Creating the future of transport

Current Topics in Transport
CT19.5

Bus priority measures – update (2005-2008)

CURRENT TOPICS IN TRANSPORT
NO. 19.5

BUS PRIORITY MEASURES – UPDATE (2005-2008)

This issue of Current Topics includes over 65 abstracts of reports, conference papers, books and journal articles which focus on ***traffic signal priority systems for buses, signal changing technologies, guided busways, bus lanes and their enforcement. Many case studies are included of urban bus priority systems in various countries, including the UK.*** These items have been selected from the material added to the Transport Research Laboratory's Library Database between 2005 and 2008. Much of the relevant English language published literature from the UK, USA, Australia and Europe is included; some of the non-UK literature is included courtesy of the OECD International Transport Research Documentation (ITRD) database.

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BUS PRIORITY MEASURES – UPDATE (2005-2008)

The way ahead for London's bus priority at traffic signals

Hounsell, NB
Shrestha, BP
Head, JR
Palmer, S
Bowen, T

IET Intelligent Transport Systems
IET (Institution of Engineering and Technology)
(Michael Faraday House, Stevenage, Herts, SG1 2AY, United Kingdom)
2008 / v2(n3) p193-200 / 8 pages / 12 refs

London has a long history of successful schemes for bus priority at traffic signals. Recently, Transport for London (TfL) has procured a modern automatic vehicle location (AVL) system for bus fleet management, passenger information and bus priority. The new system is known as iBUS and is based on global positioning system (GPS) and supporting technologies for bus location. The system eliminates the need for on-street hardware for detecting buses and provides more flexibility and opportunity for using bus detectors. However, bus location based on this system is less accurate than location based on fixed infrastructure (e.g. beacons) and could result in reduced benefits from bus priority. This paper first summarises how bus priority at traffic signals works within iBUS, and then explores the effects of GPS locational errors on bus priority benefits. This is followed by a discussion of opportunities available in the context of iBUS to build an even more efficient and beneficial bus priority system by taking advantage of its cost-effective multiple detection capabilities. The paper is based on various studies carried out by the Transportation Research Group (TRG) at the University of Southampton for TfL.

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2008-2012 Infrastructure Needs for Canadian Transit Systems

Norris, C

2008 Annual Conference and Exhibition of the Transportation Association of Canada: Transportation - a Key to a Sustainable Future
Transportation Association of Canada (TAC)
(2323 St. Laurent Boulevard, Ottawa, Ontario, K1G 4K6, Canada)
2008 / 10p / 4 refs
ISBN: 9781551872579

The fifth edition of the Canadian Urban Transit Association's (CUTA) transit infrastructure needs survey has estimated the infrastructure requirements of transit systems across the country to be $40.1 billion for the period 2008-2012. Canada's infrastructure needs over the period include bus, subway, LRT and commuter car purchases and refurbishment, development and construction of fixed guideways and rights-of-way such as BRT and LRT, new and improved maintenance facilities, stations and terminals, new park and ride facilities, the implementation of transit priority measures, new customer amenities. Transit systems were asked to list their budgeted capital infrastructure needs for the next five years (2008-2012) by dollar value. These were categorized by expenditures for replacement or rehabilitation, expenditures for expansion in response to population growth or promotion of new ridership; expenditures currently planned (under existing funding programs) and additional needs that can only be met through new external investment. Currently many transit systems are operating at or beyond their design capacity, and some systems are facing significant latent demand that cannot be satisfied without major investment in service improvement and capacity expansion.

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Bus lane set back workshop

TRL Limited and Transport for London
(Crowthorne House, Nine Mile Ride, Wokingham, Berkshire RG40 3GA, United Kingdom)
2008

TRL have developed a software tool to assist engineers to assess bus lane traffic. The tool

has been based on the statistical findings for predicting the effects of site characteristics on both priority and non priority traffic carried out previously by TRL. The assessment tool is to be trialled more extensively using BPT schemes, through a co-ordinated introductory workshop to relevant BPT project engineers.

Research and development for IBUS bus priority (2007/8)

TRL Limited and Transport for London
(Crowthorne House, Nine Mile Ride,
Wokingham, Berkshire RG40 3GA, United Kingdom)
2008

IBUS is a new system for bus priority at traffic signals which is being developed in London which makes use of GPS technology to track buses through the network. Transport for London has commissioned TRL to carry out research and development in order to enhance the benefits of bus priority in London using the IBUS system. The work involves theoretical studies, studies using simulation, trials on site, data analysis and reporting.

On Street Transit Priority Measures - Putting Buses First in Winnipeg

Wiebe, D
Krahn, D

2008 Annual Conference and Exhibition of the Transportation Association of Canada: Transportation - a Key to a Sustainable Future
Transportation Association of Canada (TAC)
(2323 St. Laurent Boulevard, Ottawa, Ontario, K1G 4K6, Canada)
2008 / 20p / 3 refs
ISBN: 9781551872579

In February 2006, the City of Winnipeg approved a comprehensive plan of transit improvements for implementation. The improvement plan included new buses, upgraded stations, intelligent transportation system applications, transit priority measures, as well as park and ride facilities. While several of the initiatives were system-wide, others were focused on major arterial streets with high levels of transit service. These streets have been designated as “Quality Corridors”. Dillon Consulting Limited was retained to study and implement the transit priority measures. This included a study of eleven Quality Corridors, modeling the traffic and transit patterns, analyzing possible transit priority measures, and implementing the recommended measures through construction. This report presents a case study of the impacts of the transit priority measures in the first three Quality Corridors of the program.

Provisional guidance on bus lane (including tramway) enforcement in England outside London

Department for Transport
(Great Minster House, 76 Marsham Street, London SW1P 4DR, United Kingdom)
2008-02 / 40p / 0 refs

This guidance has three main objectives: (a) to inform English local authorities outside London about the scope for them to set up and operate the civil enforcement of bus lanes (which includes tramways) under the provisions of the Transport Act 2000; (b) to advise them how to apply to the Secretary of State for Transport for the necessary powers; and (c) to advise them on how to set up and operate an effective and efficient enforcement regime. One of the key prerequisites for a local authority wishing to introduce civil enforcement of penalties for bus lane contraventions is that the local authority should have acquired (or applied for) civil (formerly known as decriminalised) parking enforcement (CPE) powers. This is to ensure that authorities are taking a comprehensive approach to enforcement. An authority cannot be approved for bus lane enforcement unless an order has been made designating all or part of its area as a permitted or special parking zone. This Guidance looks at how the enforcement of bus priority measures can assist in achieving the overarching objective of encouraging bus use. It is recommended that before introducing the civil enforcement of bus lanes, local authorities carry out consultation with the public and with stakeholder groups about their proposals, to ensure that they are well thought through and in line with the requirements of the population that the authority serves. Bus Lane Orders are made using powers under the Road Traffic Regulation Act 1984. Bus lanes are enforced using powers and procedures set out in the Road Traffic Offenders Act 1988. The Road Traffic Offenders (Additional Offences and Prescribed Devices) Order 1997 (SI 1997/384) amended section 20 of the Road Traffic Offenders Act 1988 by adding bus lane and bus only route offences to the existing speed and red light offences. The order also prescribed that bus lane cameras may be used to produce admissible evidence under this section. Procedures for obtaining approval for the civil enforcement of bus lanes are described. It is recommended that the local authority undertake a publicity campaign to inform the public of the start date for civil enforcement of bus lanes and to explain the objectives underlying the scheme. Revenue raised from bus lane enforcement penalty charge notices should initially be used to recover the costs of setting up, operating and maintaining the bus lane enforcement scheme. The local authority carrying out the enforcement must submit at the end of each financial year to the Department for Transport a report of the actual costs and revenues from the bus lane enforcement account. Local Authorities should check that signs comply with the Traffic Signs Regulations and General Directions, are up to date, consistent with the Traffic Regulation Orders and are properly and visibly mounted. Choice of devices for camera enforcement is outlined. Standard information to be collected when issuing a penalty charge notice is listed. Systems of appeal are outlined.

Microscopic Simulation Approach to Effectiveness Analysis of Transit Signal Priority for Bus Rapid Transit: Case Study of Beijing

Chen, X
Yu, L
Zhu, L
Yu, L
Guo, J

Conference Title: Transportation Research Board 87th Annual Meeting. Location: Washington. Held: 20080113-20080117
Transportation Research Board (TRB)
(2101 Constitution Avenue NW, Washington, DC, 20418, USA)
2008-00 / 17p / + refs

Transit Signal Priority (TSP), one of the critical components of Bus Rapid Transit (BRT), is the key technology to enhance its operational efficacy. It does not only provide priority to the BRT vehicle, but also generate the strategy that makes a trade-off between the delay of buses at the intersection and the impacts to other traffic. This paper focuses on the design and simulation evaluation of signal priority for BRT under the conditions of mixed traffic flows. Taken the Southern Axis BRT Line 1 in Beijing as a case study, different signal priority strategies, including green extension, red truncation and special phase insertion are developed for the signalized intersection along the BRT route. A signal coordination plan is designed for the section that is composed of 4 intersections in the BRT system. The study uses the VISSIM microscopic traffic simulation model to analyze the impacts of traffic parameters, especially those of non-motorized traffic, on the effectiveness of TSP application along the BRT corridor in Beijing. Simulation results indicate that the BRT vehicles would typically benefit from transit priority with travel times savings and delay reduction as well as greater schedule adherence, and that these benefits maybe obtained with little negative impacts to overall system. It is also found that the volume of non-motorized traffic is one of the most important factors that influence the effectiveness of TSP implementation in a mixed traffic flow.

Intermittent and Dynamic Transit Lanes: The Melbourne Experience

Currie, G
Lai, H

Conference Title: Transportation Research Board 87th Annual Meeting. Location: Washington. Held: 20080113-20080117
Transportation Research Board (TRB)
(2101 Constitution Avenue NW, Washington, DC, 20418, USA)
2008-00 / 12p / + refs

Segregated transit lanes are an efficient means of improving transit reliability/ speed in shared urban roads. A major limitation is the impact these lanes have on road capacity and traffic congestion. ‘Intermittent Bus Lanes’ (IBL) are an innovative concept including Variable Message Signs (VMS) and road pavement flashing lights which inform motorists to avoid transit lanes only when buses are coming. This provides transit priority while limiting impacts on other road users. If feasible, this approach has the opportunity to substantially increase the scope for transit priority in cities. However ‘feasibility’ of IBL is a major concern. A trial of IBL was undertaken in Lisbon, Portugal in 2005/6. While the results were promising more practical experience of these concepts is required to justify wide spread implementation of IBL. This paper reviews the performance a variation on the IBL concept, the Dynamic Fairway (DF) adopted for trams in Melbourne, Australia. The system was initiated in 2001 and is still operational today. The paper documents the worlds first practical on-going experience in IBL/DF operation. A review of future plans for a Melbourne bus based IBL developed called the 'moving bus lane' is also presented. Overall the performance of the Lisbon IBL trial appears to be better than that of the Melbourne DF. However circumstances were different including the road configuration, transit mode, levels of congestion and the newness of the technologies involved. Significantly both applications found good driver compliance with transit lanes suggesting the IBL/DF concept has practical performance benefits.

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Red light and through

Curry, J

Traffic Technology International
UKIP Media and Events Ltd
(Abinger House, Church Street, Dorking, Surrey RH4 1DF, United Kingdom)
2008-06/07 / p90-91 / 0 refs

This article describes a bus priority system using Wi-Fi wireless communication technologies which is being implemented in Los Angeles County, south-west USA. A pilot project demonstrated that signal priority technologies reduced the times buses stood at red lights and improved running times, without adversely affecting other traffic. Wi-Fi technologies provided effective communication between buses and junction traffic control equipment, and the project showed that Wi-Fi could be used for signal priority applications by multiple traffic operations agencies. The signal priority system was expanded to more bus corridors, and further expansion is planned. The system is able to identify the location of a bus and determine when to request signal priority by a check-in message, and can be configured to include the determined headway. An update message is sent five seconds later, and then a check-out message as the bus enters the junction. The use of wireless technology provides a total communication network without the need to install cables or detection loops. Further uses of the technology include bus arrival time displays at bus stops.

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Bus rapid transit systems: a comparative assessment

Hensher, DA
Golob, TF

Institute of Transport and Logistics Studies Working Paper
University of Sydney. Institute of Transport and Logistics Studies
(University of Sydney, Sydney, New South Wales, 2006, Australia)
2008-04 / (nITLS-WP-08-05) / 19p / 17 refs
ISSN: 1832-570X

An increasing number of nations are asking the question – what type of public transport system can deliver value for money? Although light rail has often been promoted as a popular 'solution', there has been progressively emerging an attractive alternative in the form of bus rapid transit (BRT). BRT is a system operating on its own right-of-way either as a full BRT with high quality interchanges, integrated smart card fare payment and efficient throughput of passengers alighting and boarding at bus stations; or as a system with some amount of dedicated right-of-way (light BRT) and lesser integration of service and fares. The notion that buses essentially operate in a constrained service environment under a mixed traffic regime and that trains have privileged dedicated right-of-way, is no longer the only sustainable and valid proposition. This paper evaluates the status of 44 BRT systems in operation throughout the world as a way of identifying the capability of moving substantial numbers of passengers, using infrastructure whose costs overall and per kilometre are extremely attractive. When ongoing lifecycle costs (operations and maintenance) are taken into account, the costs of providing high capacity integrated BRT systems are an attractive option in many contexts. (a)

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New Methodology for Optimizing Transit Priority at the Network Level

Mesbah, M
Sarvi, M
Currie, G

Conference Title: Transportation Research Board 87th Annual Meeting. Location: Washington. Held: 20080113-20080117
Transportation Research Board (TRB)
(2101 Constitution Avenue NW, Washington, DC, 20418, USA)
2008-00 / 13p / + refs

This research proposes a new methodology for optimizing transit road space priority at the network level. Transit vehicles are efficient at carrying large numbers of passengers within congested road space. This aids justification of transit priority. Almost all studies which have investigated transit priority lanes focus on a link or an arterial road basis and no study has investigated road space allocation for priority from a network perspective. The aim of the proposed approach is to find the optimum combination of exclusive lanes in an existing operational transport network. Mode share is assumed variable and an assignment is performed for both private and transit traffic. The problem is formulated using bi-level programming which minimizes the total travel time. The approach is applied to an example network and the results are discussed. The approach can identify the optimal combination of transit priority lanes and achieve the global optimum of the objective function. Areas for further development are discussed.

Assessing Bus Transport Reliability Using Micro-Simulation

Sorratini, JAP
Liu, R
Sinha, S

Transportation Planning & Technology
2008-06 / v631(n3)p303-324 / 16

A wide range of public transport schemes have been proposed and put in practice to improve bus service reliability (including bus lanes, bus priority signals, passenger information systems, etc.). Central to the successful evaluation of such operational and management measures is to have reliability indicators which are easy to measure and can be used readily by operators to identify unreliable services and by regulatory authorities to set standards. This paper investigates measures to assess reliability, such as headway, excess waiting time, service regularity and recovery time of an urban network, using a dynamic micro-simulation model (DRACULA). In this paper, the model results from a test case study are presented. The significant factors affecting each measure are identified and the relative merits of the indicators are discussed with regard to their practical contribution to public transport reliability. (A)

Comprehensive Evaluation of a Transit Signal Priority System Using Observed and Simulated Traffic Data

Zheng, J
Zhang, G
Wang, Y
Briglia, PM

Conference Title: Transportation Research Board 87th Annual Meeting. Location: Washington. Held: 20080113-20080117
Transportation Research Board (TRB)
(2101 Constitution Avenue NW, Washington, DC, 20418, USA)
2008-00 / 16p / + refs

The South Snohomish Regional Transit Signal Priority (SS-RTSP) project was launched to improve the level of service for Community Transit buses. To understand the overall benefit of this project, the SS-RTSP system was tested and evaluated after the completion of the hardware and software installations on the 164th Street SW street corridor (phase-one) and the SR-99 corridor (phase-two) in Snohomish County, Washington. In this study, impacts of the SS-RTSP system on both transit and local traffic operations were quantitatively evaluated based on field data. Simulation models were also built and calibrated to compute measures of effectiveness that could not be obtained from field data. The evaluation showed that the SS-RTSP system produced remarkable benefits to transit vehicles with insignificant negative impacts to local traffic on cross streets. The overall impact of the SS-RTSP system on local traffic at each intersection was not statistically significant at the p=0.05 level. Recommendations are also given to improve the performance of the current TSP system.

Expanding the Boundaries of Bus Priority in London

Bowen, T

Smart Moving Conference 2007
2007 / 6p / 0 refs

In 2005 Transport for London purchased one of the worlds largest real-time passenger information and fleet management systems in a project valued at £117M with the objectives of equipping 8000 vehicles with Global Positioning System (GPS) tracking and installing 500 passenger information signs. The option to expand the system to deploy priority at traffic signals for buses was made in April 2006 which requires up to 3200 sets of signals to be upgraded. With such a large scale deployment a number of useful tools and methods have been developed to minimise waste and improve efficiency. The desire to share this knowledge is the key purpose of this paper.

Mass deployment of bus priority using real-time passenger information systems in London

Clarke, R
Bowen, T
Head, J

Proceedings of the European Transport Conference (ETC) 2007 Held 17-19 October 2007, Leiden, the Netherlands
2007 / 9p / 0 refs

In 2005 Transport for London purchased one of the worlds largest real-time passenger information and fleet management systems in a project valued at 117M with the objectives of equipping 8000 vehicles with GPS tracking and installing500 passenger information signs. The option to expand the system to deploy priority at traffic signals for buses was made in April 2006 which requires up to 3200 sets of signals to be upgraded. With such a large scale deployment a number of useful tools and methods have been developed to minimise waste and improve efficiency. In view of the increasing competition for road space, an important tool for improving bus services is bus priority at traffic signals. This can increase buses share of the time available at signalled junctions, reduce delays to buses at junctions and potentially provide greater regularity in bus schedules. Bus priority in London was developed by the use of selective vehicle detection to give buses priority extensions and recalls at traffic signals. Previous systems have used transponders fitted to the buses linked to antennas buried in the carriageway (bus loops) and roadside beacons communicating with on-bus transponders via a short microwave link. Currently, 45% of the 3200 signalled junctions are fitted with one or other of these types of equipment. Bus priority at signals has contributed to the 38% increase in bus patronage since 1999. A description of the IBUS system is provided. It is fitted to 8000 buses (scope for 16000); and all 3200 traffic signals are to be fitted. Virtual detectors are used, avoiding on-street hardware. RTIG standard radio link from buses to signals adapted to allow ACK from signals to bus. Provision for messages from signals to buses is a future option. A bus processor unit provides an interface to signals. The network of bus processors is connected to a bus priority in-station. There are extensive data collection and monitoring facilities in the iBUS central system allowing greatly improved system management for bus priority. The system supports a short range radio link for message transmission to traffic signals, giving up to 4 notifications for an approaching bus. The location of the virtual bus detector in each approach to the junction is dependent mainly on the extension requirements. Bus priority is currently awarded through green extensions and green recalls. It has been shown that green extensions are most sensitive to detector siting and that optimal siting for green extensions is also appropriate for green recalls. Optimum detector distances have been calculated for different bus speeds on different categories of approach. A different method is needed where there is a bus stop close to the signals and iBUS contains special procedures for triggering the priority request at bus stops in order to obtain the maximum benefit to the buses. The benefits from bus priority at signals are well understood and documented in London as a result of previous experience over a period of 20 years. The analysis used in the development of iBUS indicated that total costs over the 15 year expected lifetime of the system, including capital and operational costs would be 39M and that benefits would be 147M, giving a Net Financial Effect of 108M. The magnitude and timescale of the roll-out (800 junctions/year over four years) plus the need to work in harmony with existing complex technical and organisational structures calls for a high degree of organisation.

Bus Priority Effects in Urban Mobility Case Study: Application of a Microscopic Simulation Model to Study an Artery in Cordoba, Argentina

Depiante, VS
Albrieu, ML
Molfino, A

23rd PIARC World Road Congress Paris, 17-21 September 2007
World Road Association (PIARC)
(La Grande Arche, Paroi North, Level 5, F-92055, France)
2007 / 13p / 6 refs

Public transport is clearly an efficient means of transport. It responds to mobility demand, generates less pollution and preserves energy resources. In spite of this, in Cordoba city its use has continuously declined in recent years. Speed is one of the factors affecting the system operation. Time optimization benefits users, lowering their total travel times, as well as operators, optimizing size fleets to respond to demand. Bus lanes or streets left only for bus use are one of the solutions implemented as a policy in central business districts where conflict between passenger cars and buses is significant. The scope of this paper is to analyse the effects of bus lane use in bus circulation speeds and their role in the instauration of a sustainable urban mobility. To achieve this goal, two sections of an artery were modelled by NETSIM, a microscopic simulation model. One of them with mixed traffic and the other with bus lanes. Speed measures from year 2000 and 2005 were collected, comparisons between both situations were made and conclusions extracted. The results obtained show the importance of comprehensive circulation management policies in favour of urban public transport. Not always the implementation of another bus lane results in a better solution. In fact, measures like bus priority lanes and right turn prohibitions can offer an increase in bus speeds of approximately 25%.

Ein Bussystem wie eine Strassenbahn: Nantes ergaenzt Strassenbahn durch das Konzept Bus Way / A bus system like a tramway

Deutsch, V

Nahverkehr
2007 / v25 (n1/2) p42-9 / 2 refs
ISSN: 0722-8287

At the beginning of November 2006, Nantes started to run a bus system called Bus Way. It is 7 km long with 15 stops and most of its length is on-road but exclusive to the buses and with priority at traffic lights. The intention was to have substantial road capacity reductions towards the centre which caused a deconstruction of a four-lane motorway to a two-lane road with bus way. The article describes the PT system as a whole, the construction and operation of the bus way, the articulated natural gas buses and the redesign of streets and places. (A)

Results of the microscopic modelling of traffic interactions at stops, junctions and roads for the design of bus rapid transit facilities

Fernandez, R
Burgos, V
Cortes, CE

Proceedings of the European Transport Conference 2007 Held 17-19 October 2007, Leiden, the Netherlands
2007 / 9 refs

This article shows the microscopic modelling of the interactions between vehicles and passengers on public transport stops and stations, and its relation with the rest of the traffic, as a way to contribute to an appropriate physical and operational design of bus rapid transits (BRT) systems. Its aim is to contribute to the design of bus infrastructures such as busways, interchange stations, bus stops, as well as conventional bus priorities. The text reports how to improve the description of the public transport in conventional traffic microsimulators by means of API (Application Programming Interface). Previous advances reported elsewhere on an API for PARAMICS are considered in this work. The API named MISTRANSIT for MIcroscopic Simulation TRANSIT combines models of stop interactions considering passengers as modelling entities such as the PASSION model with traditional car-following and lane-changing models of

PARAMICS. Firstly, two issues on the design of divided BRT stations to increase their capacity are analysed (a divided station is made of m stopping points with n berths each one). The first issue is the suitable separation between two adjacent stop points. In order to do this the evolution of the queue length at the downstream stop point depending on combinations of bus flows and passenger demands was studied. The second element was the study of the impact of weaving manoeuvres on the capacity of the upstream stop point; combinations of flows and demands at the downstream stop point are considered for this issue. Both issues made possible to obtain the global capacity of a divided station, being observed that the interaction between stop points can reduce capacity by between 7 to 10 %. Having defined the appropriate designs of stops to cope with the demand of buses and passengers, its interaction with the rest of the traffic was analysed. First, the interaction among a stop or station with a downstream traffic signal was studied; in particular, the effect of the distance to the signal and its time settings in the capacity and delay at the stop. Previous results obtained with the bus stop simulation software IRENE were compared with those coming from the MISTRANSIT approach. The performance of a fixed-time plan versus active priority at traffic signals was also analysed. The combination of MISTRANSIT and PARAMICS allowed the measurement of benefits and costs for all users as well as those of public and private transport users. Preliminary results indicate that, as the flow of buses increases, the strategy of signals operated by buses lose rapidly its efficiency. In summary, the article contains directions to improve the design of BRT such as those to be implemented in cities as Santiago (Transantiago) or London (East London Transit, Greenwich Waterfront Transit). The concept and capacity of divided stations, for example, has not been reported in the literature. This has effect in the design of other BRT facilities, as signal priorities, segregated right of ways, and special cross-sections. Also, the suitability, costs and global benefits of other strategies can be analysed as a result of this work; for example, short bus lanes to avoid traffic queues or pre-signals to facilitate manoeuvres of public transport vehicles.

Nantes - Line 4 Busway

Garigue, D
Belouard, R

23rd PIARC World Road Congress Paris, 17-21 September 2007
World Road Association (PIARC)
(La Grande Arche, Paroi North, Level 5, F-92055, France)
2007 / 8p / 0 refs

The line 4 BusWay has expanded the dedicated lane public transport framework system, composed of 3 tramway lines, to serve the south eastern section the greater Nantes area, France. The line was built in the context of the master plan for public transportation, which is one of the initiatives of the urban transit plan. Line 4 is 7 km long and has 15 stations. It connects the ring road (Porte de Vertou) to the centre of Nantes in less than 20 minutes, with a frequency of 4 minutes at peak times. Four park-and-ride car parks with a total capacity of 800 parking places are located along the line, which was placed in service on 6 November 2006. The line 4 BusWay took the elements that made the tramway a success (dedicated lane, stations, priority at intersections, high frequency and extended hours) and applied them to a bus system.

Innovative approach towards robust appraisal: preparation of business case for transport schemes in London

Ghosh, S
Steffens, I

Proceedings of the European Transport Conference 2007 Held 17-19 October 2007, Leiden, the Netherlands
2007 / 5 refs

London, due to its regional, economic and political prominence both nationally and internationally, constantly aims to expand the performance level of its transportation infrastructure, mostly in form of boosting up the capacity of public transport infrastructure. Whilst improvements to railway infrastructure are considered to be long term measures and cost intensive in nature, the introduction of bus priority schemes on some of the busiest roads in London, is often seen to be an efficient and cost effective public transport oriented approach in bringing in more capacity to the transportation system. Transport for London (TfL) being entrusted with the onerous task of selecting and implementing the projects expected to bring in maximum returns in form of revenues and social benefits; has devised an approach of prioritising the schemes based on a socio-economic and financial appraisal system, through the preparation of business schemes. This includes: determining the project life cycle based on its nature and scale; determining operation, management and other indirect costs over and above the scheme capital cost; identifying a long list of likely project benefits focussing on multiple areas and dimensions; a methodology for optioneering and shortlisting of likely benefits in consultation with various stakeholders; methodologies for quantifying various nature of benefits; consideration of underlying assumptions and their possible impact on benefits forecasting; uncertainties in bus operations in the medium to long term and defining the sensitivity tests to incorporate those risks; and incorporating indirect effects of schemes in the vicinity which are likely to have impacts on the project(s) being appraised. The paper is intended to share the innovative approach adopted for the appraisal of various scales of projects, by giving examples of different case studies. The objective is to present a balanced approach in preparing business cases in order to achieve maximum robustness of the appraisal as well as exploring as many dimensions and benefit streams, within the given time and cost constraints.

Impacts of a New Express Bus Service in Waterloo Region

Hellinga, B
Cicuttin, J

2007 Annual Conference and Exhibition of the Transportation Association of Canada: Transportation - an Economic Enabler
TAC (Transportation Association of Canada)
(2323 St Laurent Boulevard, Ottawa, Ontario, K1G 4J8, Canada)
2007 / 25p / 3 refs
ISBN: 1551872528

The Urban Transportation Showcase Program (UTSP) is a Federal Government program with the goal of quantifying, through field deployments (showcases), the impacts that various transportation initiatives have on green house gas (GHG) emissions. The Regional Municipality of Waterloo proposed the implementation of an express bus service supported by various bus control and traveller information technologies (e.g. transit signal priority, web-based trip planner, automatic passenger counting system), community based marketing initiatives, and inter-modal integration measures. The express bus service (iXpress) commenced service at the beginning of September 2005. The supporting bus control and traveller information technologies have been deployed incrementally. Despite delays in technology implementation the iXpress has been successful in attracting riders with most recently available data showing that ridership is at 92% of forecasted levels and growing. The analysis presented here demonstrates that iXpress is currently responsible for the reduction of approximately 1.5 million kilometres of personal automobile trips per year, with an associated reduction of approximately 500 tonnes of GHG emissions.

‘Keeping London Moving’ Bus Priority in London

Hodges, J

Proceedings of the European Transport Conference 2007 Held 17-19 October 2007, Leiden, the Netherlands
2007 / 0

The paper outlines the history and development of bus priority in the UK, with most examples from the London area. The transport policy and the potential contribution bus priority can make to sustainable transport solutions is examined. The paper looks back over the past 10 years and particularly highlights in detail developments from 2000, where substantial progress has been made with the political support of the Mayor and considerable partnership delivery has been achieved by the 33 London Boroughs (through the London Bus Priority Network) and TfL. But, traffic congestion remains outside of the congestion charging zone and is increasing. The focus of the paper will be on the progress made over the last six years in London, incorporating the London Bus Initiatives 1 and 2 (LBI), formalisation of the Bus Priority Partnership with the London Bus Priority Network (LBPN), the Corridor Management (Intensified Bus Priority) pilots on Route 38 and 149, the introduction of central London Congestion Charging, and the development of iBus and Selective Vehicle Detection (SVD) at traffic signals. Finally, details of the forward planning Third Generation Bus Priority programme, taking into account the predicted population and employment growth over the next 10 years (+800,000 people and

900,000 new jobs), transport requirements for 2025 (T2025), Network Management Plans and the western extension to the Congestion Charging Zone will conclude the paper.

Implementing differential bus priority for timetabled service

Hounsell, NB
Shrestha, BP

Proceedings of the European Transport Conference 2007 Held 17-19 October 2007, Leiden, the Netherlands
2007 / 15p

The need for sustainable transport operations in cities is focusing more attention on the needs of buses to provide fast, frequent and reliable services. One favoured measure is bus priority at traffic signals, particularly where roadspace is limited and traffic signal density is high. As bus fleets are increasingly equipped with satellite-based Automatic Vehicle Location (AVL) systems, it is now possible to provide differential priority, where different levels of priority can be awarded to buses at traffic signals according to their adherence to schedule/frequency. The objective of this type of priority method is usually to produce greater punctuality in the service (in the case of timetabled service).This type of priority gives a higher level of priority to late buses and a lower level or no priority to the buses which are early or on time. Although differential priority can help make buses more punctual and reduce passenger waiting time, it may not always be the preferred strategy. For example, two main limitations of differential priority are (i) its inability to help buses when bunched (i.e. in groups of 2 or more) and (ii) the lower journey time savings compared to the policy of giving priority to all buses. Clearly passengers waiting for a bus gain from improved punctuality, whilst those on board benefit from reduced running times and these two objectives may require different priority strategies. Important implementation issues needing consideration are: passenger arrival patterns; junction characteristics (e.g. degree of saturation) and bus timetable. Passenger arrival patterns need to be considered when deciding the priority strategy. For example, if passengers tend to arrive randomly at bus stops (as happens in higher frequency services even if timetabled), the priority strategy might be better based on regularity (not punctuality) to reduce waiting time. Differential priority can be good in constraining bus priority (by giving priority to late buses only) and avoiding unacceptable delays to non-priority traffic, especially at junctions with higher degrees of saturation. However, in the case of under-saturated junctions, priority can be given to all buses with little disbenefit to the non-priority traffic, perhaps allowing bus drivers to do their own time keeping. Good timetabling can also play a crucial role in differential priority; the timetable should be properly designed, regularly updated and should incorporate the benefits obtained from bus priority. Differential priority may then operate to best effect. This paper will discuss and analyse these various aspects of differential priority with reference to case studies in London and simulation modelling, to illustrate the concepts and provide quantification of alternative strategies. Conclusions will include recommendations for implementation related to alternative performance criteria which may be adopted.

The way ahead for London's bus priority at traffic signals

Hounsell, NB
Shrestha, BP
Palmer, S
Bowen, T

Proceedings of the 14th World Congress on Intelligent Transport Systems (ITS), held Beijing, October 2007
ITS America
(400 Virginia Avenue, SW, Suite 800, Washington, DC, 20024-2730, USA)
2007 / 9 refs

Recently, Transport for London (TfL) has procured a modern Automatic Vehicle Location (AVL) system for fleet management, passenger information and bus priority. The new system is known as iBUS and is based on GPS and supporting technologies for bus location. In this system, bus detector locations are configured in the on-bus computer and hence are also known as "virtual detectors". The predefined virtual detector coordinates are compared with the location of the bus obtained from the on-bus navigation system to trigger a priority request. The request is made through radio messages from each bus to the traffic signals encountered en-route. This system eliminates the need for on-street hardware for detecting buses and requesting priority. Hence the incremental cost of installing bus priority at signals is much lower than with the existing system and the location of detection points is more flexible. This has prompted TfL to plan to extend bus priority to most of the traffic signals in London. Apart from reduced cost, the system also provides facilities to allocate up to four detection points to each bus movement at an individual junction. This provides an opportunity to enhance bus priority considerably through improved methods of control giving potentially greater benefits. This paper presents some of the methodologies studied to enhance bus priority at traffic signals using the iBUS system.

Satellite positioning system Galileo - Czech Republic approach. Priority system for public transport

Pribyl, P
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Proceedings of the 14th World Congress on Intelligent Transport Systems (ITS), held Beijing, October 2007
ITS America
(400 Virginia Avenue, SW, Suite 800, Washington, DC, 20024-2730, USA)
2007 / 2 refs

The Czech Ministry of Transport supported five year research project looking for proper application of GALILEO in the rail and road area. Prague firm Eltodo EG is responsible for roads. A few interesting possibilities of global positioning system for city management were investigated. The article presents new approach to the priorities for buses in the case of traffic overloaded intersection. In this situation, the registration point for a bus is only virtual and it depends on a length of a queue at the approaching arm of the intersection. The system gives priority in accordance with the queue length and delay of the bus. It is undergoing testing in Prague.

SCOOT and UTC Consultancy 2005-2007 - Work at TRL

TRL Limited and Transport for London
(TRL Limited, Crowthorne House, Nine Mile Ride, Wokingham RG40 3GA, United Kingdom)
2007

TRL have a contract with Street Management, TfL to provide software development and consultancy services regarding the London SCOOT UTC system. The contract provides for a partnership where one of the stated aims is to create conditions where both partners (TfL and TRL) are able to provide long term support to each other in UTC matters. As part of this project a new technically 'open' SCOOT UTC system has been developed which can easily be ported to different operating systems such as VMS, Windows NT and LINUX. Enhanced versions of some of the existing programs (e.g. Time Table preparation, Plan preparation, SCOOT Data input) have been developed. The first release of the new system OPUS 1 has been controlling the traffic lights in London for a number of years and is regularly upgraded. The most recent upgrade which is currently undergoing Factory Acceptance testing includes the latest Version of SCOOT MC3 which will effect how SCOOT operates in three key areas: communications, congestion control and puffin pedestrian facilities. It also provides additional new bus priority logic which TRL have developed for TfL under a separate contract to take advantage of some of the new facilities that IBUS (a new bus management and information system which uses satellite technology to track buses) will provide.

A Modeling Framework for Bus Rapid Transit Operations Evaluation and Service Planning

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Mahmassani, HS
Abdelghany, AF

Transportation Planning & Technology
Taylor & Francis
(Abingdon, Oxfordshire, United Kingdom)
2007-12 / v30(n6)p571-591 / 21

In this paper, we present a dynamic traffic assignment-simulation modeling framework (DYNASMART-P) to support the evaluation and planning of Bus Rapid Transit (BRT) services in urban transportation networks. The model represents the different characteristics associated with BRT operations such as: exclusive right-of-way lanes, limited-stop service, signal prioritization at congested intersections, and enhanced bus stops to reduce passenger boarding times. A set of simulation experiments is conducted using the model to study the impact of introducing a hypothetical BRT service in the Knoxville area in the State of Tennessee. In these experiments, the different operational characteristics of BRT are evaluated in terms of potential impact on transit ridership and on the interacting auto traffic. The results illustrate the advantages of BRT for increasing transit ridership and improving overall system performance. (A)

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Modelling of bus station access and capacity

Graham, N

Australian Institute of Traffic Planning and Management (AITPM) National Conference, 2007, Canberra, Act, Australia
Australian Institute of Traffic Planning and Management (AITPM)
(Po Box 6684, Halifax Street, Adelaide, South Australia, 5000, Australia)
2007-10 / p175-87 / 6 refs
ISBN: 0957884095

Many cities in Australia are grappling with issues of promoting bus patronage and access in city centres. However, there is a range of competing business, government and community objectives in relation to transport supply, demand, pricing, technology, service levels and sustainability that make it difficult to satisfy the competing needs. A recent project in Canberra grappled with these issues and experience from this project can apply to other Australian cities. It included the development and assessment of proposals designed to make public transport more accessible in Canberra city and to encourage more people to use it. A key element of the project was the assessment of the feasibility of replacing the existing central bus interchange with two more compact bus stations in City West and City East. Both mathematical and micro-simulation modelling was used to assess the operation of the bus stations and associated bus priority works for accessing the stations. This highlighted the importance of reducing bus dwell times at stops to achieve compact station arrangements and the need for a more efficient ticketing system. (a)

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Analysis of current practices for improving the level of service of on-road public transport, HOV and emergency vehicles

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2007-10 / (nAP-R307/07) / 67p / - refs
ISBN: 1921329270

This report describes the concept and definition of level of services (LOS) for specific road users that include on-road public transport, high occupancy vehicles (HOV) and emergency vehicles. It reviews current practices to improve their LOS and describes modelling case studies. The allocation of space to priority road users is an effective means to provide priority and improve their LOS. Examples include queue jump lanes for buses, bus/transit lanes on freeways and arterials and also bypass lanes on freeway on-ramps. The allocation of time is another effective means to provide priority, e.g. special signal phases, green extensions and phase pre-emption for buses, trams and emergency vehicles. Tools such as HOV lanes, on-road public transport schemes, etc. can be applied to increase the person throughput of a corridor. The overall success of such schemes is dependent on how successful the application is at promoting behavioural change in the community and attracting travellers to carpool or use on-road public transport as an alternative to single occupant vehicles. (a)

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Cambridgeshire - flexibility: it guided our transport plans

Hill, K

Tramways & Urban Transit
Ian Allen Publishing
(Riverdene Business Park, Molesey Road, Hersham, Surrey, KT12 4RG, United Kingdom)
2007-06 / v70 (n834) p209-211 / 0 refs
ISSN: 1460-8324

Cambridgeshire County Council's guided busway will be the longest guided busway in the world and the UK's most comprehensive bus rapid transit project. It is being built along a disused railway line between St Ives and the north west of Cambridge. An additional section of busway is being built from Cambridge station to Addenbrooke's Hospital. New bus priority measures are also being introduced in Huntingdon to improve journey times for guideway bus passengers. The background to the project is outlined. Facilities for walking and cycling are also receiving heavy investment. The council has a history of working closely with local bus operators. The council's park and ride scheme operated by Stagecoach attracts over 1.6 million users per annum, with a new fleet planned for 2007. A key milestone in the planning process for the guided busway was the Cambridge to Huntingdon Multi-Modal Study in 2001. This considered the problems of congestion and safety in the A14 corridor focusing on public transport, road improvements and policy measures and involved extensive public consultation. The reasons for the selection of a busway over light or heavy rail are outlined. The contract for building the busway was awarded to Edmund Nuttall Ltd. In 2006, Stagecoach, Huntingdon and District, and Whippet Coaches signed an inception agreement committing to buying new buses and running services on the guideway.

Developing bus rapid transit systems in Brazil through public private partnerships

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Senna, LAD
Strambi
Martins, W

International Conference on Competition and Ownership in Land Passenger Transport, 10th, 2007, Hamilton Island, Queensland, Australia
University of Sydney. Institute of Transport and Logistics Studies
(University of Sydney, Sydney, New South Wales, 2006, Australia)
2007-08 / p103-25 [PLENARIES] / 32 refs

The bus rapid transit (BRT) project of Porto Alegre consists of a diametral route crossing the city centre and linking trunk and feeding interchange terminals being planned to accommodate areas dedicated to retail and service activities. It is expected that these areas will generate enough revenue to remunerate private investors, under a PPP scheme, for the construction of the terminals and most of the infrastructure required to upgrade some sections of the existing busways to BRT standards. The BRT project for the East-Northeast zone of Sao Paulo proposes to use value capture mechanisms made legal by the Statute of the Cities, enacted in 2001. These include the concept of an urban operation a legally defined set of interventions and projects to be carried out within a specific area and the issue of tradable certificates of additional building rights in the area. In combination, these mechanisms allow the anticipation of the financial resources required to execute the proposed projects needed to raise property values in the region. (a)

Swansea Metro Project (Bus Rapid Transit)

Ephraim, G
Whitehead, D

Proceedings of the European Transport Conference (ETC) 2006, September 2006, Strasbourg, France
London Association for European Transport
2006 / 18p / 0 refs

The City and County of Swansea in partnership with FirstGroup has developed proposals for a 'Bus Rapid Transit' system for Swansea. The bus vehicle is articulated, and aims to offer a tram-like operation to potential passengers.

A prototype is in operation. The Bus Rapid Transit system is termed as Swansea Metro, and consists of the following elements: On-Street Infrastructure: Priority vehicle infrastructure along the 15km Metro corridor, consisting of priority measures and busways (with operational qualities similar to tramways). The Vehicle: An articulated bus vehicle, termed as StreetCar, with the appearance and general qualities of a tram - but running on-street on rubber tyres, not a fixed track. Fast automated ticketing system: Automatic ticket machines both on and off-vehicle are proposed. Enhanced waiting facilities: Bus stop waiting facilities will need to be of a high quality, incorporating Real Time Passenger Information and high specification bus shelters. First Group are responsible for developing the vehicle and associated ticketing systems. Arup is undertaking design of infrastructure on behalf of the City & County of Swansea. Detailed investigations of junction capacity have been undertaken. The whole of the proposed central area 'one-way system' has been modelled using micro-simulation techniques (using VISSIM). Capacity tests indicate that the proposed infrastructure will accommodate StreetCar movements and existing traffic, pedestrian and cycle movements.

The benefits of bus priority within the central London congestion charging zone

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Melhuish, T
Mckenna, D
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Proceedings of the European Transport Conference (ETC) 2006, September 2006, Strasbourg, France
2006 / 5p

Transport for London (TfL) believes that bus priority measures and bus lanes in particular, remain a vital intervention tool within central London and the congestion charging area. Furthermore, case study data supports the assertion that bus lanes are justified and are working as intended. The bus network plays a vital role in the Capital's transport system, providing access to jobs and town centres, the Underground and rail services. In order to encourage car users to switch to using public transport, people's experience of travelling by bus must be transformed: the chronic problems of unreliability and slow journeys have to be tackled. Increasing population and employment levels, combined with improvements to the public transport system, have seen bus patronage increase by 38.2% since 1999/2000. Over a third of London households do not own a car and rely heavily on the public transport network, and with a predicted rise in London's population levels from 7.2 million to 8.1 million by 2016 it is imperative that the benefits of bus priority measures are locked in now to ensure protection for the future prosperity of London and its residents. Bus lanes are important to mitigate the adverse impacts of other traffic management schemes on buses, in particular, safety schemes and all-round pedestrian crossing phases. They can also be used to offer additional benefits such as improved lane discipline, as in the Westminster City council, Haymarket scheme, outlined below. Westminster City Council implemented a number of bus lanes (Kingsway, Waterloo Bridge north, Waterloo Bridge south and Haymarket) using experimental powers before the commencement of congestion charging. Before and after case study data, clearly shows that in three out of four corridors, the mean bus running time reduced after the implementation of bus lanes and congestion charging. It should be noted that the fourth scheme (Haymarket) was implemented to improve lane discipline and reduce accidents. Initial findings are that this objective was achieved as accidents along this route reduced by 66%. Additionally, traffic queue lengths were measured on Kingsway, Waterloo Bridge north and Waterloo Bridge south to verify the running time benefits that had been attributed to these bus lanes. Queue data for Kingsway and Waterloo Bridge northbound, indicates that the bus lane is effective in enabling buses to by-pass general traffic queues. The case for Waterloo Bridge southbound was more marginal as traffic queues only occasionally exceeded the bus lane setback distance. However, due to proposals to introduce signals at the IMAX roundabout for road safety reasons, queue lengths are predicted to increase on this link, but the movement of buses will be protected by the extant bus lane. London boroughs remain satisfied that bus priority schemes are still justified and are appropriate solutions to consider where traffic conditions, either now or in the future, will worsen for buses and their passengers.

USING GPS FOR BUS PRIORITY IN LONDON: TRAFFIC SIGNALS CLOSE TO BUS STOPS

Hounsell, NB
Shrestha, BP
Palmer, S
Bowen, T

Proceedings of the ITS World Congress, Held London, 8-12 October 2006
Ertico ITS - Europe
2006 / 12p / 13 refs

London's bus network is one of the largest and most comprehensive urban transport systems in the world. The contribution of buses is recognised by implementing a series of initiatives including bus priority at traffic signals. London has a long history of the implementation of bus priority at traffic signals. It has kept pace with the development of new technologies by updating its bus priority system. Now, London is moving towards a bus management system based on GPS (Global Positioning System) which will also be used to provide bus priority at traffic signals. This paper describes theoretical work carried out by TRG on behalf of Transport for London Bus Priority Team to tackle the challenge posed by locational error associated with GPS where a traffic signal is close to a bus stop.

THE EFFECT OF THE COMBINED USE OF PUBLIC TRANSPORTATION PRIORITY SYSTEMS AND CENTER LANE SHIFT SYSTEMS

Ichikawa, A
Kamigawara, S

Proceedings of the ITS World Congress, Held London, 8-12 October 2006
Ertico ITS - Europe
2006 / 6p / 0 refs

In provincial cities without other mass public transportation than transit bus system, it has been a grave social problem that the spread of private cars after 1960s increased traffic congestion which hinders the passage of the buses. In this thesis, the idea is introduced to considerably ease traffic congestion using Public Transportation Priority Systems (PTPS) and Center Lane Shift Systems bringing a 35% reduction in the journey time of buses and a 29% reduction of that of other vehicles. These systems were installed in Niigata, Japan in March, 2005.

BUS SIGNAL PRIORITY BY UTILIZING ON-BOARD UNITS OF BUS REAL-TIME INFORMATION SYSTEM

Lin, WH

Proceedings of the ITS World Congress, Held London, 8-12 October 2006
Ertico ITS - Europe
2006 / 8p / 1 refs

This research focuses on utilizing existing on-board units of bus real-time information systems for bus signal priority. When a bus approach the designated intersection, the center receives information from the bus, estimates how long the bus arrives the intersection, and sends the priority request to the signal controller. The controller then chooses an appropriate signal priority strategy. GPRS network is the communication channel from bus to center and from center to controller. Three tests are included in this research, communication frequency, bus check-in range and location of bus stops, to see their influence on BSP system.

BIAS - A NEW GENERATION OF URBAN MANAGEMENT AND CONTROL SYSTEM

Mcdowell, B

Proceedings of the ITS World Congress, Held London, 8-12 October 2006
Ertico ITS - Europe
2006 / 8p / 0 refs

As part of a £30m public transport priority project Glasgow is implementing a Bus Information And Signalling (BIAS) system involving over 300 signal sites and 460 buses. BIAS is challenged to deliver key benefits for the project and then continue to monitor and support operation of the services thereafter. Consequently, BIAS aims to be a new generation of system capable of supporting a more integrated and effective approach to managing our urban networks. Using the UK's UTMC standards and the flexibility provided by the Common Database concept BIAS brings integrates traffic control and bus information/ management components with wider managerial tools.

Route 149 - Intensive bus priority

Pye, R
Bode, C

Proceedings of ETC 2005, Strasbourg, France 18-20 September 2005 - Transport Policy and Operations - Traffic Engineering and Street Management - Innovations in Urban Traffic Management and Control
London Association for European Transport
2006 / 15p / 2 refs

As part of recent bus priority programmes in London, bus route 149 has been the subject of the design and implementation of intensive bus priority measures. Investigations have been undertaken into how to optimise the use of the existing highway for buses. The types of measures to achieve this optimisation are the standard well-established bus priority techniques together with traffic signal control strategies to control traffic conditions on the route, enforcement strategies and complimentary traffic management measures in side roads. On the route an assessment has been made of the potential bus journey time improvements that could be achieved through the introduction of a package of bus priority measures. On a section of the route micro-simulation modelling (VISSIM) has been used to identify the primary influences on bus journey times and reliability and the extent of these influences. The main influences on bus journey time and reliability have been found to be: Signal timings/operation; Kerbside controls/activity; Bus stop spacing; Bus lanes. VISSIM models have been built for the existing situation (base model) and for a number of different scenarios: Differing levels of kerbside activity; Varying methods of signal control (in particular a study has been undertaken on the journey time impacts of the introduction of 'all green to pedestrian' facilities at signal junctions) New and extended bus lanes; Changed kerbside controls. From these different scenarios and by using varying flow levels (undersaturated through to oversaturated) it has been possible to begin to assess and understand the impact of the application of different techniques on bus journey times and reliability. In addition to the investigative and modelling work, bus priority measures have been implemented on-street. This has enabled the actual impact of the measures to be compared to the theoretical assessments of the potential reduction in journey times using before and after monitoring surveys. The bus journey time surveys broke down the journeys into their constituent parts enabling it to be determined where the actual changes in journey time were coming from. As well as having information on changes in bus operation resulting from the introduction of the bus priority measures, surveys have also covered other activities on the route. Survey results are available to indicate the impact of the measures on: General traffic journey times and reliability; Kerbside activity. The other element of this project has been how to continue to manage this route and 'lock-in/protect' the benefits that have been achieved for bus services.

MAP MATCHING ALGORITHMS FOR INTELLIGENT TRANSPORT SYSTEMS APPLICATIONS

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Ochieng, WY
Noland, RB

Proceedings of the ITS World Congress, Held London, 8-12 October 2006
Ertico ITS - Europe
2006 / 7p / 9 refs

Map matching algorithms play a key role in providing the navigation solution for many Intelligent Transport Systems (ITS) and Location Based Services (LBS). It is essential that the map matching algorithm used in the navigation module meets the specified requirements set for a particular service. Although the performance of a map matching algorithm depends on the characteristics of data inputs, the technique used in the algorithm can enhance the overall performance. This paper sets out to report on map matching algorithms developed by the authors in earlier work, and whether these can satisfy the required navigation performance (RNP) of various ITS services and LBS applications. This is achieved by testing the algorithms using real-world field data. The results suggest that these algorithms are capable of supporting the navigation function of many services including route guidance, bus priority at junctions, fleet management, etc.

Modelling signalised urban networks in London - A Strategy Approach

Robinson, J

Proceedings of ETC 2005, Strasbourg, France 18-20 September 2005 - Transport Policy and Operations - Traffic Engineering and Street Management -Integrated Traffic Management I
London Association for European Transport
2006 / 34p / 0 refs

The Directorate of Traffic Operations (DTO) within Transport for London is responsible for "Keeping London Moving", through active management of the road network. The capacity of London's road network is essentially capped and the challenge for the DTO, given the continuing increases in demand, is to improve the efficiency of the network, while maintaining a balance between the needs of all road users. This includes pedestrians, cyclists and bus passengers, with the emphasis on optimising "people movement". To address these issues, the DTO recognised the need for a fundamental review of its approach to network control planning, both at a strategic and a tactical level. It has put in place a long term programme to address these issues and this paper gives an overview of the programme, provides information on progress to date and describes in more detail some of the lessons learnt. The strategic programme to support network planning has three major elements: (1) A common approach to network modelling. The initiation and design of traffic schemes on London's road network is undertaken by a variety of agencies, including local authorities (Boroughs), developers, consultants, as well as TfL itself. DTO is tasked with the network impact assessment and operation of these schemes to ensure the balance for all road users is maintained. This task is dependent upon comprehensive and accurate modelling. There is a need for a consistent and high quality approach and this is being addressed by the creation and publication of Modelling Guidelines. The Guidelines are now in daily use across a number of agencies and the paper will provide a practical insight into the guidelines themselves and their impact so far.(2) Integration of modelling and planning from the local level design to London-wide planning. Traditional approaches have used a range of different and isolated tools for local traffic control planning, junction design, area planning and long term strategic assignment models. DTO is implementing processes and initiating system and product development to deliver integrated solutions. This will link models across the full planning and design spectrum. The concept involves sharing data between the following: Operational systems (UTC, Remote Monitoring etc.). Traditional local level models (Linsig, Transyt etc.). Micro-simulation models. Assignment models. High level strategic models. The paper will give practical examples of the use of these integrated techniques in the planning and design of various large scale proposals including: intensified bus priority route corridor strategies; major London tram schemes; Crossrail; and the proposed extension of London's Congestion Charging Zone.(3) TrainingLondon, in common with many major cities, has found that there is a severe shortage of staff with the appropriate mix of engineering and analytical skills required to design, develop and operate London's complex road network. DTO is addressing this through a unique UTC training and development programme. Launched in 2003, the programme addresses three key urban traffic engineering skill areas: modelling, network design and network operation. There has been a major investment in a 2-year training programme for over 30 graduates, which is designed to create the skills London needs over the next 5 to 10 years. The paper will outline the main topics in the syllabus and give a progress report as the first group of graduates completes the course.

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IMPROVING BUS PUBLIC TRANSPORT PROVISION THROUGH RTI AND UTMC - INTEGRATION ISSUES & SYSTEMS

Trettin, S

Proceedings of the ITS World Congress, Held London, 8-12 October 2006
Ertico ITS - Europe
2006 / 8p / 0 refs

This paper discusses integration opportunities for the provision of good and efficient bus services using open standards and similarly structured protocols illustrated in three examples. The first shows the integration of two bespoke RTI (real time information) systems as carried out this year in Birmingham, UK. The second example details how the same communications system can serve different purposes, demonstrating how an overarching communications strategy needs to capture all the requirements. The third example illustrates how an RTI-UTC (urban traffic control) server to server link for Selective Vehicle Detection can remove the need for short range communications between the bus and the traffic light controller.

Accommodating non-stop public transport in urban traffic control

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Canepari, G

Proceedings of the ITS World Congress, Held London, 8-12 October 2006
Ertico ITS - Europe
2006 / 6p / 3 refs

Priority at intersections is a good way to improve the quality of public transport. Priority ranges from avoiding delays, to giving green to public transport at the earliest possibility in the cycle. There is a trade-off between smooth handling of private traffic and public transport priority. Priority can be disruptive, with a big impact on overall performance and stops of private traffic - with the associated environmental impact. New computer guided vehicles, like the Phileas bus, challenge the trade-off. These new vehicles need absolute priority. New mechanisms were designed and implemented that give absolute priority with minimal disruption to other traffic.

Simulating public transport priority measures using AIMSUN

Wong, E

Transport Engineering in Australia
2006 / v10(n2) p111-26 / 2 refs

The public transport capabilities of AIMSUN are investigated through the implementation of a case study. It is noted that public transport facilities are simulated through the implementation of bus stops and creation of public lines. Physical measures such as bus lanes are implemented with the use of reserved lanes in the required sections in the network. Transit signal priority (TSP) measures are implemented in AIMSUN with the use of GETRAM extensions to interact with existing network equipment such as detectors and external controllers. Through simulation, public transport priority measures are found to be effective in reducing the overall delay time for the public transport vehicle. Strategies such as signal coordination, implementation of bus lanes and TSP involving green extensions and early green measures are implemented. Although increases in delay times for the general traffic is often cited as a disadvantage for TSP measures, preliminary investigation suggests that the reductions in delay times by the public transport users far outweigh the increases in delay time for the general traffic on a per user basis. (a)

Impacts of Coordinated Traffic Signal Control Strategies and Bus Priority

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Bang, KL

Conference Title: Transportation Research Board 85th Annual Meeting. Location: Washington. Held: 20060122-20060126
Transportation Research Board (TRB)
(2101 Constitution Avenue NW, Washington, DC, 20418, USA)
2006-00 / 13p / + refs

Swedish urban traffic signal systems are normally coordinated with fixed time plan selection. Within this framework local traffic actuated signal timing adjustments are applied based on detector inputs aimed to reduce the number of vehicles in the dilemma zone. Active bus priority is also achieved with the aim to display green signal at the arrival of the bus to the stop line. Due to lack of knowledge of traffic performance impacts of these techniques a major research study was undertaken funded by the Swedish Road Administration. The aim was to evaluate the following control strategies using Stockholm as case study: 1) Fixed time coordination (FTC); 2) Fixed time coordination with local signal timing adjustment (FTC-LTA); 3) Same as 2) + active bus priority (PRIBUSS); 4) Self-optimizing control (SPOT). The methodologies for the study included field data collection using mobile and stationary techniques, offline signal timing calculations with TRANSYT; microscopic simulation modeling using the HUTSIM model. The study obtained the following results: (1) Local traffic adjustment with the manual FTC reduced total delay with 1%. (2) Signal timings determined using TRANSYT reduced the average intersection delay with 9% compared to manual signal settings. (3) Local traffic adjustment reduced total delay with a further 5%. (4) Bus travel time was reduced by 11% using PRIBUSS, and 28% using SPOT. (5) Travel time for all vehicles did not increase using PRIBUSS, and was reduced by 6.5% with SPOT. Results of comparing PRIBUSS and SPOT to FTC-LTA were shown to be statistically significant.

Christchurch: applying world's best practice in sustainable public transport in our backyard

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Hinman, D
Woods, S

Australian Institute of Traffic Planning and Management (AITPM) National Conference, 2006, Melbourne, Victoria, Australia
Australian Institute of Traffic Planning and Management (AITPM)
(Po Box 6684, Halifax Street, Adelaide, South Australia, 5000, Australia)
2006-08-01 / 251-65 / 3 refs
ISBN: 0957884052

Many Australasian cities are struggling to implement more sustainable transport systems in response to increasing congestion, while attempting to maintain their future liveability and commercial viability. Most of these cities are facing a range of difficulties, including implementation of components of their transport systems, quantifying the costs and benefits of sustainable transport systems, and getting and maintaining public and stakeholder support for sustainable transport improvements. Christchurch, New Zealand, a city of 350,000 people, is overcoming many of these difficulties and has successfully implemented some key components of a more sustainable transport system. Public transport improvements include a new bus interchange and integrated transit oriented development, new routes including cross suburban services, smart card ticketing, real time information, express bus services and city centre transit priority. This paper summarises the results of almost a decade of planning, implementation and monitoring of different elements of the public transport system. The paper also highlights the lessons that can be learned from Christchurch's experience and provides insights into how similar improvements could be achieved for a number of Australasian cities. (a)

SCOOT-managing congestion, control and communications

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2006-03 / v47(n3) p88-92 / 2 refs
ISSN: 0041-0683

The SCOOT Urban Traffic Control system is now operating in over 200 cities and towns worldwide. Since the system was installed there has been a continuous program of research and development to provide new facilities which take into account new technology and meet the requirements of the traffic manager. This paper reports on a new version SCOOT MC3 which has recently been released. SCOOT has been modified to use time-stamped data which allows for small time delays in communications between the UTC software and Outstation Transmission Units (OUT) whilst maintaining the excellent level of traffic control. This should increase range of communication options available and in particular allow the use of some of the newer data communications systems which are packet based. A congestion supervisor has been developed to afford the operator a better understanding of the congestion occurring in the network. This should enable the limited resources within local authorities to be used efficiently and facilitate the use of the extensive congestion management tools available in SCOOT. Other new developments affect how SCOOT operates in providing bus priority and in controlling puffin pedestrian crossings. (A)

Bus lanes with intermittent priority: Strategy formulae and an evaluation

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Transportation Research B
Elsevier Science Ltd
(The Boulevard, Langford Lane, Kidlington, Oxford, OX5 1GB, United Kingdom)
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ISSN: 0191-2615

This paper evaluates strategies for operating buses on signal-controlled arterials using special

lanes that are made intermittently available to general traffic. The advantage of special bus lanes, intermittent or dedicated, is that they free buses from traffic interference; the disadvantage is that they disrupt traffic. We find that bus lanes with intermittent priority (BLIPs), unlike dedicated ones, do not significantly reduce street capacity. Intermittence, however, increases the average traffic density at which the demand is served, and as a result increases traffic delay. These delays are more than offset by the benefits to bus passengers as long as traffic demand does not exceed by much the maximum flow possible on the non-special lanes; the smaller the excess the better. BLIPs are not intended for roadways nearing or in excess of capacity. The main factors determining whether an intermittent system saves time are: the traffic saturation level; the bus frequency; the improvement in bus travel time achieved by the special lane; and the ratio of bus and car occupant flows. In some scenarios where a dedicated bus lane could not be operated, a BLIP can save to bus and car occupants together as much as 20 persons-min of travel per bus-km. The required conditions for this to happen are quite particular. Typical savings are smaller. Formulae are given. (A) “Reprinted with permission from Elsevier”.

Bus Rapid Transit Plans in New York’s Capital District

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ISSN: 1077-291X

The Capital District Transportation Authority (CDTA) is seeking to implement Bus Rapid Transit (BRT) service in the New York (NY) 5 corridor, which runs for 16.5 mi between Albany and Schenectady. The benefits of BRT will be to improve service for current riders, draw new riders to the system, help spur economic revitalization in the corridor, provide key nodes for new development, and improve the image of transit in the Capital District as a whole. When fully in place, the key features of BRT on NY 5 will include limited-stop service, substantial passenger facilities and amenities at each station, real-time passenger information, improved pedestrian environment, park-and-ride opportunities, priority treatment at intersections, queue jumpers at key points, off-vehicle fare collection, and a specific brand image to distinguish BRT from other bus services. The cumulative impact of these types of improvements--in travel time, passenger comfort, passenger information, and image--will lead to an increase in transit ridership in the NY 5 corridor. Based on experience at other North American transit agencies that have implemented BRT, an increase of 22% to 29% is expected, depending on the ultimate travel time savings that is achieved.

Simulation of Transit Signal Priority Using the NTCIP Architecture

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Transit Signal Priority (TSP) is an important element of Bus Rapid Transit (BRT) that involves coordinated efforts between transit vehicle detection systems, traffic signal control systems, and communication technologies. Successful deployment of TSP requires thorough laboratory evaluation through simulation before field implementation. This paper presents the development and application of a simulation model specifically designed for the design and evaluation of TSP systems. The proposed simulation tool models in detail all the TSP components in accordance with the National Transportation Communications for ITS Protocol (NTCIP) standard for TSP systems. The study is intended to shed light on how the variety of TSP elements can be addressed in microscopic simulation in a structured and systematic fashion. Sample applications of the model on a real-life arterial corridor in California demonstrate its capabilities and features.

Impact of Bus Priority Attributes on Catchment Area Residents in Dublin, Ireland

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In many jurisdictions, political and infrastructural restrictions have limited the feasibility of road pricing as a response to urban congestion. Accordingly, the allocation of dedicated road space to high frequency buses has emerged as a second-best option. Analyses of the evidence emerging from this option emphasize the engineering and technical issues and do not systematically interrogate the customers, those in the bus catchment area that use or could potentially use the service. This paper attempts to correct for this asymmetry in focus by analyzing characteristics and preferences of users and non-users through a survey of 1,000 households for a particular quality bus catchment area in Dublin, Ireland. Preliminary findings are encouraging, both for the use of this policy instrument as one which can yield considerable consumer satisfaction, and in terms of modal share analysis, especially because the corridor under scrutiny represents a much higher socio-economic profile than Dublin or Ireland as a whole.

A study of the PRISM selective vehicle detection system

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Traffic Engineering & Control
Hemming Information Services
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2006-06 / v47(n6) p224-227 / 5 refs
ISSN: 0041-0683

The Profile Identification Selection Module (PRISM) (Peek Traffic Limited, 2005) provides a means of selective vehicle detection (SVD) by the analysis of inductive profiles obtained from loops embedded in the carriageway. A key advantage of PRISM over many alternate SVD systems is the negation of the need for vehicle-mounted equipment. PRISM was evaluated for the SVD of buses for bus priority via Bus Split, Cycle and Offset Optimising Technique (Bus SCOOT) (TRL, 2005). Two test sites on the A630 Balby Road in Doncaster were examined. Data on over 800 buses revealed an accuracy of detection of 65% at both test sites with false detection rates of 0.38% and 0.49% of traffic volume. In a simultaneous study of Bus SCOOT the microscopic journey times of 1,590 buses (in total) were recorded over one day of normal SCOOT operation and one day of bus priority via Bus SCOOT. The survey revealed only fractional reductions in journey time 0.06% and 0.1% neither of which were shown to be statistically significant. (A)

Planning for the future of the ftr - it's all a question of priority

Thomas, R

Local Transport Today
Local Transport Today Ltd
(Quadrant House, 250 Kennington Lane, SE11 5RD, United Kingdom)
2006-08-24 / (n450) p12-3 / 0 refs
ISSN: 0962-6220

Swansea City Council is investing over £10 million in the Swansea Metro project and the introduction of the First Group's innovative 'ftr' public transport system on a single bus corridor between the city's two hospitals. The infrastructure for the hybrid tram/bus vehicle will give priority for the vehicles at key junctions. First had identified Swansea as a good potential location for an ftr service and identified the best route within the city. The ftr service can replicate most of the benefits of a light rail system at a fraction of the cost. The project will be funded by the Welsh Assembly government and some Objective One money from the European Union. Extensive redevelopment of the city centre has been undertaken to accommodate the route of the ftr service. A new bus station will be built in the city centre. The proposed ftr route was labelled the Swansea Metro service as the council wanted a distinctive brand to complement existing park-and-ride services.

Benefits for buses in the real world - a simple method for assessing benefits/impacts of traffic schemes

Bode, C
Webber, C

Proceedings of ETC 2005, Strasbourg, France 18-20 September 2005 - Transport Policy and Operations - Traffic Engineering and Street Management - Integrated Traffic Management II
London Association for European Transport
2005 / 20p / 3 refs

We live in an environment where transport strategies set objectives that traffic engineers have to achieve in practice. Often, despite the best efforts of engineers these goals are not being met. In bus priority, for example, traffic engineers are often required to obtain journey time savings set by policy makers of 10-20%. Modelling using TRANSYT, micro-simulation, etc can resolve this problem however this can involve substantial data collection, and time in validating and running the model. There is therefore a need to develop a simple method of assessing possible journey time savings on a length of road; a simple method, which can be used at the feasibility stage and can feed through to those preparing the overall objectives. Using a spreadsheet based system, a method has been developed to identify problems on the traffic network and to suggest achievable journey time savings. To achieve this, the route is broken down by delay features creating a series of links and nodes. Delay characteristics are assigned to each feature. Using these attributes and the distances between features, the journey times can be calculated based on acceleration/deceleration profiles of different vehicle types. The model compares theoretical 'optimum' journey times with actual journey times to identify areas where route performance can be improved. The model also allows feature specific and/or whole route improvement schemes to be assessed, to help in determining which initiatives are likely to provide the most economic solution to improving journey times. The paper will explore the policy background that has necessitated the development of the model, and its theoretical basis. The paper will also outline the how the model has been validated against observed route performance data and its initial application as a system to develop bus priority schemes and to compare the possible saving of LRT versus bus.

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Bus rapid transit in Australasia: performance, lessons learned and futures

Currie, G

Institute of Transportation Engineers (ITE) Annual Meeting, 2005, Melbourne, Victoria, Australia
Institute of Transportation Engineers (ITE)
(1099 14th Street, Washington, DC, 20005-3438, USA)
2005 / 19p / 24 refs
ISBN: 1933452080

Australasia has one of the oldest BRT systems; the Adelaide North East Busway which has been operating for over 15 years. It also has some of the worlds newest systems. The Brisbane South East Busway, the Brisbane Inner Northern Busway, and the Sydney Liverpool-Parramatta Transitway have now been operating for between 1 to 4 years. This paper reviews the experiences of Australasian BRT systems by describing each system, measuring current performance and identifying lessons learned with their implementation. The paper also describes the future for BRT development in Australasia. It then outlines performance from a market, urban development and operational viewpoint. Lessons learned are then outlined mainly sourced from interviews with system operators. A description of plans for future system development is then presented followed by a discussion of the main findings of the review. (a)

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Roadspace allocation for public transport priority

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Sarvi, M
Young, W

Australian Institute of Traffic Planning and Management (AITPM) National Conference, 2005, Brisbane, Queensland, Australia
Australian Institute of Traffic Planning and Management (AITPM)
(Po Box 6684, Halifax Street, Adelaide, South Australia, 5000, Australia)
2005 / p77-94 / + refs
ISBN: 0957554036

Road management authorities have a difficult task juggling competing demands for limited road space and time. This dilemma is highlighted when pressure arises for greater priority for public transport services. This paper describes a methodology developed in Melbourne, Australia to assist the road management authority, VicRoads, to evaluate trade-offs in the use of its limited road-space for new bus and tram priority projects. The approach employs traffic micro-simulation modelling to assess road-space re-allocation impacts, travel behaviour modelling to assess changes in travel patterns and a social cost benefit framework to evaluate impacts. The evaluation considers a comprehensive range of impacts including the environmental benefits of improved public transport services. Impacts on public transport reliability improvements are also considered. Although improved bus and tram reliability is a major rationale for traffic priority its use in previous evaluations is rare. (a)

Strengths and weakness of bus in relation to transit oriented development

Currie, G

Transit Oriented Development: Making it Happen, 2005, Perth, Western Australia, Australia
Planning and Transport Research Centre, Curtin University
(Gpo Box U1987, Perth, Western Australia, 6845, Australia)
2005 / 19p / 19 refs

While Transit Oriented Development (TOD) has almost exclusively concerned rail based modes there has been a recent interest in bus related TOD with an emphasis on new bus rapid transit (BRT) developments in North/ South America and Australia. This paper takes a critical look at the strengths and weakness of bus based transit systems in relation to TOD through a review of the literature and an assessment of TOD related developments. The performance of BRT systems in relation to TOD are considered with specific reference to BRT systems in Australia. In addition TOD related to local suburban or 'low order' bus service is considered. The paper describes the general concept of TOD and how this relates to features of transit modes, outlines the literature relevant to bus based TOD and identifies the strengths and weakness of bus based transit systems in relation to TOD. It concludes by using the findings of the review to identify ways in which bus based TOD might be better planned and implemented. (a)

Bus rapid transit: past, present, future: evolution into a worldwide winner

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Institute of Transportation Engineers (ITE)
(1099 14th Street, Washington, DC, 20005-3438, USA)
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ISBN: 1933452080

The paper will brief earlier efforts to develop bus priority on running ways for bus transit, such as: exclusive bus roadways, contra-flow exclusive bus lane; contra-flow, with barriers, arterial bus lanes, downtown bus lanes, busway systems, and guided bus systems. The introduction of further "BRT elements" will then be analyzed, through review of recent programs which demonstrate the evolution of true Bus Rapid Transit Systems. Looking to the future, there will be extensions of BRT systems, as well as development of new BRT or BRT-related systems. New systems could include further applications of guided bus technology, that is, mechanical, electronic, or optical. BRT services may also be integrated with other advanced concepts such as "managed lanes", as being applied in San Diego and proposed for the NY-NJ area. (a)

The economic cost of congestion when road capacity is constrained: lessons from congestion charging in London

Goodwin, P

Introductory Report and Summary of Discussions at the 16th ECMT International Symposium on Theory and Practice in Transport Economics, Held Budapest, October 2003
OECD Publications Service
(2 Rue Andre Pascal, 75775 CEDEX 16, France)
2005 / p121-142 / 25 refs
ISBN: 92-821-2333-2

The role of the case of congestion charging in improving economic efficiency is discussed in relation to London where it is argued that increasing transport charges and reducing traffic may be the optimal way of improving economic efficiency. Studies on the cost of congestion in London arrived at a range of figures which were used to calculate the cost and benefits of a road pricing scheme. Mid-range estimates of net benefit in the order of œ130m a year were produced by the Government Office for London and Transport for London. Downward revision of the benefits to œ100m a year resulted from the tendency of authors of subsequent reports to exercise caution. The author suggests that the benefits as originally calculated represent an underestimate. The net benefits resulting from the use of money from congestion charging to improve the quality of public transport also need to be taken into account, particularly once these improvements have been put in place. Many relatively cheap small-scale measures usch as bus lanes, speed cameras, better enforcement and signal improvements may produce benefits 2- to 4-fold greater than those expected of major infrastructure construction, with a figure of œ25m-50m a year suggested. Wider economic benefits to business of reduced congestion may also need to be considered, on top of the direct economic benefits. No account is usually taken of the economic benefits of environmental benefits, such as less personnel stress leading to less sick leave. A value of environmental benefits may be 10-20% or 30-100% depending on the method of estimation. The 20% figure gives an extra œ20m of benefit. It is suggested that some additional benefits may take up to five years to become apparent. A total net benefit of at least œ200m is considered likely.

AVL based Bus Priority at Traffic Signals: A Review and Case Study of Architectures

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European Journal of Transport & Infrastructure Research
Delft University Press
(P.O. Box 5048, NL 2600 GA, Netherlands)
2005 / v5(n1) p13-29 / 19 refs
ISSN: 1567-7133

Recent developments in technologies such as Automatic Vehicle Location (AVL) and advanced control systems have stimulated new interest in bus priority facilities using traffic signals. The use of AVL systems has generated opportunities for implementing flexible bus-specific priority strategies according to performance. The extent of the opportunities available depends very much on the architecture of a bus priority system, including the location(s) of intelligence determining the priority level and its implementation, and the method of priority request to the traffic signal. These aspects are important from the point of view of bus priority performance, communication requirements and the cost of the system. This paper draws together and compares the various architectures currently being used for AVL-based bus priority, providing an overall review to supplement other papers which are usually concerned with individual systems. The paper reviews current bus priority systems used across Europe under five different architecture categories. The present bus priority architecture in London is then analysed in more detail as a case study. The paper concludes with a discussion of issues for this application, given the continuing advances in locations and communication technologies, and issues for the future. (A)

Selective vehicle detection (SVD) - bus priority and GPS technology

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Shrestha, BP
Mcleod, FN
Gardner, K
Palmer, S
Bowen, T

Proceedings of ETC 2005, Strasbourg, France
18-20 September 2005 - Transport Policy and Operations - Traffic Engineering and Street Management - Innovations in Data Collection
London Association for European Transport
2005 / 13p / 8 refs

Transport for London (TfL) is investigating the use of GPS technology in public transport for bus location and related services such as selective vehicle detection at Traffic Signals. Although GPS-based systems are perceived to be flexible and versatile, a drawback of this technology is the locational error associated with it. This error could result in some buses missing the given priority actions, particularly extensions. This paper provides analysis and discussion of the effect of GPS error on bus priority taking account of different detector locations, detector combinations and operational conditions. This study was carried out using TRG's microscopic simulation model, SIMBOL. Simulations were carried out with the assumptions that buses are detected using virtual detectors which may be positioned anywhere on the link. GPS location errors were assumed to be random and unbiased and GPS detection was assumed to be available 100% of the time. Bus priority was assumed to be awarded as done in SCOOT. Simulations of single virtual detector at various locations for different levels of GPS error showed that: Increasing GPS error reduces the bus priority benefits. In general, the reduction in benefit due to GPS error was found to quite small when compared with the impacts of other factors such as the junction degree of saturation, using central extensions and using a lower value of the SCOOT parameter bauth (the maximum displacement of a stage change allowed for an extension). The reduction in bus delay savings due to GPS error appeared to be fairly constant over the different detector distances considered. Existing bus journey time variability influences the impact of GPS error on bus delay savings. Simulation results showed that the influence of the GPS error is more noticeable where the journey time variability is low and less noticeable where the variability is high. Results from using an exit detector to end priority extensions when the bus is detected showed that the GPS error influences the optimal location of the exit detector. Assuming the use of local extensions, the GPS error required the location of the exit detector to be shifted downstream of the signals by a distance equal to the maximum detection error anticipated. This was necessary to avoid premature termination of extensions when buses are detected before they pass through the signals. Results from using an exit detector to hold priority extensions until the bus reaches the signals, in addition to the cancelling function, increased bus delay savings slightly. e simulation results showed that GPS error, of the magnitudes expected, has a relatively low impact on bus delay savings when compared to the impacts of other factors such as the junction degree of saturation, use of central extensions and use of a lower value of bauth.

Using Hardware-in-the-Loop Simulation to Evaluate Signal Control Strategies for Transit Signal Priority

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Bertini, RL
Pangilinan, C
Lasky, M

Transportation Research Record
Transportation Research Board (TRB)
(2101 Constitution Avenue NW, Washington, DC, 20418, USA)
2005-00 / (n1925) / 227-234 / + refs
ISBN: 0309093996
ISSN: 0361-1981

The City of Portland, in collaboration with TriMet (Portland's regional transit service provider) and the Oregon Department of Transportation, has implemented transit signal priority (TSP) at more than 240 intersections on seven transit routes as a part of the Streamline program. This study focuses on the simulation of one intersection in Portland by using hardware-in-the-loop simulation to examine the effects of TSP signal control strategies on transit performance. More specifically, near- and far-side bus stops are studied with hardware-in-the-loop traffic simulation to determine the effect of stop location on the effectiveness of the Portland TSP system. This analysis is verified by using a deterministic spreadsheet model to determine the effectiveness of the system and to address whether a green time extension plan should be used if there is passenger activity at a nearside stop.

Moving swiftly along: bus rapid transit systems

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Traffic Technology International
UK & International Press
(Abinger House, Church Street, Dorking, Surrey, RH4 1DF, United Kingdom)
2005-10/11 / p57-8 / 0 refs
ISSN: 1356-9252

High-capacity bus rapid transit (BRT) systems were originally developed in South America, but the concept is being developed in Asia. In China, where traffic congestion is rapidly becoming a problem, buses are the mainstay of public transport for most cities. In Beijing, three high-capacity BRT routes are being built for approximately 200 articulated buses with flat-fare, pre-paid ticketing and intelligent transport systems. Chong-qing is also developing a high-capacity BRT with a dedicated 12-km busway. In Indonesia, a high-capacity BRT network has been introduced in Jakarta, with three busways. The TransJakarta BRT has been shown to be capturing demand from other modes. In Vietnam, the Hanoi People's Committee has adopted BRT as part of its Mass Transport strategy. The system will feature integration terminals for bus and motorcycle passengers, an exclusive central busway, with at-floor boarding at stations set about 400-500m apart.

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Ipswich walks away from 1960s

Cumberbatch, S

Surveyor
Hemming Group
(32 Vauxhall Bridge Road, SW1V 2SS, United Kingdom)
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ISSN: 0039-6303

Suffolk County Council, UK, has plans for a œ15M package to improve pedestrian and cycling facilities and bus services with a comprehensive urban traffic management and control (UTMC) system. The plans are needed to increase the capacity of the town's roads to meet the expected increase in population. The 1960s inner-ring road is approaching capacity on many sections at peak periods. The plan is to extend the current bus loop eastwards, allowing Upper Brook Street, the main thoroughfare, to be pedestrianised. The two current bus stations will be upgraded and improvements will be made to bus corridors and bus priority with the aim of increasing public transport usage by 30-40%. The new UTMC could reduce traffic volumes by directing drivers into free car parking spaces whilst giving bus priority at problem junctions. Work is beginning on three interconnected streets in the 'Ipswich Village' quarter to encourage more careful driving and greater pedestrian use. White lines, signs, double yellow lines and pedestrian guardrails will be removed and new lighting will be provided. The colour, texture and layout of the carriageway materials will emphasise the change in environment.

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Improved Transit Signal Priority System for Networks with Nearside Bus Stops

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Transit signal priority (TSP), which has been deployed in many cities in North America and Europe, is a traffic signal enhancement strategy that facilitates efficient movement of transit vehicles through signalized intersections. Most TSP systems, however, do not work well in transit networks with nearside bus stops because of the uncertainty in bus dwell time. Unfortunately, most bus stops on U.S. arterial roadways are nearside ones. In this research, weighted-least-squares regression modeling was used to estimate bus stop dwell time and, more important, the associated prediction interval. An improved TSP algorithm that explicitly considers the prediction interval was developed to reduce the negative impacts of nearside bus stops. The proposed TSP algorithm was tested on a VISSIM model of an urban arterial section of Bellaire Boulevard in Houston, Texas. In general, it was found that the proposed TSP algorithm was more effective than other algorithms because it improved bus operations without statistically significant impacts on signal operations.

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Analysis of Transit Signal Priority Using Archived TriMet Bus Dispatch System Data

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Strathman, J
Bertini, RL
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(2101 Constitution Avenue NW, Washington, DC, 20418, USA)
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Findings are presented on changes in bus running times, on-time performance, and excess

passenger wait times following implementation of transit signal priority (TSP) in select bus corridors in the Portland metropolitan region. Analysis of the effectiveness of TSP is often undertaken by using simulation techniques or empirical studies that are limited in either scope or data availability, or both. The current research uses an abundance of trip-level data collected from TriMet's Bus Dispatch System, in Portland, Oregon. The study focuses on the most common performance measures of interest to both transit operators and passengers and shows that the expected benefits of TSP are not consistent across routes and time periods, nor are they consistent across the various performance measures. The authors believe that benefits of TSP will accrue only as the result of extensive evaluation and adjustment after initial deployment. In most cases, an ongoing performance monitoring and adjustment program should be implemented to maximize TSP benefits.

Advanced Transit Signal Priority Control with Online Microsimulation-Based Transit Prediction Model

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An advanced transit signal priority (TSP) control method is presented: it provides priority operation in response to real-time traffic and transit conditions. A high-performance online microscopic simulation model was developed for the purpose of predicting transit travel time along an intersection approach. The proposed method was evaluated through application to a hypothetical intersection with a nearside bus stop. The performance of the proposed method was compared with that of normal signal operation without TSP and a conventional signal priority method. The experimental results indicated that the developed method provided efficient and effective priority operation for both transit vehicles and automobiles. The proposed method significantly reduced transit vehicle delays as well as side-street traffic delay compared with conventional active priority control.

Demonstrating intensive bus priority

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Traffic Engineering & Control
Hemming Group
(32 Vauxhall Bridge Road, SW1V 2SS, United Kingdom)
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ISSN: 0041-0683

Bus priority measures have been implemented in London, UK, to improve bus speed and reliability. The Bus Priority Flagship Team studied the primary influences on bus journey times and reliability using a range of VISSIM microsimulation models. The study was conducted on a section of route 149, Kingsland Road, Hackney. The model results are discussed with reference to junction timings, bus lanes, and kerbside activity and enforcement. These showed that traffic signal timings had the most impact on journey times and that bus lanes provided the most benefits under congested conditions. Kerbside activity and compliance with kerbside controls could have an impact on journey times. These priority measures were introduced onto Bus Route 149 progressively from 2000 and the effects of the different measures were monitored. It was shown that a successful approach would seek to include improvements at traffic signal junctions, provision of bus lanes and control of kerbside activity.

Smart results

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Traffic Technology International
UK & International Press
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In 2003, the Alameda County Congestion Management Agency (ACCMA) turned 14 miles of San Pablo Avenue in the East San Francisco Bay Area, California, USA, into a SMART corridor. The project increased bus ridership by nearly 78% and reduced run time by 17%. Bus services were improved by giving them transit signal priority, improved signal coordination, fewer stops at wider intervals, real-time passenger information, and low-floor vehicles. The transit signal priority element uses Opticom Priority Control devices mounted on buses. The increased attractiveness of the Rapid Bus service to car users led to 18% of bus passengers leaving their cars behind for the first time. The SMART Corridor programme focused on arterial roadways. Emergency services were equipped with Emergency Vehicle Preemption technology in order to allow them to reach incidents promptly. SMART corridors are suitable for use as evacuation routes in the event of a disaster. The Automatic Vehicle Location (AVL) allows fire departments to view the location of their emergency vehicle. The success of Rapid Bus has stimulated the start of three similar SMART corridor projects in the Bay area.

Strategically Deploying Bus ITS at WMATA

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Raine, W

Conference Title: 2005 Bus & Paratransit Conference Proceedings. Location: Columbus. Held: 20050515-20050518
American Public Transportation Association
(1666 K Street, NW, Washington, DC, 20006-, USA)
2005-05 / 6p / - refs
ISBN: 1931594163

This paper describes how the Washington Metropolitan Area Transit Authority (WMATA) has committed organizationally to a "back to basics" approach that emphasizes system reliability and customer service. Intelligent Transportation Systems (ITS) are recognized as a means for reaching these goals and delivering tangible benefits. WMATA is currently deploying several significant bus ITS components. In addition, WMATA's major business systems are being integrated through an enterprise-wide Information Technology Renewal Program (ITRP) that has been underway since 2002. For these efforts to pay off, WMATA's challenge is determining how to maximize the benefit of these deployments by combining them into an integrated system while operating within a "stovepipe" environment. Working with the existing culture, we are striving to deliver: (1) interoperability among the different technologies; (2) a systems architecture for integrating on-board and wayside bus information processes and communications systems; (3) integration of on-board WMATA bus ITS with other WMATA systems and regional ITS initiatives. At the same time, these efforts must also be consistent with regional National ITS Architecture requirements and available industry standards. Successfully meeting these challenges will enable the Authority to enhance service reliability and customer satisfaction through projects such as: (1) real-time bus arrival information; (2) schedule-based transit signal priority; and (3) simplified sign-on for bus operators. This paper examines some of the technical as well as cultural issues WMATA is currently facing--both internally and as a regional transportation provider--as the organization strives to complete complex technological projects while transitioning from a "discrete projects" mentality to integrated systems deployments. We look at what we have accomplished, lessons learned, challenges that remain, and WMATA's vision for improving system reliability and customer service through technology integration.

Translink looks for high quality delivery of bus priority measures

Thomas, R

Local Transport Today
Local Transport Today Ltd
(Quadrant House, 250 Kennington Lane, SE11 5RD, United Kingdom)
2005-09-29 / (n427) p12-3,15 / 0 refs
ISSN: 0962-6220

This article contains an interview with Keith Moffatt, chief executive of Translink, the state-owned public transport operator in Northern Ireland. Translink operates both Northern Ireland's rail services and most bus services. New trains have been delivered, but the Government has designated about 50% of Northern Ireland's rail infrastructure 'non-core', as it carries significantly fewer passengers than the core half. The non-core half has been given a window of 5 years to prove it is viable. There is funding in place for a long-term strategy for the core network. The bus operating business is more complex and has suffered years of neglect. The regional transport strategy includes a target of 40% growth in bus patronage in ten years. Moffatt looks for new measures to deliver bus priority, with more bus lanes, and is interested in the possibility of park-and-ride being used to augment public transport passenger numbers. He emphasises the need for local involvement and feels that the key issues are not around regulation but are centred on

the delivery of the regional transport scheme. Both bus deregulation and central control would require reform prior to the policy being implemented.

Bus rapid transit corridors in Sydney for sustainable development: benefits of advance detectors

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Rossi, B

Conference of Australian Institutes of Transport Research (CAITR), 27TH, 2005, Brisbane, Queensland, Australia
Monash University (Institute of Transport Studies)
(Building 60, Monash University, Clayton, Victoria, 3800, Australia)
2005-12 / 5p / 7 refs

A recent innovation related to the public transport scene in Sydney is the development of a bus rapid transit network. The first phase of the project known as the Liverpool to Parramatta Transitway commenced operation in 2003 and the paper presents an analysis of benefits of the intersection priority technology adopted in this project. The analysis presented in the paper is based on data collected from 103 bus runs and shows there are significant travel time benefits to passengers. More importantly, the analysis shows there are reduced system costs to the operator resulting from the reduction of number of buses and drivers required. Quantification of benefits attributable to upstream detectors at priority signals is main purpose of this paper. Brief comparison with overseas case studies is also included. (a)

Performance of Transit Signal Priority with Queue Jumper Lanes

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Gan, A

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Queue jumper lanes are a special type of bus preferential treatment that allows buses to bypass a waiting queue through a right-turn bay and then cut out in front of the queue by getting an early green signal. The performance of queue jumper lanes is evaluated under different transit signal priority (TSP) strategies, traffic volumes, bus volumes, dwell times, and bus stop and detector locations. Four TSP strategies are considered: green extension, red truncation, phase skip, and phase insertion. It was found that queue jumper lanes without TSP were ineffective in reducing bus delay. Queue jumper lanes with TSP strategies that include a phase insertion were found to be more effective in reducing bus delay while also improving general vehicle operations than those strategies that do not include this treatment. Nearside bus stops upstream of check-in detectors were preferred for jumper TSP over far-side bus stops and nearside bus stops downstream of check-in detectors. Through vehicles on the bus approach were found to have only a slight impact on bus delay when the volume-to-capacity (v/c) ratio was below 0.9. However, when v/c exceeded 0.9, bus delay increased quickly. Right-turn volumes were found to have an insignificant impact on average bus delay, and an optimal detector location that minimizes bus delay under local conditions was shown to exist.

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