领域中，通过马尔可夫决策过程对孤立交叉口各个相位的车流量进行建模，基于合作博弈论中的成本分摊方法，将孤立交叉口每个相位视作博弈参与者，将各个相位的车流量视为博弈参与者的谈判成本，将最终获得的绿灯时间为最后的收益，通过分析各个相位之间的合作竞争关系，建立基于合作博弈论中成本分摊模型的孤立交叉口信号配时模型，根据各个相位的谈判成本的大小，运用成本分摊方法，求解出各个相位的最优绿灯时间。最后通过VISSIM交通仿真软件对于本模型进行仿真验证，并与固定配时的方案进行比较，饱和度较低的相位依据博弈获得的绿灯时间较少，该相位的延误时间会稍微增加，饱和度较高的相位依据博弈获得的绿灯时间增加，该相位的延误时间会大幅降低，总的来说可以比较明显的降低该孤立交叉口的延误时间，以此来说明方案的有效性。

关键词：博弈论，成本分摊，信号配时，马尔可夫决策过程
Development of an Effective Truck Route Signage Program

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Abstract

The City of Tampa (COT) in Florida, USA contains numerous major freight generators and destinations including two seaports, a rail intermodal yard, the cargo capable Tampa International Airport, and a large variety of logistics activity centers (LACs). To promote the positive usage of the roadway network and to guide commercial truck drivers to drive on the designated truck route system and increase their compliance, the research team assisted COT in developing an effective Truck Route Signage Program for the City of Tampa via a research project. The main objective of this research project sponsored by COT was to establish standards for sign types, sizes, and locations for truck route signage, conduct before-and-after data analysis for a pilot implementation, and evaluate the effectiveness of the proposed truck route signage. Based on the possible truck route violations, eight study locations/intersections with 11 legs were selected for before-and-after data collection and analysis. Truck traffic data were obtained from count tubes, which are capable of collecting vehicle classification data along with the traffic counts, and analyzed to compare the rate of trucks taking non-truck routes before and after the implementation of the proposed truck route signage. A paired t-test analysis was conducted to check the statistical significance of before and after data analysis. Overall, the result showed a 46 percent reduction in the total number of different category of trucks after implementing the proposed combination of positive and negative truck route signs. The significant increase of truck traffic traveling on designated truck route system is projected to improve the mobility of the overall traffic stream along with the truck reliability and travel times. The large reduction in truck traffic on non-truck routes via this pilot implementation is also projected to significantly improve safety on the residential and non-commercial areas whey they are widely implemented.

Keywords: Truck Route Signage; Truck Guidance Signage, Truck Signage Location
Design and Development of a Mobile-phone APP-based Travel Survey System

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Abstract

Travel demand forecasting models are used to predict temporal and spatial distribution of travel demand, and support to make decisions about transportation infrastructure planning and construction. The development of travel demand models requires a large amount of travel behavior data, but traditional paper or Webs based household travel surveys is time-consuming and labor-intensive. Their natures of collecting travel information afterwards may also result in a large amount of misleading or even “wrong” behavior information being collected. In this paper, a mobile-phone App based travel survey system is designed and developed in order to facilitate large-scale travel surveys. The system consists of a mobile-phone App, a data server and a website of data management platform, which is capable of collecting socio-economic data and travel information of urban residents with a smart phone. At first indoor stay points and outdoor stay points are identified by changed positioning accuracy and slide window. It is shown that the system proposed can be used to continuously collect accurate and real-time personal socioeconomic attributes data and travel data at a much lower cost. Therefore, this system is ready for a large-scale implementation. It helps to extract complete travel information, such as travel purpose and travel mode, and provides a complete solution to these issues presented in traditional travel survey methods. Then it significantly reduces survey cost and offers capability of continuously collecting travel behavior data at any spatial scale.
Study on Rail Transit Training Resource Audit and Configuration Management System Based on Safety Considerations

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Abstract

There is a close relationship between the operation safety and the application of training equipment. If the relationship is not handled well, it will lead to serious problems, even the conflicts. So designing training equipment management information system is extremely urgent. First, the main training categories are carded, such as drivers training, construction and maintenance, daily safety management, canteen safety, etc., and the basic flow chart of the 4 types of training are drawn; Second, the training equipment management database Train_Database is constructed based on training process, equipment involved, trainers, contingency plans of the 4 kinds of raw data, which lay the foundation for the follow-up of the management information system design and development; Third, the training equipment declaration and management system is developed, which is called Training_Equipment_MS, and the main modules are: equipment resource information management module, equipment declaration module, equipment audit module, safety check form filling module, equipment declaration results publicity module, etc. Finally, the functions of each module are shown in details. It has good practical guidance to the application and operation of rail transit, which can reduce accidents and hidden danger in the course of training.

Keywords: Urban Rail Transit Training, Equipment Management, Queuing Theory, Training Safety, System Design, Training Equipment Declaration and Audit
A Trip Generation Forecasting Method Based on Point of Interest Data Mining from Internet

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Abstract

Trip generation rates are often used to estimate the trips generated in the first step of the traditional four-step travel demand forecasting method. However, since the accurate land use information is often hard to get, it is very difficult to know exactly where travelers originate and where they go. The forecasting results, therefore, are often questioned about their accuracy in practice. Aiming to address this problem, a new method is proposed to obtain the traffic analysis zone (TAZ) point of interest information from web data collection to represent detailed land use information and to establish multiple regression forecasting model of trip generation. The model is then calibrated and validated in a case study using the OD trips estimated through mobile phone data in the Chao Yang District, Beijing. A comparison of the trip generation results shows that the mean relative error of the trip estimation from the mobile phone data and the results from the proposed method is about 14%, and the coefficients of the model provide alternative estimates of trip generation rates. The proposed method is an exploration of data mining and web data collection techniques in traditional transportation planning. It will not only help reduce the workload of data collection but also help researchers and planners to obtain more detailed land use information, and therefore, improve the travel demand forecasting accuracy.

Keywords: Trip Generation Rates, Web Data Collection, Point of Interest, Data Mining, Multiple Regression Model
Application of Big Data Analysis Concept on Flexible Pavement Deflection Prediction Modeling

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Abstract

This study strives to illustrate the benefits of incorporating the principles of dimensional analysis, subject-related knowledge, and statistical knowledge into pavement prediction modeling process. Modern regression techniques including local regression and regression splines as well as back propagation neural networks were briefly introduced. Factorial BISAR runs for different pavement systems were conducted to generate the deflection databases for the analysis. The resulting ANN model using all dominating dimensionless parameters was proved to have higher accuracy and require less network training time than the other counterpart using purely input parameters. Increasing the complexity of ANN models does not necessarily improve the modeling statistics. The results also showed that using higher number of neurons and hidden layers sometimes lead to even worse modeling statistics which was an indication of over training and should be avoided. Several local regression models requiring minimal amount of modeling time were also developed using the same databases.

Key words: Big Data Analysis, Artificial Neural Networks, Modern Regression Techniques, Flexible Pavement Deflection
Three-dimensional Geometric Continuity of Expressway Alignment and its Influence on the Characteristics of Typical Accidents

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Abstract

The geometric continuity of highway alignment is an important factor in evaluating the quality of alignment. Highway alignment is a three-dimensional space curve formed by the superposition of two design lines of horizontal and vertical section. The methodology, which evaluating the geometric continuity of alignment, is actually based on the two-dimensional horizontal alignment and cannot effectively reflect the geometric continuity of three-dimensional space and its influence on driving safety. In this paper, the analysis of geometric continuity of expressway alignment is carried out with the characteristic parameter of three-dimensional space curvature. It is found that there is a sudden change of three-dimensional space curvature of highway alignment at two-dimensional horizontal alignment feature points, which does not meet the requirement of geometric continuity for vehicle running. Moreover, based on three operating expressways, this paper analyzes the relationship between the three-dimensional space curvature mutation of expressway alignment and traffic accident, it finds out that the side safety accidents, such as collision structure and scraping, are obviously more than other road sections. Finally, the potential causes of lateral safety caused by the sudden change of three-dimensional curvature of expressway alignment are analyzed, which provides a new idea for the evaluation, safety evaluation and optimization of alignment quality.

Keywords: Highway Alignment, Three-Dimensional Geometric Continuity, Sudden Change of Space Curvature, Accident Characteristics, Lateral Safety
Study of the Serviceability of the Bridge During the Deck-Replacement Staged Construction

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Abstract

With increasing traffic, some existing steel or concrete bridges may not be designed for the higher demand for today’s service loads and traffic volume. Some of the bridge structures are aged and, depending on the historic maintenance and repair, may need rehabilitation or even replacement. Most need reconstruction of the bridge or replacement of the deck. This research is mainly studying responses of steel bridges under different load cases during and after deck replacement, which may apply to any type of bridges.

For keeping the traffic moving during deck-replacement construction, two major problems are studied in this paper: 1) closure pour case which requires deflection control of the decks finished at different stages; 2) the stress changes in deck with and without add-on girder (the extra girder added during deck replacement for construction purpose) in the transverse direction during and after the reconstruction. Both problems are studied by FEM method with CSi Bridge software. For the closure pour case, the time-dependent effects which contribute to the differential displacement between stages are discussed. The closure pour study involves concrete creep and the girder camber at different stages.

The add-on girder is adopted and studied to alleviate differential displacement between two decks resulted from creep effect as well as shrinkage. For the stress change of the deck in the transverse direction due to the add-on girder, parametric study is conducted to investigate the value of tensile stress over the add-on girder, which can potentially result in cracks in longitudinal direction. The placement of vehicle load, girder spacing as well as the span length have different impacts on the tensile stress of the deck over the add-on girders. The tensile stresses of the deck in transverse direction corresponding to different parameters are compared with the critical cracking stress. The parametric study can serve as the indicator for removing or retaining the add-on girders based on the requirement of project.

Keywords: Staged Construction, Deck Replacement, Closure Pour Case Study, Creep Effect, Add-On Girders, Serviceability
Application of Generalized Local Information Entropy Based on Deflection in Damage Identification

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Abstract

A damage index of generalized local information entropy based on deflection data is constructed on the basis of information entropy theory. The effects of the index are verified using a simply supported reinforced concrete beam under three different sampling numbers, respectively, and the results are normalized. A numerical model of the concrete beam is simulated by Midas/civil, and the effects of the damage index in locating cracks, damage quantification, and noise immunity are studied. The results show that the generalized local information entropy based on deflection can locate damages accurately, analyze the quantification of damages, and has the ability of noise immunity.

Keywords: Damage Detection, Generalized Local Information Entropy, Deflection, Simply Supported Beam, Noise Immunity
Portable Electronic Friction Coefficient Instrument

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Abstract

The anti-skid performance of the pavement is an important index to ensure traffic safety. How to test and evaluate the anti-skid performance of the pavement accurately and quickly is an important issue to be solved. This paper based on the research of other friction tester, using the simplest friction principle: \( f = u \times N \), the tension sensor, stepper motor and tilt sensor are controlled by the single chip microcomputer through simple circuit and program, Portable electronic friction coefficient tester. The portable electronic friction coefficient instrument simplifies the whole test system to be easy to carry. It is automatically controlled by the circuit, and the operation is simple and accurate. The instrument is suitable for measuring the anti-skid value of asphalt pavement and cement concrete pavement, which can be used to evaluate the anti-sliding ability of pavement under wet conditions.

Keywords: Traffic Safety, Friction Coefficient, Improved Design
Abstract

標線具有引導駕駛前方道路線型之功用，為最基本之道路安全設施。然而在台灣卻有許多地區之道路標線，可能因為施工廠商之不了解，與主管機關認知不同，使標線和法規衝突。或因年久失修，而磨損殆盡使用路人於道路上而無所適從，輕則違規，重則可能產生車禍事故等。

本研究將針對國內外之標線研究進行文獻回顧，接著透過實際觀察法，收集台灣地區標線畫設錯誤之案例，並使用層級分析法 (Analytic Hierarchy Process, AHP) 為作研究方法，發展出三大構面以及十一個準則，研究結果顯示以法規面為最需優先改善，接續為劃設面以及維修面，準則則以標線錯誤為第一優先，並建議標線之法規應該有所分級，一部法規無法適用所有道路。

Keywords: 標線改善、層級分析法、交通安全
Systematic Optimization of Comprehensive Transfer Centers in Jiangsu Province in China

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摘要

综合客运枢纽规划建设和是构建综合交通运输体系和落实以人民满意为中心发展思想的重要抓手。枢纽内的换乘导向系统对引导旅客正确而有效地完成空间定位、换乘路径选择、紧急疏散等行动不可或缺。

从江苏省已建成的综合客运枢纽的运营效果看，存在对换乘导向系统设计不重视、责任不明确、标志图案不统一、指示不清晰等问题，直接影响了旅客出行效率和满意度。

为此，江苏省交通运输厅规划研究中心和江苏纬信工程咨询有限公司组织开展了综合客运枢纽换乘导向系统优化研究。对全省16个已建成的综合客运枢纽换乘导向系统进行了细致体验式的问题查找，并赴北京、深圳、大阪、东京等地进行了学习调研，在参考换乘导向系统相关国家标准、行业规范基础上，研究编制了《江苏省综合客运枢纽换乘导向系统技术指南》，从加强管理和技术指导两个方面提出了相关要求，对现有规范标准缺失部分进行了补充，以便更好地指导我省综合客运枢纽换乘导向系统的建设。
Trip Characteristics Analysis of the Elderly in Guangzhou Based on Big Data
基于大数据的广州市老人出行特征分析

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Abstract

In order to understand the impact of aging problem on the transport system, this paper analyzes the travel characteristics of the elderly in Guangzhou using the IC card data. This paper analyzes and compares the individual travel features between the elders and the ordinary people in the aspects of travel volume, travel ratios, travel time, travel patterns, the average 15 minutes of travel volume in a week and travel fares. And we also analyze the rules of variation of elders' travel behaviors with age by compares travel features between 60-65-year-old elders and the elders order than 65. In addition, we also study the transfer behavior of the elderly and determine the transfer threshold. Finally, we determine the transfer volume and the distribution of transfer station of the elderly. This results can be used for developing a more rational travel policy for the elderly.

Keywords: IC Card Data, Elderly, Trip Characteristics, Transfer
Session 4: Systematic Design and Optimization of Rail Transportation and Transfer Center

ICTPA 31-372

Subway Route Planning Based on Maximized Benefit of Investment

基于投资效益最大化的地铁线路规划

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摘要

地铁线路规划在实践中以基于多方案比选的经验型方法为主，所获得的线路方案往往难以保证是最优方案。本文尝试对地铁的线路规划进行数学建模，以单位投资下线路服务人口最大为目标，同时保证地铁线路和站点布局满足站距、资金、线路总长度及几何条件等约束，并采用MATLAB对模型进行深度优先搜索算法设计，最终求解得到最优线路方案。本文以洛阳为例进行实例验证，得出满足约束条件的多个可行线路方案，并在不同站点设置条件下分别得到投资效益最优的方案。本研究所提出的方法可供地铁规划人员和决策者参考，对当前采用PPP模式的地铁项目，此方法对其财务前景分析和相关决策也具有十分重要的参考价值。

关键词：城市交通, 交通规划, 投资效益, 地铁线路规划, PPP
A Study on the Key Influential Factors of Subway Traffic Dispatcher’s Error Issues

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Abstract

As a central conductor of the urban rail transit system, the dispatchers are critical to both safety and efficiency of railroad operations. They are responsible for monitoring and planning in the Human-Machine-Environment interactive system to make certain the safety of trains and the passengers. These are complex cognitive tasks that require higher human reliability to ensure the normal operation. In order to prevent and reduce human errors, this paper researched the key influential factors of dispatcher’s errors based on the cognitive information processing model and task analysis, it concluded that 16 abilities, judgment ability, memory ability, emergency reaction ability and so on, are crucial factors to impact on the dispatcher’s work performance, the safety and efficiency of the system. For the purpose of knowing the dispatcher’s current status level of these capacities, we conducted 6 tests to test 210 dispatchers from Shanghai Metro by using Vienna Test System (VTS), finally obtained 12 indexes to describe the 16 capacities, through the statistical analysis, the standards for the 12 indexes are defined. The results found that the abilities of monitoring in a long time, attention and reaction speed, discrimination, judgment, memory and decision-making are the weak spots of dispatchers, and what the subway corporation need to focus on. Then this paper compared the capacities of dispatcher with different dimensions, the results show that the older and longer the work seniority the dispatcher is, the worse the ability of monitoring in a long time is, and there is a significant link between the abilities and the specific tasks of the dispatchers. Therefore, the metro corporation can organize the targeted training for the dispatchers to strengthen their own abilities to reduce human errors by combining their specific tasks. At the same time, the research also laid a foundation for the demand of dispatcher’s vocational skills model.

Keywords: Urban Rail Transit, Subway Dispatcher, Human Errors, The Key Factors of Dispatcher’s Errors
Session 4: Systematic Design and Optimization of Rail Transportation and Transfer Center

ICTPA 31-282

Study on the Evolution of Regional Rail Transit Network in Beijing - Tianjin - Hebei Region

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Abstract

The improvement of regional rail transit network is an important support for the coordinated development of the Beijing-Tianjin-Hebei region, while the study of its evolution rule can give reference to the development of the rail transit. Based on the Space L model of complex network model, this paper proposes the complex network model of Beijing-Tianjin-Hebei regional rail transit from 1950 to 2030 by Gephi software, calculating the characteristic indexes such as network average degree, network diameter, average path, clustering coefficient and so on. The evolution of the characteristic indexes shows the Beijing-Tianjin-Hebei regional rail transit network has experienced a three-phase development from 1950 to 2030. The increasing trend of average degree and the decreasing trend of network diameter and average path show that the network structure is gradually developing and perfecting. From the perspective of regional coordinated development, it is recommended to give priority to the construction of rail transit in the new area and capital new airport. At the same time, we should strengthen the links with existing sites in the region.

Keywords: Railway Transportation, Network Evolution, Complex Network, Beijing - Tianjin - Hebei Region, Regional Rail Transit
User Behavior Analysis of Car Sharing under Urban Traffic Conditions

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Abstract

The promotion of car sharing plays an important role in alleviating the urban pressure, especially in the energy saving and emission reduction in urban areas. Car sharing has been gradually becoming an important option for residents' travel demand. The Logit model is widely used in the field of traffic distribution analysis. Based on the multiple Logit model, this paper proposes a model of residents' travel behavior, and uses the case of Seattle area to analyze the factors that affect the travel choices of residents based on a survey. By analyzing the final results, it is concluded that the main factors that will promote the proportion of car sharing will have positive effect on energy saving and emission reduction.

Keywords: Car Sharing, Multiple Logit Model, Travel Behavior, Emission Reduction
A Data Driven Method for Delay Duration Estimation of High Speed Train

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Abstract

Punctuality is commonly acknowledged as a key performance indicator for the railway industry. However, the train delays are usually unavoidable due to various kinds of disruptive events. In this paper, data mining and analysis of historical delay descriptor records is used to analyze and discover causes for major delay events, which is essential for effective operation strategy planning and improving rail management. We develop a data driven method to model the relationship between delay duration and cause, and statistically estimate future delay duration. The estimation results are critical for rail control center’s first-response procedures, as well as for travelers’ information.

Keywords: Train Delay Events, Text Mining, Dimension Reduction, Statistical Prediction Models, Delay Duration Estimation
Customer Service Considerations for High Speed Railways

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Abstract

High speed railway is in vogue, and many countries are considering high speed railway projects. High speed railway is a different product from conventional railway and coach service.

In transportation, customer service goes beyond the traditional view of providing safe, reliable and convenient movement from origin to destination. While these attributes are important, they are often taken for granted by the customers. Nowadays, it is important to look into the expectations of the customers, including both stated and implied expectations.

To be successful, the railway operator has to clearly define the level of customer service to be provided to the potential customers.

This paper attempts to look into some of the positive experience in transportation operations in different parts of the world and see how these examples can be applied to the high speed railway customers.

Keywords: Customer Service, High Speed Railway, Project Definition, Servqual Model
Enhancing Anticipatory Traffic Signal Control with Metamodeling and Iterative Learning Optimization

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Abstract

This paper proposes a metamodeling framework for an effective design of network traffic signal settings called anticipatory traffic signal control. Anticipatory traffic control takes a bi-level structure and determines signal settings to optimize network-wide objectives, e.g., minimize total travel time, taking into account travelers’ route choice response and the resulting equilibrium flow patterns. The route choice response is usually predicted through a response function known as traffic assignment model. In general, the actual human response behavior can never be precisely modeled. The model-reality mismatch contributes to suboptimal control performance and hence brings unexpected congestion in real-life traffic operations. This study introduces a metamodel as a surrogate of the unknown structural model bias, which can be corrected in order to improve control optimality. The metamodeling framework is able to (1) integrate the model-based control design with data-driven learning techniques, and (2) provide a closed-form and analytical model bias formulation that allows theoretical investigation of the model approximation error. Furthermore, it is known that traffic model parameters may be quite sensitive to characteristics of an urban road network, which need to be identified for the specific network in consideration. In this study, a choice behavioral parameter estimation is also performed. The objective is to achieve a better model calibration jointly with the model bias correction. We then present an iterative optimizing control algorithm to elevate the traffic system towards its optimal operating performance by learning from observations. Numerical examples confirm the effectiveness of the proposed method in improving control performance, despite structural mismatch between reality and the model used to anticipate the response of travelers.

Keywords: Network Design; Traffic Signal Control; Model Bias; Metamodeling; Iterative Learning
Analyzing the Real Bus Route Planning Using Trip Characteristics of Urban Public Transit

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Abstract

Based on the rise of ‘Internet & Bus’ (Ruyue Bus) service demands on public transportation in recent 2 years, this article proposes a Ruyue Bus route planning method based on traditional bus IC card data mining and analysis. First of all, we need to carry out the information analysis of individual and group trips based on bus IC card data mining and find out residents' historical travel mode. Through the analysis of bus travelers' time, stops, and routes etc., we can get important long distance bus travel OD pairs, which can provide sufficient data reference for Ruyue Bus’ passengers’ analysis, routes and operating time etc. In the final case analysis, the effectiveness of the proposed method is verified through the actual effect of Ruyue Bus' routes opening.

Keywords: IC Card Data, Trip Characteristics, Ruyue Bus, Route Planning
Planning of Elderly Exclusive Bus Line: A Case Study of Fuzhou

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Abstract

Although the state has adopted some encouraging policies on elderly people's public transport trips in recent years, due to the late start of the development of public transport in our country, many deficiencies have emerged in the face of rapid social aging. In order to ensure safe and convenient travel for the elderly, and to avoid the waste of public transportation resources, this paper proposes a special bus plan to separate the elderly from young citizens in space. Take Taijiang as the study area, this paper through the statistical analysis of the elderly travel characteristics of the elderly there are two peak hour time. Then, the original unit method was used to predict the traffic demand of the elderly in the target area of Taijiang in the year. The design of five elderly exclusive bus lines using TransCAD planning software was also proposed. Suggestions were also made for the facilities of exclusive bus lines. Finally, five evaluation indicators are constructed to evaluate the five public transit lanes in order to provide reference for the implementation of the actual project in the future.

Keywords: Elderly, Travel Behavior, Exclusive Bus Line
Identifying Spatial Distribution of Residents’ Public Transportation Travel with Smart Card Data

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Abstract

Identifying the spatial distribution of travel activities can help better understand the urban structure. In this paper, smart card data is used to describe the spatial distribution in a city. Firstly, the travel network is constructed, in which nodes represent stations and edges represent travel relationships between nodes. The travel origins, destinations and node strength are extracted from the smart card data, and then the properties are calculated to evaluate the system performance. The comprehensive structural centrality index is calculated to mine the importance ranking of travel origins and destinations from the weighted sum of the centrality indices, and the PageRank is used to identify hubs of each network. Secondly, the community detection method is applied to reveal the community structures by using spatial clustering and partitions of travel activities. Finally, a case study of Guangzhou is conducted using the smart card data of residents’ public transportation travel from a macroscopic aspect. Results imply that the bus travel network has the characteristics of small world and community structure. The bus network also has a significant commuting feature and hub nodes show district differences in each network. The mass transit railway network is tightly connected and highly loaded and has no obvious community structure. In this study, network analysis and community detection are used to reveal the relationship between travel modes and city structures, which could potentially aid in analyzing and optimizing the layout of public transportation, making and applying urban transportation policies.

Keywords: Spatial Distribution, Public Transportation Travel, Smart Card Data, PageRank, Community Detection
ICTPA 31-116
Optimization of Cross-line Bus Stations with the Influence of Railway Network

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Abstract

Focusing on the long through-type bus lines in big cities, a bi-level programming model was set up to design the stops of through-type bus line with full consideration of the impacts of rail transit network and its evolution. The full-load rates of associated bus routes were guaranteed in a reasonable range after optimization. The goal of the upper level model was the comprehensive minimum of passengers trip costs, bus operation cost and the inequality of full-load ratios of different intervals of the bus line, and the decision variables were the setting decisions of each stop and the headway of the bus line; the lower level model was a passenger flow assignment model based on Logit-SUE which took the crowding perception of passengers in bus vehicles into account, and the decision variables were the number of passengers in different trip routes. The GA and MSA algorithm were used to solve the bi-level optimization model, and a case was given to prove the feasibility and effectiveness of the model and algorithms. Finally, the sensitivity analyses of the time value of passengers \( \omega \) were given. The results showed that the model put forward in this paper could fully consider the influences of the rail transit network, and the target value of the optimized line was 47.2\% better than the original line, the bus operation cost and the inequality of full-load ratios of different intervals were reduced by 49.7\% and 23.6\% respectively. At the same time, this paper emphasized that it was necessary to consider all the possible demand points for target bus line in every optimization that corresponded to the continuous changes of the urban rail network. It proved that the target value with the method considering all possible demand points could be reduced by 22\% and 17.4\% compared with the method considering only the existing demand points corresponding to two different stages of rail transit network. Finally, the bigger \( \omega \) leads to the higher \( P_{rail} \), with the increasing of \( \omega \), the demand of travelers who choose the bus mode is smaller, and so is the cost of the bus operation.

Key words: Traffic Engineering, Bus Stops, Through-Type, Bi-Level Programming Model, Urban Rail Transit, Evolution Trend, Logit-SUE
Naturalistic Bicycling Behavior Pilot Study

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Abstract

In the United States, the bicycle has become popular as a viable mode of transportation, although transportation needs still largely focus on automobiles. Unfortunately, bicyclists suffer significantly higher rates of injuries and fatalities compared to automobile users. Bicyclist safety is a major concern in Florida, where the bicycle fatality rate was nearly triple the national average in 2015. A naturalistic bicycle behavior pilot study was conducted based on the actual rides of bicyclists in the Tampa Bay area. The research team successfully designed, developed, and produced bicycle data acquisition systems and recruited 100 eligible participants for comprehensive data collection for naturalistic bicycling behavior analysis. Results of the pilot study provide valuable insight on the following six key areas: 1) understanding the behavior, experience, and interactions of bicyclists and drivers making right turns at intersections (right hook), 2) understanding the behavior, experience, and interactions between drivers making left turns and oncoming bicyclists (left hook), 3) understanding the behavior, experience, and interactions of bicyclists and drivers at night, 4) understanding bicyclist route-choice decisions with given origins and destinations, 5) assessing bicycling behaviors of bicyclists with and without formal bicycle-riding training, and 6) analyzing bicycle crashes or close calls and determining their contributing factors. The data analyses also show relationships between bicyclist compliance behaviors to traffic rules and their age, gender, experience, and self-reported risk and distraction proneness. The research findings from this pilot study provide a solid foundation for development of effective engineering, education, and enforcement countermeasures to improve bicycle safety and support multimodal and sustainable transportation.

Keywords: Naturalistic Bicycle Study, Bicycle Safety, Behavior, Compliance Rate, Interaction
Research on Allocation of Capacity/flow and Optimization of Runway Configuration Based on Dynamic Capacity

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Abstract

The airport capacity is dynamically affected by the complicated factors such as weather. The capacity imbalance caused by the capacity change and the air traffic demand are the important reasons for airport congestion and flight delays. Firstly, to solve the problem of capacity allocation and runway allocation decision under the condition of airport dynamic capacity, a dynamic decision model of capacity allocation and runway allocation is established by two-stage stochastic programming. Secondly, the predator-prey search algorithm is used to analyze the case. Finally, the results show that the algorithm can obtain a reasonable operation strategy and verify the feasibility and effectiveness of the proposed model. It can be seen that the model algorithm can be widely used in multi-runway airport with different runway configurations, which can provide auxiliary decision support for improving the running quality of ATC.

Keywords: Air Transportation, Runway Configuration Decision Making, Predatory Search Algorithm, Multi-Runway, Flow Optimization

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Topic 7: Air Transportation Management and Bicycling Behavior Study
Terminal area Approach Route Short-time Utilization Rate Model Based on Space-time Occupation Analysis

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Abstract

The process method would be used, and the operation process of the terminal area airspace system is divided into three sub processes: the approach, the departure, and the over flight. As the terminal area of the bottleneck of air traffic transport networks, the problem of air traffic congestion and flight delays caused by the inefficient operation of airspace often occurs, and the calculation and assessment of airspace utilization rate becomes very urgent. Airspace utilization calculation is made for route of terminal area process. Based on spatial dimension and based on space-time occupation analysis, a calculation model of route utilization of terminal area is established. By calculating the utilization rate of approach routes in different time segments during the day, the model for calculating the route utilization rate of short-term terminal areas and the route utilization rate of short-term terminal areas during rush hour are established. Finally, an example is given to get a graph of the short-term utilization rate.

Keywords: Short Time, Airspace Utilization Rate, Approach Route Utilization Rate, Space-Time Occupation Analysis, Assessment Mode
Influence of Talking Speed on Dialogue Quality Between Pilots and Land Controllers

语速对管制员和航空器驾驶员陆空通话性能的影响

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摘要

语速是影响管制员和航空器驾驶员之间陆空通话性能的重要因素之一。首先利用文字记录分析法对三个进近管制单位的3478条陆空通话语音数据进行了处理，再以字/分钟作为语速的衡量标准，从航空器驾驶员复诵错误、通话者要求对方重复、与对方证实通话内容和未及时应答等方面对数据进行了分析。结果表明：总体来说管制员和航空器驾驶员的通话错误非常少，仅为0.49%。全部数据的平均语速为354字/分钟，中文通话平均语速376字/分钟，英文通话平均语速223字/分钟。中、英文语速均高于日常生活和国际民航组织规定的100字/分钟的语速标准。对数据的进一步研究发现中文语速保持在200-250字/分钟或以下，英文语速保持在100-150字/分钟或以下时，产生通话错误及问题的发生率较低。最后, 从语速角度提出了减少通话问题的建议。

关键词：陆空通话, 进近管制, 管制员, 航空器驾驶员, 语速
The Impact of the Reimagination of New Bus Network on METRO Rail’s Ridership in Houston

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ABSTRACT

Houston METRO has recently executed a Five-year Transit Service Plan to provide simpler, faster, more frequent service and better service on both weekdays and weekend. The reimagined bus network service was implemented on August 16, 2015. Previously, a series of systematic expansions of METRO Light Rail took place from December 2013 up to May 2015 which was intended to provide service around downtown and Texas Medical center area as parking is highly expensive and difficult in these places. There was a significant rise in the overall ridership immediately after launching the new bus network service incorporating with the recently improved rail network. It is important to study METRO light rail’s ridership before and after the reimagining of its bus network to evaluate the performance outcomes of the system reimagination. The objective of this research is to study the monthly ridership pattern of METRO light rail station-by-station to localize the area of impact of the change in ridership. The following two questions were identified to be answered: (1) Has the new bus network a significant impact on light rail ridership? (2) If yes, what is the area of impact and how it is affecting users? In this paper, a change in rail ridership was predicted with the reinforcement of more connected bus network. The study revealed that there has been a remarkable increment in rail ridership. Although, it was discovered that the total ridership increment in Red Line within one year of implementation was 13% but afterward it started to decrease. Also, the areas of impact, either significant change occurred or not, were localized. Furthermore, few probable causes of such shifting in ridership were recognized. The results of the above analyses can be useful to the decision makers and planners of METRO to fix strategies for further improvements of the overall bus and rail network utilizing its existing resources.

Keywords: Light Rail, Rail Network, Ridership, Reimagining, Bus Network
A Simulation Approach for Assessing Passenger Flow Dynamic Loading Capacity of Platform in Urban Rail Transit

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ABSTRACT
This paper focuses on calculating the dynamic loading capacity of platform in a skip-stop urban rail transit system and establishes the simulation model using colored timed Petri nets (CTPN) in order to evaluate the passengers’ distribution efficiency. Based on the random utility theory, passengers’ choosing behavior between the express and local lines is simulated which arranging and controlling the trains’ arriving and departure events in accordance with the train schedule. It could simulate the process of passengers’ boarding and alighting on the platform at the same time. With the information contained in train schedule on peak hour, a case study about the comparison simulation experiment with different passenger flow traffic demands is conducted and two conclusions is given. One shows that train stopping time and seating capacity have a significant impact on passengers’ distribution efficiency on the platform and the other one is that skip-stop operation scheme has a higher adaptability to single direction interchange demand of the passenger flow than before.

Keywords: Passenger Flow Dynamic Loading Capacity, Colored Timed Petri Nets (CTPN); Skip-Stop System, One-Platform Interchange, Passengers’ Distribution Efficiency, Path Selection
The Fusion Evaluation Method of Two Networks Based on The Cloud Model - Fuzzy Comprehensive Evaluation Method

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Abstract

The good connection between the urban road network and the external freeway network is the basis of the smooth movement of the urban area. The fusion evaluation of the two networks are studied. Firstly, through to the facilities and the service performance and the connection point operation quality, the evaluation indicator system of two networks is established, that including the matching degree level of two networks, the service level compatibility of two networks, the convenience degree of the network to each other, inward and outward toll station utilization degree, the service area rate of the connection point, and the service area overlap rate of the connection point are included as evaluation indicators. Then, based on the cloud model and fuzzy comprehensive evaluation method, the fusion evaluation method based on cloud model - fuzzy comprehensive evaluation method of two networks is established, and the fusion evaluation process is determined. Finally, a case analysis of the skeleton road network and the external freeway of Changsha city is carried out to verify the effectiveness and scientific of the method.

Keywords: Urban Road Network, External Expressway, Fusion, Cloud Model - Fuzzy Comprehensive Evaluation
Passenger Transfer Conflict Delay in Large Passenger Transport Hubs

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Abstract

In the passenger transfer process, passenger congestion conflict is a very important factor in transfer delays in large passenger transport hubs. By analyzing passenger walking speed, passenger arrival rate, the capacity of walking facilities and passengers’ expected travel time, a model for calculating conflict delay in the passenger transfer process is established in this paper. The relationship between the average delay due to passenger conflict, the arrival rate and the absolute value of the difference in passenger arrival rates from different directions is calculated, and a simulation platform of passenger travel behavior, which is based on NetLogo, is established to simulate the passenger transfer conflict process. The outcomes verify that the model is effective, feasible and accurate. Therefore, the research results make great contributions towards the evaluation of the layout plans of passenger transfer facilities in large hubs, and provide a theoretical foundation for perfecting hub transfer facilities.

Keywords: Passenger Transport Hub, Layout Optimization, Netlogo, Passengers’ Transfer Facilities, Conflict Delay
Attitudes of Jordanian Drivers Toward Specific Road Safety Issues

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Abstract

Jordan, classified the World Bank as an upper-middle income developing country, is among the countries with high road traffic accident (RTA) rates. According to Jordan Traffic Institute, road users are considered responsible for over 90% of the total accidents. Therefore, it is necessary to provide an understanding of their behaviour in order to develop strategies to reduce the number and severity of RTAs.

Using a pre-designed questionnaire, common drivers’ behavioral issues were examined. These include: attitudes of drivers to speed and speed limit enforcement, mobile phone use while driving, experience of fatigue and falling asleep while driving and aggressive driving.

The results of this study reveal that over speeding is the main cause of RTAs in Jordan and that few drivers drive when they have fatigue or are sleepy or during rush hours. Most of fatigue-related accidents occur in early morning trips. Furthermore, the results reveal that there is a lack of awareness among the community regarding the impact of using mobile phones while driving as 64% of respondents reported using hand-free phone while driving. In general, Jordanian drivers were found to be aggressive when they drive. Female drivers were found to be more aggressive than male drivers and young drivers more than adults.

Keywords: Survey, Road Safety, Perception, Driver Behaviors
Scheduling Bus Arrival Timetable Based on Service Reliability

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Abstract

Bus arrival timetable is an important reference for people to plan their travel. Compared with the existing transit information release platform and electronic bus stop, it has the advantages of wide coverage, simple setting and low cost. According to the percentile value of the historical arrival time, this paper takes the probability of passengers to catch public transport above 90% as the target, considers the maximum one-way running time and the maximum waiting time of passengers and proposes a arrival timetable scheduling model based on service reliability. Selecting Guangzhou 11 line as a study example, the results show that if passengers arrive the stop according to the timetable, the average site reliability is 90.5% and the average waiting time is 3.6min on working days. The average site reliability is 98.5% and the average waiting time is 4.3min on non-working days. Compared with the traditional method and passengers’ random arrival, the overall reliability of this method is increased by 23.8% and 44.6% respectively.

Keywords: Traffic Engineering, Bus Timetable, Passenger Waiting Time, Service Reliability
Highway Safety Evaluation at the Operation Stage: An Overview

公路运行阶段安全性评价研究综述

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Abstract

At the operation stage or the post-evaluation stage, the typicality of evaluation indicators and the high efficiency of parameter acquisition are significant for highway safety evaluation. Especially for low-grade highways (grade 3 or 4 highways), mountainous roads and rural roads with poor safety environment. There is often lack of basic alignment design data. With the development of safety evaluation technology, new methods of data collection and new evaluation indicators have emerged. This paper analyzes and summarizes the research status and development trends in fields of domestic and international highway safety evaluation technology at the operation stage. It reviewed the safety evaluation at the operation stage from three aspects, including data collection, traffic performance indicators and safety evaluation, and alignment operating indicators and safety evaluation. Furthermore, existing problems in the current research and future development trends are proposed.

Keywords: Highway, Safety Evaluation, Data Collection, Operational Indicators, Alignment
Analysis of the Service Quality of Bus Transit Stops

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Abstract

There is a positive relationship between the model split of the bus and satisfaction of bus transit. And as an important part of the bus service, the service quality of the bus stop has a great influence on the bus user’s satisfaction. Therefore, in order to promote travelers’ satisfaction of the bus service, it is necessary to analyze the service quality of the bus stop. This paper analyzes the service quality of the bus stop with the Rasch model. Through the analysis of data with the Rasch model, the difficulty of the item relating to the service quality of the bus stop and the ability of the bus user are obtained. It is found from the comparison of the difficulty that travelers are dissatisfied with bus arrival information, complaint system, noise level, waiting time the most for the bus stop, and are dissatisfied with the noise level, walking distance, bike parking and complaint system for the BRT station. Also, it is found that the way travelers come to the bus stop or station, travel purpose, frequency of traveling by bus, familiarity with the bus line, smartphone app availability, gender have a great influence on travelers’ evaluation of the service quality.

Keywords: Bus Stop; Service Quality; Rasch Model; Demographic Character
**Abstract**

Customer service is vital to the success of a company, be it a utility giant or a monopolized public transport operator. Thanks to nowadays political climate and the proliferation of the Internet multimedia. But no matter how well you may treat your customers, for one reason or another, things will go wrong. We have to deal with such incidents.

A policy must be established by the top management of a corporation to deal with any untoward events such that all staff from top to down will be prepared. Procedures or guidelines must be available and communicated to all staff. In day to day management, if each minor incident is duly investigated, root causes ascertained and remedial actions followed up properly, the practice will be conducive to continuous improvement. For incidents of a more serious nature, appropriate grade of staff should be designated to manage on site. He or she must be able to ensure safety of customers, staff and external rescue parties; preserve evidence; coordinate speedy recovery; and provide timely feedback to senior management.

Incident management is in fact an integral part of safety management. To be proactive, regular drills and exercises, preferably involving government rescue parties are essential. In this paper some experience will be shared in the practical application of incident management in the Mass Transit Railways of Hong Kong.

**Keywords:** Incidents, Customer Service, Safety Management, MTR
Assessment of Leading Pedestrian Interval Suitability and Effectiveness - Before-after Pilot Study in Florida

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Abstract

Pedestrian safety is a major concern throughout the United States and is one of the highest priorities for the Florida Department of Transportation (FDOT). Vehicles often fail to yield to pedestrians at signalized intersections, especially when pedestrians enter an intersection with a concurrent green signal in the same direction of vehicle travel. Leading Pedestrian Interval (LPI) is a low-cost countermeasure to provide pedestrians with an advance start before the concurrent green signal to increase pedestrian visibility and safety in crosswalks. However, LPI is not universally applied at any signalized intersections since it is dependent on varying characteristics. This paper presents an integrated study to assess the suitability and effectiveness of LPI implementation at signalized intersections. A comprehensive and in-depth literature review was conducted, and draft LPI implementation warrants were developed after intensive and valuable input information was collected. Pilot data collection and analyses were conducted before and after LPI implementation at nine selected intersections covering geographically-diverse environments. Results showed that LPIs were effective in reducing vehicle-pedestrian conflicts, yielded only a small influence on intersection operation efficiency, and produced promising utilization efficiency. The results from the LPI pilot implementation clearly did not indicate that driver yielding behavior to pedestrians increased after LPI implementation. Therefore, supplemental measures such as “No Turn on Red” blankout signs and “Yield to Pedestrians” signs were recommended for implementation along with LPI to increase the yielding percentage. The research findings provide a clear insight of suitability of LPI implementation and its effectiveness and deliver a solid basis for future development of Florida statewide LPI implementation guidelines that include LPI warrants, implementation process, and supporting information.

Keywords: Leading Pedestrian Interval (LPI), Vehicle-Pedestrian Conflict, LPI Implementation Guideline, Pedestrian Safety
Research on Methods of Freight Safety Evaluations

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Abstract

Since there exits significance of prevention and control for freight risks, and methods of freight safety evaluations are investigated in this paper. Firstly, according to the index system of the freight risk, the risk source risk degrees of freight are divided into five levels, such as great dangerous, dangerous, unsafe, basic safety and safe. Secondly, BP neural network evaluation model of freight security is established. To train the BP neural network evaluation model, the screened factors through risk assessment index with greater safety impact on freight is selected as input neurons, and combining characteristics of four factors to obtain model input data. Finally, the experiments of BP neural network evaluation model of freight security are conducted, and the experimental results indicate that the evaluation accuracies are over 88.75%, which show effectiveness of the proposed method of BP neural network evaluation model of freight security.

Keywords: Freight Risk, Driver, Risk Evaluation, BP Neural Network System
Research on Risk Analysis Methods of Freight Transport

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Abstract

In order to analyze the risks of transport vehicles, and investigate the characteristics of transport goods in the transport process, the common characteristics of the freight were analyzed and summarized in this paper. Firstly, the risks in freight process are divided into four aspects, such as person, vehicle, road (environments) and goods. Secondly, the risk assessment index method with five levels evaluation is proposed to assign the corresponding evaluation index to the probability of accident occurrence and the damage caused by each risk source. Thirdly, the selection of risk indicators for drivers, vehicles, roads (environment) and goods is carried out. Finally, the index system of the freight risk is constructed based on the filtered results in this paper.

Keywords: Freight Risk, Risk Assessment Index Method, Risk Factor, Freight Risk Index System
Quantitative Evaluation of the Development of Suburban Center in Shenzhen from the Perspective of Transportation

交通视角下深圳市外围中心区发展评估

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Abstract

Due to the historical reasons of the special economic zones, there were notable differences in the urban development of the original SAR in Shenzhen and other places. After the integration of Shenzhen Special Economic Zone in 2010, the government implemented "Special Zone Integration Action" for six consecutive years. The original SEZs, especially the Suburban Center, have made great improvements in urban style and infrastructure, but the functions of the business center given by the plan have been developed slowly. Based on multi-source data from the population and employment density, the distribution of occupations and residences, and the changes in land use in recent years, the development of the Suburban Center was quantitatively evaluated. The results show that the process of development outside the original SEZ basically follows the process of attenuation from the gradient of the center area. The Suburban Center area is more responsible for housing functions and the improvement is not obvious in recent years. Finally, on the basis of this analysis, some propose was put forward to develop suburban center.

Keywords: Shenzhen Spatial Structure, Development Evaluation
A Method for Determining Main Channel of Regional Logistics Network Based on Bi-level Optimization Model

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Abstract

The paper analyzed the internal constituent and the external associate factors of the logistics network, introduced the concepts of node importance and economic connection potential energy, established the node importance index system, given the calculation method, constructed an optimization model based on double-target constraint for determining the main channel of regional logistics network. The basic idea of the improved PSO algorithm is used to solve the model, and the effectiveness of the method is verified by an example analysis.

Keywords: Logistics Network, Logistics Channel, Economic Connection Potential Energy, Bi-Level Optimization Model
Research on Optimization Model of Order-Picking Path for Comprehensive Cargo Lost and Handling Cost

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Abstract

The difference between value and weight of goods in logistics distribution center is more and more important, how to control the risk of damage and handling cost in the process of order-picking is becoming the key problem of order-picking route optimization. On the basis of considering the value and weight of goods at the same time, this paper constructs an order-picking route optimization model synthesizing damage risk and handling cost. Through the analysis of the model, the genetic algorithm is used to solve the model, and the optimal genetic parameters are determined by calculation. Finally, the model and algorithm are programmed by MATLAB, the validity of the model is validated by the distribution of the weight and value of the goods in the optimal solution, and the validity of the algorithm is validated by the accuracy, stability and calculation speed of the optimal solution.

Keywords: Route Optimizing Problem, Cargo Loss, Handling Cost, Genetic Algorithm
A New Method for Vision-based Fatigue Driving Detection and Assessment

一種基于机器视觉的驾驶人疲劳检测及状态评估方法

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Abstract

Safety assisted driving system is an important part of intelligent transportation system (ITS), and the driver fatigue detection system is an important research direction of safety assisted driving. This paper presents a non-intrusive prototype computer vision system for real-time fatigue driving detection, and establishes a fatigue state evaluation model. Firstly, we conduct the face detecting and tracking by using Haar-like features and an improved CamShift algorithm. Secondly, template matching method is applied to reduce the computational cost during eye-detection phase, and we increase the accuracy of detection rate by introducing an eye-validation process. Thirdly, we detect and estimate iris center in H channel of HSV color space, and fits the iris with an ellipse. The ratio of short and long axis of this ellipse is for characterizing the driver’s fatigue features. After the extraction of eye fatigue features, we finally calculate PERCLOS measurement for fatigue evaluation. Experimental results show that the system has good accuracy, robustness and real-time performance. the research achievements can be used in automobile safety assistant driving system and road safety evaluation.

Keywords: Fatigue Driving, Adaboost Cascade, PERCLOS, Camshift Algorithm, Ellipse Fitting
Research on Key Technologies of Traffic Video Smoke Detection Based on Multi-feature Fusion

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Abstract

The fire is fiercer than the tiger and needs to be protected from unburnt. With the rapid development of society, the process of urbanization in our country is accelerating, the traffic environment is becoming more and more complicated, and the security risks of traffic scenes are also increasing day by day. Traffic fires are one of the major hidden dangers. This paper aims to improve the prevention and control of traffic fires and effectively reduce the adverse effects caused by traffic fires. A smoke detection algorithm based on traffic video sequences is proposed. By constructing a Gaussian mixture model, the motion foreground in traffic video is extracted, and the digital morphological filtering is used. The technology circle takes suspected smoke areas and conducts multi-feature fusion analysis. Under the HSL color model, the information of each channel is normalized and combined with statistical methods to determine the threshold. In the analysis of morphological characteristics, irregularity mutations were used as metrics, and statistical analysis was used to monitor irregularities in video images. In combination with the diffusion characteristics of smoke, an edge diffusion model based on the center of gravity of the suspected smoke region was established. The diffusion direction and spread rate were taken as primary reference variables. Through the analysis of the smoke free diffusion model, the characteristics of the smoke diffusion entropy increase motion are obtained, the smoke “entropy change” model is established, the motion of smoke motion and noise are distinguished, and the detection of fire smoke is realized. After experimental verification and analysis, and Fourier transform of the image entropy change, the conclusion that the interference motion and smoke motion have different characteristic signals was obtained. Comprehensive multi-feature fusion weighted analysis, the establishment of a comprehensive criteria formula for the traffic video image for smoke detection and alarm, enhance traffic prevention and control of fire.

Keywords: Traffic Fire Prevention and Control, Smoke Detection, HSL Color Model, Smoke "Entropy Change" Model, Multi-feature Fusion
Analysis of Driver’s ECG Index Under Poor-viewing conditions
不良视距条件下驾驶人的心电指标测试及分析

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Abstract
This paper mainly studies the traffic problems from the perspective of physiology. With the aid of the car-simulated driving system, records the ECG data under four kinds of poor viewing conditions of the driver’s, and then analyzes the characteristics of the driver's ECG changes to determine the driver’s working load under poor viewing conditions. The results show that as the traffic environment deteriorates, the driver's nervousness increases, and the time-domain and frequency-domain characteristics of ECG data have been affected. Poor visibility will make the driver feel insecure, the mental load has increased greatly, and resulted a strong sense of tension, panic and fatigue, which affects the stability and safety of driving.

Keywords: Poor Viewung Conditions, ECG Index, Simulation Testing, Time Domain Index, Frequency Domain Index
Effectiveness Evaluation of Infrastructure -to-Vehicle Messages in Work Zone Advance Warning Area

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Abstract

Simulations and field tests have shown that the connected vehicle technologies would not only enhance the mobility and safety of traffic operation, but also possibly reduce fuel consumption and exhaust emissions. So far, there is no consistent evaluation procedure on the performances of these in vehicle messages to drivers in work zone area. The objective of this research was to test, compare and develop a warning system to prevent occurring of work zone crashes and reduce vehicle emission. The main purpose of this study was to test and evaluate the different set of warning messages in the advance warning area of a work zone and develop an evaluation system for the warning system from the perspective of speed, acceleration rate, brake positions, lane changing positions, emission and work load. The work load of the three types of warning system was evaluated based on the NASA-TASK Load Index. The application of the mixed audio and image messages was able to reduce the overall vehicle emissions (CO₂, CO, HC and NOₓ). With the help of the both audio and image messages, drivers tend to recognize the road situation earlier than in the conventional situation and this will have a positively influence on driving safety. Especially, the mixed messages scenario out weights the other two scenarios in speed, acceleration rate, braking positions, emission, and work load.

Keywords: Driving Simulator, In-vehicle Warning Message, NASA Task Load Index, Evaluation System
The Influence of Bus Driver’s Sex on Vehicle Operation during Parking at Harbor Bus Station

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Abstract

Because of the differences in psychological and physiological characteristics of male and female bus drivers, different vehicle operating characteristics will be caused. In order to study the difference of bus operating characteristics during parking at harbor bus stations, the male and female bus drivers were tested in real vehicles respectively. The vehicle dynamic performance test system was used to collect the operating data during the parking and then the operation characteristics of the two buses are compared by the theoretical and comparative analyses. The results show that both the male and female bus drivers run smoothly in both the inbound and the outbound process, the average speed of female driving is higher, and the range of speed is wider than that of male. The range of acceleration and deceleration of male is larger than that of female. Based on the collected data, we used VISSIM traffic simulation software to evaluate male and female driver's bus operating efficiency. The evaluation index shows that there are differences in the effect of speed on the operating efficiency between the two during the inbound and outbound process. The majority of female evaluation indexes are better than the male ones. The optimized evaluation indexes show that when the bus intends to enter the station, the speeds of 9~12 km/h can reach the optimal operating efficiency. The results of this study are instructive in improving bus operating efficiency and providing drivers with training on the basis of gender differences.

Keywords: Bus Driver, Bay Terminal, Operational Characteristics, Simulation, Sex
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**Topic 12: Smart Transit Management and Service Optimization**

ICTPA 31-357

**Smart Bus Travel Pattern Studies under High Density Urban Environment with an Example of Macau Bus System**

基于高密度城市环境的智慧公交出行研究-以澳门公交为例

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**摘要**

澳門是世界人口密度最高的城市之一，交通長期成為城市發展的核心問題，對此特區政府提出以「公交優先」為解決交通問題的重心方策。其後特區政府又於 2017 年 8 月 4 日與阿里巴巴集團簽署了《構建智慧城市戰略合作框架協議》，標誌構建澳門為智慧城市得到明確的地位。澳門公交業與政府也期望透過智慧城市以有效管控交通，因而研探出合適於澳門環境的智慧巴士發展軸，其中包括:

一）提升公交營運效率：透過 APTS 系統的行車紀錄，以追蹤車輛的異常狀況，有助巴士之營運及調度。

二）大數據的搜集：以 RFID 與電子票支付系統，以記錄站點進出時間乃至使用者特徵、等數據，達至對基本客運量等數據的掌握及分析。

三）優化居民的出行體驗：手機軟件提供實時巴士狀況，巴士車廂也提供視聽娛樂設置、更配備無線網絡、USB 充電口等貼心服務，以優化居民的出行體驗。


**Non-motorized Time Analysis Consumed by Passengers at Ground Bus Stations**

地面公交站的乘客慢行时间影响分析

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**Abstract**

Passengers prefer walking to the bus when the bus dwells outside the station. In China, this is a very frequent phenomenon along the transit corridor. To analyze the time consumed by passengers at bus stations more realistic, this article divides time consumed at bus stations into waiting time, extra walking time and boarding time. The extra walking time is deduced on the basis of queueing and probability theory. Analysis shows that extra walking time of the passengers increases significantly when the number of parking berths at the ground bus station is larger than three. Under certain conditions, there is a negative correlation between the extra walking time and headway. The correlation between extra walking time and dwell time is positive in certain condition. The conclusions of this study can help guide the detailed design of bus stations and coordinate operation of bus lines.

**Keywords:** Bus Station, Non-Motorized Time, Queueing Theory, Berth
Modeling and Solving the Bus Bridging Evacuation Problem as a Dynamic System

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Abstract

Bus bridging refers to transporting affected passengers to their destination stations during metro disruption by buses dispatched from depots. It plays an important role in improving quality of emergency management and service reliability of city’s public transportation system during metro operational disruptions. Usually, the optimization objective for such a bus bridging system is to transport the affected passengers to their destination metro stations at the minimum total evacuation cost from passengers and metro operators. In the study, we model the bus bridging evacuation problem and design a general simulation-based genetic algorithm to solve the bus bridging evacuation problem. The algorithm treats the bus bridging evacuation system as a dynamic system in which the locations of buses and the evacuation demands at the disrupted metro stations change over time, and the variables such as the arrival and departure time of a bridging bus fleet and the numbers of debarking and boarding passengers for each disrupted metro station are modeled as the function of time. Results from a case study demonstrate the effectiveness of the dynamic model and the advantages of the solving algorithm.

Keywords: Bus Bridging Evacuation, Dynamic System, The Simulation-Based Custom Genetic Algorithm, Metro Disruptions
Entropy Model of Dynamic Bus Dispatching Based on Prediction of Back-Station Time
基于预测回站时间的动态公交调度“熵”模型

Lenan Yang*, Liang Zou

Abstract

In the actual operation of the bus, due to the influences of passenger flow, traffic conditions and other factors, the vehicle back-station time is often delayed, which brings difficulties in commuting according to timetable that results in the discontinuity of the bus. With the development and popularization of intelligent public transportation, the prediction technology of bus travel time is becoming more and more mature. By predicting the back-station time, it can effectively forecast the discontinuity which provides a new thought to perfect the bus system. Therefore, the “Entropy model of dynamic bus dispatching based on prediction of back-station time” is proposed, which can be used to decreasing the passive effect of discontinuity by extending the departure interval of the early bus in advance, and to realize the fairness on adjustments of the departure interval by using entropy theory. Finally, the model is validated by two examples, and the results show that the model can match the distribution pattern of the bus departure interval before and after adjustment as far as possible, reduce the bus break, balance the occupancy rate and improve the stability of bus operation.

Keywords: Travel Time Prediction, Dynamic Bus Dispatching, Entropy Mo