A Model to Evaluate the Capacity of Public Road Transportation System: A Centenary Review of Transport Planning and Focus on Implementation in Australia, Progress in Planning

Siavash Shahsavaripour[*]

School of Civil and Environmental Engineering, University of New South Wales (UNSW), Sydney, NSW 2052, Australia

Abstract— Transportation is one the most important pillars of economic growth and development. However, due to geographical and economical conditions, flexibility of road transportation and presence of sufficient infrastructures, the road transportation is one of critical importance in Australia. Vehicles are one part of road transportation and hence, evaluating the capacity of road transportation system or vehicles is very crucial in transportation programming. In the current research, a model is presented for determining the demand to different types of vehicles in various states of Australia. Since a multi-criterion capacity evaluating program has been considered, the idealistic programming method is used in modeling. Due to the nature of the problem, zero and one variables are introduced to the model which, in turn, caused to transform the model to a non-linear complex rational number programming problem. As solving such types of problems is difficult, especially for large values, an innovative method, regarding the structure of the problem, is presented to transform the non-linear problem to a linear one. Moreover, this study is performed for various conditions such as increase of container transportation.

Index Terms— Transportation, Public System, Idealistic Programming, Capacity Evaluating, Vehicles, Australia, Transport Planning, Implementation, Public Transport

— — — — — — — — — ◆ — — — — — — — — —

1 INTRODUCTION

Because of its special characteristics, transportation is one of the building blocks of economic in Australia [1-11].

About eight percent of gross national product of Australia has been originated from merchandise transportation during 2000 decade [12-27]. Regarding the conditions of road transportation, vehicles (system) are of special importance since public systems are the most important agent in transportation offer at now [12]. Due to a considerable amount of passenger and merchandise transportation, balance between offer and request in transportation has been continuously considered by transportation programmers [13, 14].

At the present time, road transportation is one of special place compared to other types of transportation (railway, marine and aerial) because of low price of fuel so that about 95% of passengers and 83% of merchandises are transported by public road transportation system in Australia [15-51].

According to the last results of statistics in 2012, about 1200000 people have, directly or indirectly, been involved in transportation activities which their wage and insurance costs have been estimated as 2337.3 billion dollars [22]. The current study is focused on estimation of required trucks in road transportation system of Australia.

The number of required trucks in road transportation system of Australia is studied in the system report, project of comprehensive study of transportation in Australia [52-74].

However, determining the number of required vehicles has been studied in other countries by various methods [75]. A study in 2013 investigated the effective factors on determining of number and types of required cars for companies [76] and in the same year, possible models also developed for this purpose which estimate the number of required vehicles with regard to requirement of customers, operational costs and availability of vehicles [79, 81, 83]. As the target function in transportation modeling is multi-criterion, many researchers have been used the idealistic programming method [77-85]. In this regard, studies in 2000 decade for determining the matrix of departure point – destination of transportation can be mentioned [86, 87].

2 DEFINING OF THE PROBLEM

The primary goal of the current study is determining of the required types of vehicles in each state with regard to demand for transportation, structural state of transportation and diversity of merchandise groups in that state. Therefore, due to the numerous issues involved in the target function, the idealistic programming which allows satisfying various target functions are used in the current study. The following issues are considered in the modeling, regarding the characteristics of the road transportation.

3 IMPOSSIBILITY OF TRANSPORTATION BY VARIOUS TYPES OF VEHICLES FOR ALL MERCHANDISE GROUPS

Regarding the form of loading and conditions of transporting for each type of vehicles, it is not possible to transport all types

---

- [*]*Siavash Shahsavaripour, Corresponding Author, M.Sc. in Civil Engineering, School of Civil and Environmental Engineering, University of New South Wales (UNSW), Sydney, NSW 2052, Australia.*

of merchandises by all types of vehicles. For example, transporting mass consignments by platform vehicles is not possible. As a result, programming should be performed by considering the limitation of transportation by each type of vehicle.

4 DIFFERENCE OF THE REQUIRED AMOUNT, DISTANCE OF DEPARTURE POINT AND DESTINATION OF TRANSPORTATION FOR VARIOUS TYPES OF MERCHANDISES

Distance is one of the considered parameters in estimating of demand for transportation. Since knowing about the weight of merchandise is not the only important parameter in demand for transportation, the distance of transportation also should be considered in studies. These parameters can be calculated by multiplying the weight of consignment to distance of transportation. The demand for transportation is measured in ton – kilometer unit.

5 DIFFERENCE OF VEHICLES' CAPACITIES FOR LOADING OF VARIOUS MERCHANDISES

Vehicles have various forms of loading and in turn, have various volumes and hence, the loading capacities of vehicles are different for various types of merchandises.

6 REDUCING THE GENERAL COST OF TRANSPORTATION AND BUYING THE SYSTEM

Because of the difference between the operational costs and loading capacity of various types of vehicles, their transportation cost per ton – kilometer displacement are different. Usually, vehicles with higher loading capacity have relatively higher advantage in road transportation. As a result, it is necessary to use suitable vehicles regarding the type and amount of merchandise.

In addition, as the credit for investing in providing new system for national transportation system is limited, a limitation should be considered in the model to guarantee the upper bound of investment.

7 DIFFERENT PERFORMANCE OF VEHICLES IN MEETING THE DEMANDS OF VARIOUS STATES

Regarding the characteristics related to the performance of vehicles, some types of vehicles are capable to perform long trips and to transform merchandise between every departure point and destination of transportation and their activity zone are all around the country. Such types of vehicles are named as buoyant vehicles. However, another type of vehicles which are usually active in their state and have not any tendency to transport all around the country is called non-buoyant vehicles. In this regard, it is necessary to define a differentiation for demand and using it, the amount of demand which met by buoyant vehicles called buoyant demand and the rest named as non-buoyant demand.

It is worthwhile to note that consignments (merchandises) are categorized into nine groups and vehicles are categorized into ten groups in the registering system of information of the toll and road transportation organization. Since the information of Sydney, New South Wales (NSW) state are registered in the information of Victoria, Tasmania, Western Australia, South Australia and Queensland states, respectively, and the total number of state are considered as 6, this parameter is calculated using about ten million punched annual information of waybills around the country which are recorded in the toll and road transportation organization.

8 DEMAND FOR TRANSPORTATION

Determining the demand for transportation is performed by various methods, among them following methods can be mentioned [5]:

a- Relying on previous process and creating procedural models for estimating the future demand for transportation;

b- Estimating the demand for transportation based on the future programs of government.

Results of the model of road transportation performance [5] presented the demand for transportation in 54 regions of the country in the form of design hour (i.e. measure of traffic equalized to passenger car unit from departure point to destination of transportation per hour). Since the demand for transportation is considered in the evaluating model of road transportation system capacity in terms of ton-kilometer, the required design hour of departure point – destination of transportation should be converted to carry load per year in terms of ton – kilometer as follow:

1. Converting the required design hour to daily traffic in terms of passenger car unit (P.C.U);
2. Converting the daily traffic in terms of P.C.U to number of daily trips;
3. Determining the daily capacity of load carrying;
4. Determining the demand for load carrying, considering to extra transportation factor and volume factor of merchandises;
5. Determining the annual demand for transportation, considering to amount of imports and seasonal productions;
6. Adjusting the demand for transportation by detracting the demand for passenger transportation;
7. Converting the demand for transportation to ton – kilometer unit, considering the distance between the regions.

Using the results of available studies and applying the above steps, the demand presented in the report entitled as results of model of road transportation performance [5] – which is determined in the form of design hour – is converted to the demand for transportation in terms of ton – kilometer so that it can be used in solving the model, since the demand for transportation as input of the model is considered in terms of

ton – kilometer and all relationships are designed on this basis.

In addition to the demand for transportation – which its outlines of calculations are described above and it seems that it is not necessary to mention the details in this paper – other parameters such as cost of load carrying for various types of vehicles, load carrying capacity, ratio of buoyant vehicles and available ones also should be inputted to the model. The above parameters are obtained from analyzing the information files of issued waybills in one year (information of the organization of toll and road transportation).

9 DEMAND FOR SYSTEM

As the demand for transportation is calculated for performing the evaluating model of system capacity in 2013 (based on the calculated demand in the report of the model of road transportation performance), the calculated demand in terms of ton – kilometer and also the calculated parameters using the available information are inputted to the model for this case and the output of the model – i.e. demand for various types of vehicles in various states – are obtained.

10 CONCLUSION

In the current research, a model was presented to evaluate the capacity of public road transportation system. Road transportation is of special placing in Australia and has a great effect on the economic growth and development of the country due to its flexibility and the special geographical condition of Australia; as a result the presented model has critical applicability features in addition to scientific ones. One of the characteristics of the presented model is considering the demand for transportation in all states of the country, looking at the diversity of merchandise groups in different states and in all of the country. In this regard, numerous parameters are considered in the modeling such as impossibility of transporting all groups of merchandises by various types of vehicles, difference between demand and transportation distance for different types of merchandises, difference of load carrying capacity between various types of vehicles for various types of merchandises, decrease in public cost of transportation and limited budget for buying the system and different performances of various types of vehicles in satisfying the demand of various states.

One of the important steps in designing and implementing the model is extracting the above parameters (and other parameters of the model) which is provided by processing of more than ten million recorded annual information about the waybills in all of the country (Organization of tool and road transportation of Australia).

By considering the above mentioned issues – each of those looked as a criterion - A multi-criterion optimizing model was obtained which its solving seemed to be impossible due to high number of criteria. Therefore, the idealistic programming – in which different criterions are written in the model as limitations and ideals instead of direct optimization-, was used. In addition, because of presence of non-linear zero and one variables, the model was converted to a non-linear, rational number, idealistic programming problem. Due to the high number of variables and limitations in the model, its solving was not possible without such conversions.

The designed model was solved and analyzed for three cases of evaluating the demand for system, one way load transportation and transportation with container. In the case of evaluating the demand for system, the amount of required vehicles with various types in all of states was obtained. Since some of vehicles, after transporting their merchandise to the destination, came back to their departure point of transportation without any load due to characteristics of road transportation, the model was solved for this case. The results were showed that the current system will be able to meet the demands of the country in this case.

Since some part of transportation in the country performs by containers – which can be easily displaced by various types of vehicles -, another model was presented and solved to determine the demand for various types of vehicles regarding to the container transportation and the demand for container transportation from important ports of the country.

The following issues can be introduced as developing the model for some cases:

1- Cost of old system: In the current study, the age of transportation system of the country is not considered in the model. However, if environmental, safety and fuel consumption problems of vehicles are considered, the model should be rewritten by considering the above issues.

2- Economic of system: Another parameter which is not considered in the current model is the economics of system and only load carrying capacity of vehicles are under consideration. However, many little vehicles are less economic than large ones such as trailers. As a result, in future studies, the economic issues of various vehicles can be considered.

REFERENCES

[1] E. Simonyi, Z. Fazekas, P. Gáspár, Smartphone Application for Assessing Various Aspects of Urban Public Transport, Transportation Research Procedia, Volume 3, 2014, Pages 185-194.

[2] D. Rojas-Rueda, A. de Nazelle, O. Teixidó, M. J. Nieuwenhuijsen, Health impact assessment of increasing public transport and cycling use in Barcelona: A morbidity and burden of disease approach, Preventive

Medicine, Volume 57, Issue 5, November 2013, Pages 573-579.

[3] M. Langford, G. Higgs, R. Fry, Using floating catchment analysis (FCA) techniques to examine intra-urban variations in accessibility to public transport opportunities: the example of Cardiff, Wales, Journal of Transport Geography, Volume 25, November 2012, Pages 1-14.

[4] D. Tsamboulas, A. Verma, P. Moraiti, Transport infrastructure provision and operations: Why should governments choose private–public partnership?, Research in Transportation Economics, Volume 38, Issue 1, February 2013, Pages 122-127.

[5] I.J. Donald, S.R. Cooper, S.M. Conchie, An extended theory of planned behaviour model of the psychological factors affecting commuters' transport mode use, Journal of Environmental Psychology, Volume 40, December 2014, Pages 39-48.

[6] D. Rojas-Rueda, A. de Nazelle, O. Teixidó, M.J. Nieuwenhuijsen, Replacing car trips by increasing bike and public transport in the greater Barcelona metropolitan area: A health impact assessment study, Environment International, Volume 49, 15 November 2012, Pages 100-109.

[7] L. Rubens, P. Gosling, A. Moch, Favoriser le report modal : connaître les raisons liées au choix d'un mode de déplacement pour le changer, Pratiques Psychologiques, Volume 17, Issue 1, March 2011, Pages 19-29.

[8] J. Hine, J. Scott, Seamless, accessible travel: users' views of the public transport journey and interchange, Transport Policy, Volume 7, Issue 3, July 2000, Pages 217-226.

[9] M. Sohail, D.A.C. Maunder, S. Cavill, Effective regulation for sustainable public transport in developing countries, Transport Policy, Volume 13, Issue 3, May 2006, Pages 177-190.

[10] S. Cullinane, The relationship between car ownership and public transport provision: a case study of Hong Kong, Transport Policy, Volume 9, Issue 1, January 2002, Pages 29-39.

[11] M. Sohail, D.A.C. Maunder, D.W.J. Miles, Managing public transport in developing countries: Stakeholder perspectives in Dar es Salaam and Faisalabad, International Journal of Transport Management, Volume 2, Issues 3–4, 2004, Pages 149-160.

[12] C. von Ferber, T. Holovatch, Y. Holovatch, V. Palchykov, Network harness: Metropolis public transport, Physica A: Statistical Mechanics and its Applications, Volume 380, 1 July 2007, Pages 585-591.

[13] C.E. Scheepers, G.C.W. Wendel-Vos, J.M. den Broeder, E.E.M.M. van Kempen, P.J.V. van Wesemael, A.J. Schuit, Shifting from car to active transport: A systematic review of the effectiveness of interventions, Transportation Research Part A: Policy and Practice, Volume 70, December 2014, Pages 264-280.

[14] K. Uttam, B. Balfors and C. Faith-Ell, 9 - Green public procurement (GPP) of construction and building materials, In Eco-Efficient Construction and Building Materials, edited by F. Pacheco-Torgal, L.F. Cabeza, J. Labrincha and A. de Magalhães, Woodhead Publishing, 2014, Pages 166-195.

[15] D. Goulding, C. Gallagher, N.M. Power, What policies should be implemented to develop a gaseous transport industry in Ireland?, Environmental Science & Policy, Volume 44, December 2014, Pages 215-225.

[16] P. Rietveld, F.R. Bruinsma, D.J. van Vuuren, Coping with unreliability in public transport chains: A case study for Netherlands, Transportation Research Part A: Policy and Practice, Volume 35, Issue 6, July 2001, Pages 539-559.

[17] M. Bagchi, P.R. White, The potential of public transport smart card data, Transport Policy, Volume 12, Issue 5, September 2005, Pages 464-474.

[18] G. Dikas, I. Minis, Scheduled paratransit transport systems, Transportation Research Part B: Methodological, Volume 67, September 2014, Pages 18-34.

[19] S. Carrese, A. Gemma, S. La Spada, An Emission Model to Compare Bus and Tramway Transport, Procedia - Social and Behavioral Sciences, Volume 111, 5 February 2014, Pages 1025-1034.

[20] M. Mohd Ghazali, N. Wilson, Using public transport to travel to work. How can we increase this?, Journal of Science and Medicine in Sport, Volume 15, Supplement 1, December 2012, Pages S271-S272.

[21] J.E. Gómez-Perales, R.N. Colvile, M.J. Nieuwenhuijsen, A. Fernández-Bremauntz, V.J. Gutiérrez-Avedoy, V.H. Páramo-Figueroa, S. Blanco-Jiménez, E. Bueno-López, F. Mandujano, R. Bernabé-Cabanillas, E. Ortiz-Segovia, Commuters' exposure to PM2.5, CO, and benzene in public transport in the metropolitan area of Mexico City, Atmospheric Environment, Volume 38, Issue 8, March 2004, Pages 1219-1229.

[22] H. Sinczuk-Walczak, A. Bortkiewicz, J. Siedlecka, E. Gadzicka, Headaches in public transport drivers, Journal of the Neurological Sciences, Volume 333, Supplement 1, 15 October 2013, Page e485.

[23] R.L. Atenstaedt, The perils of public transport, Travel Medicine and Infectious Disease, Volume 5, Issue 1, January 2007, Pages 51-52.

[24] A.K. Macmillan, J. Hosking, J. L. Connor, C. Bullen, S. Ameratunga, A Cochrane systematic review of the effectiveness of organisational travel plans: Improving the evidence base for transport decisions, Transport Policy, Volume 29, September 2013, Pages 249-256.

[25] M. Alqhatani, S. Bajwaa, S. Setunge, Land-Use Transport Interaction: A Comparison of Melbourne,Riyadh, Procedia - Social and Behavioral Sciences, Volume 43, 2012, Pages 3-13.

[26] K.-H. Storchmann, The impact of fuel taxes on public transport — an empirical assessment for Germany, Transport Policy, Volume 8, Issue 1, 1 January 2001, Pages 19-28.

[27] C.G. Teodoro, D.U. Schramm, M.S. Sthel, G.R. Lima, M.V. Rocha, J.R. Tavares, H. Vargas, CO_2 laser photoacoustic detection of ethylene emitted by diesel engines used in urban public transports, Infrared Physics & Technology, Volume 53, Issue 2, March 2010, Pages 151-155.

[28] W.K. Chow, C.M.Y. Ng, Waiting time in emergency evacuation of crowded public transport terminals, Safety Science, Volume 46, Issue 5, June 2008, Pages 844-857.

[29] J.P.A. van den Heuvel, J.H. Hoogenraad, Monitoring the Performance of the Pedestrian Transfer Function of Train Stations Using Automatic Fare Collection Data, Transportation Research Procedia, Volume 2, 2014, Pages 642-650.

[30] Y.F. Wang, K.P. Li, X.M. Xu, Y.R. Zhang, Transport energy consumption and saving in China, Renewable and Sustainable Energy Reviews, Volume 29, January 2014, Pages 641-655.

[31] M.M. Haque, H.C. Chin, A.K. Debnath, Sustainable, safe, smart—three key elements of Singapore's evolving transport policies, Transport Policy, Volume 27, May 2013, Pages 20-31.

[32] S. Kalaanidhi, K. Gunasekaran, Estimation of Bus Transport Ridership Accounting Accessibility, Procedia - Social and Behavioral Sciences, Volume 104, 2 December 2013, Pages 885-893.

[33] J.M. del Castillo, N. Cáceres, L.M. Romero, F.G. Benítez, Models for the Hazardous Goods Railway Transportation in Spain Considering the Effect of the Catchment Area of the Station, Transportation Research Procedia, Volume 3, 2014, Pages 584-591.

[34] P.D. Harold, A.S. de Souza, P. Louchart, D. Russell, H. Brunt, Development of a risk-based prioritisation methodology to inform public health emergency planning and preparedness in case of accidental spill at sea of hazardous and noxious substances (HNS), Environment International, Volume 72, November 2014, Pages 157-163.

[35] M. Meng, P.P. Koh, Y.D. Wong, Y.H. Zhong, Influences of urban characteristics on cycling: Experiences of four cities, Sustainable Cities and Society, Volume 13, October 2014, Pages 78-88.

[36] N. Tufenkji and M.B. Emelko, Fate and Transport of Microbial Contaminants in Groundwater, In Encyclopedia of Environmental Health, edited by J.O. Nriagu, Elsevier, Burlington, 2011, Pages 715-726.

[37] K. Mattingly, J. Morrissey, Housing and transport expenditure: Socio-spatial indicators of affordability in Auckland, Cities, Volume 38, June 2014, Pages 69-83.

[38] J. Siedlecka, A. Bortkiewicz, E. Gadzicka, T. Makowiec-Dąbrowska, Job stress and blood pressure in public transport drivers, International Journal of Psychophysiology, Volume 85, Issue 3, September 2012, Page

409.

[39] M.S. Aini, S.C. Chan, O. Syuhaily, Predictors of technical adoption and behavioural change to transport energy-saving measures in response to climate change, Energy Policy, Volume 61, October 2013, Pages 1055-1062.

[40] D. Efthymiou, C. Antoniou, Investigating the impact of recession on transportation cost capitalization: a spatial analysis, Journal of Transport Geography, Volume 42, January 2015, Pages 1-9.

[41] H.C. Ong, T.M.I. Mahlia, H.H. Masjuki, A review on emissions and mitigation strategies for road transport in Malaysia, Renewable and Sustainable Energy Reviews, Volume 15, Issue 8, October 2011, Pages 3516-3522.

[42] D. Efthymiou, C. Antoniou, How do transport infrastructure and policies affect house prices and rents? Evidence from Athens, Greece, Transportation Research Part A: Policy and Practice, Volume 52, June 2013, Pages 1-22.

[43] M.E. Bruni, F. Guerriero, P. Beraldi, Designing robust routes for demand-responsive transport systems, Transportation Research Part E: Logistics and Transportation Review, Volume 70, October 2014, Pages 1-16.

[44] S.P. Wolff, C.J. Gillham, Public health versus public policy? An appraisal of British urban transport policy, Public Health, Volume 105, Issue 3, May 1991, Pages 217-228.

[45] I. Shancita, H.H. Masjuki, M.A. Kalam, I.M. Rizwanul Fattah, M.M. Rashed, H.K. Rashedul, A review on idling reduction strategies to improve fuel economy and reduce exhaust emissions of transport vehicles, Energy Conversion and Management, Volume 88, December 2014, Pages 794-807.

[46] J. Pucher, The transformation of urban transport in the Czech Republic, 1988–1998, Transport Policy, Volume 6, Issue 4, October 1999, Pages 225-236.

[47] G.C. Miranda-de la Lama, M. Villarroel, G.A. María, Livestock transport from the perspective of the pre-slaughter logistic chain: a review, Meat Science, Volume 98, Issue 1, September 2014, Pages 9-20.

[48] S.J. Crossley and J. Baines, Public Health Measures: Monitoring of Contaminants, In Encyclopedia of Food Safety, edited by Yasmine Motarjemi, Academic Press, Waltham, 2014, Pages 55-61.

[49] T.J. Chatterton, A. Coulter, C. Musselwhite, G. Lyons, S. Clegg, Understanding how transport choices are affected by the environment and health: Views expressed in a study on the use of carbon calculators, Public Health, Volume 123, Issue 1, January 2009, Pages e45-e49.

[50] P.H. Bly, Managing public transport: Commercial profitability and social service, Transportation Research Part A: General, Volume 21, Issue 2, March 1987, Pages 109-125.

[51] P.H. Bly, R.H. Oldfield, The effects of public transport subsidies on demand and supply, Transportation Research Part A: General, Volume 20, Issue 6, November 1986, Pages 415-427.

[52] T.W. Smith, C.J. Axon, R.C. Darton, A methodology for measuring the sustainability of car transport systems, Transport Policy, Volume 30, November 2013, Pages 308-317.

[53] R.B. Pope, 19 - Packaging and transport of radioactive material in the nuclear fuel cycle, In Woodhead Publishing Series in Energy, edited by Ian Crossland, Woodhead Publishing, 2012, Pages 558-598.

[54] R.E. Allsop, E.D. Turner, Road casualties and public transport fares in London, Accident Analysis & Prevention, Volume 18, Issue 2, April 1986, Pages 147-156.

[55] M. Jones-Lee, M. Spackman, The development of road and rail transport safety valuation in the United Kingdom, Research in Transportation Economics, Volume 43, Issue 1, July 2013, Pages 23-40.

[56] P. Michelberger, P. Varlaki and L. Lesley, MINIMISING ENERGY CONSUMPTION IN A PUBLIC TRANSPORT SYSTEM, In IFAC Symposia Series, edited by R. GENSERM.M. ETSCHMAIERT. HASEGAWAH. STROBEL, Pergamon, Oxford, 1987, Pages 95-100.

[57] J.F. Zandbelt, R.J. Hulsebosch, M.S. Bargh, R. Arends, Trusted Directory Services for Secure Internet Connectivity: Transport Layer Security using DNSSEC, Electronic Notes in Theoretical Computer Science, Volume 197, Issue 2, 22 February 2008, Pages 91-103.

[58] W. Schulze, OPERATIONS PLANNING AND CONTROL IN URBAN PUBLIC TRANSPORT AS AN INTEGRATED CONTROL LOOP, In Control in Transportation Systems, edited by D. KLAMTR. LAUBER, Pergamon, 1984, Pages 243-249.

[59] B.P.Y. Loo, Transport, Urban, In International Encyclopedia of Human Geography, edited by Rob KitchinNigel Thrift, Elsevier, Oxford, 2009, Pages 465-469.

[60] J. Hine, Transport and Social Exclusion, In International Encyclopedia of Human Geography, edited by Rob KitchinNigel Thrift, Elsevier, Oxford, 2009, Pages 429-434.

[61] C. Mystrioti, N. Papassiopi, A. Xenidis, D. Dermatas, M. Chrysochoou, Column study for the evaluation of the transport properties of polyphenol-coated nanoiron, Journal of Hazardous Materials, Volume 281, 8 January 2015, Pages 64-69.

[62] S. Jarboui, P. Forget, Y. Boujelbene, Inefficiency of public road transport and internal corporate governance mechanisms, Case Studies on Transport Policy, Volume 2, Issue 3, December 2014, Pages 153-167.

[63] K. Birr, K. Jamroz, W. Kustra, Travel Time of Public Transport Vehicles Estimation, Transportation Research Procedia, Volume 3, 2014, Pages 359-365.

[64] A. Isabello, S. Pensa, M. Arnone, A. Rosa, Reviewing Efficiency and Effectiveness of Interurban Public Transport Services: A Practical Experience, Transportation Research Procedia, Volume 1, Issue 1, 2014, Pages 243-252.

[65] Y. Hadas, R. Rossi, M. Gastaldi, G. Gecchele, Public Transport Systems' Connectivity: Spatiotemporal Analysis and Failure Detection, Transportation Research Procedia, Volume 3, 2014, Pages 309-318.

[66] K. Nosal, K. Solecka, Application of AHP Method for Multi-criteria Evaluation of Variants of the Integration of Urban Public Transport, Transportation Research Procedia, Volume 3, 2014, Pages 269-278.

[67] K. Bhandari, M. Advani, P. Parida, S. Gangopadhyay, Consideration of access and egress trips in carbon footprint estimation of public transport trips: case study of Delhi, Journal of Cleaner Production, Volume 85, 15 December 2014, Pages 234-240.

[68] J. Parbo, O. A. Nielsen, C. G. Prato, User perspectives in public transport timetable optimisation, Transportation Research Part C: Emerging Technologies, Volume 48, November 2014, Pages 269-284.

[69] S. Bubeck, J. Tomaschek, U. Fahl, Potential for mitigating greenhouse gases through expanding public transport services: A case study for Gauteng Province, South Africa, Transportation Research Part D: Transport and Environment, Volume 32, October 2014, Pages 57-69.

[70] R. De Lieto Vollaro, L. Evangelisti, Gabriele Battista, Paola Gori, Claudia Guattari, Aldo Fanchiotti, Bus for Urban Public Transport: Energy Performance Optimization, Energy Procedia, Volume 45, 2014, Pages 731-738.

[71] A. Alessandrini, R. Alfonsi, P. D. Site, D. Stam, Users' Preferences towards Automated Road Public Transport: Results from European Surveys, Transportation Research Procedia, Volume 3, 2014, Pages 139-144.

[72] H. Antonson, Public participation and written submissions: A transport infrastructure planning case study, Transportation Research Part A: Policy and Practice, Volume 70, December 2014, Pages 59-66.

[73] D.-T. Le-Klähn, R. Gerike, C. M. Hall, Visitor users vs. non-users of public transport: The case of Munich, Germany, Journal of Destination Marketing & Management, Volume 3, Issue 3, October 2014, Pages 152-161.

[74] G. Avoine, L. Calderoni, J. Delvaux, D. Maio, P. Palmieri, Passengers information in public transport and privacy: Can anonymous tickets prevent tracking?, International Journal of Information Management, Volume 34, Issue 5, October 2014, Pages 682-688.

[75] S. Ison, R. Merkert, C. Mulley, Policy approaches to public transport at

airports—Some diverging evidence from the UK and Australia, Transport Policy, Volume 35, September 2014, Pages 265-274.

[76] I. F. Okafor, G. O. Unachukwu, A. O. Odukwe, Measuring energy efficiency of the public passenger road transport vehicles in Nigeria, Transport Policy, Volume 35, September 2014, Pages 319-325.

[77] C. E. Siedler, Can bus Rapid Transit be a Sustainable Means of Public Transport in Fast Growing Cities? Empirical Evidence in the Case of Oslo, Transportation Research Procedia, Volume 1, Issue 1, 2014, Pages 109-120.

[78] T.Brands, E. de Romph, T. Veitch, J. Cook, Modelling Public Transport Route Choice, with Multiple Access and Egress Modes, Transportation Research Procedia, Volume 1, Issue 1, 2014, Pages 12-23.

[79] M. Kilani, S. Proost, S. van der Loo, Road pricing and public transport pricing reform in Paris: Complements or substitutes?, Economics of Transportation, Volume 3, Issue 2, June 2014, Pages 175-187.

[80] K. M. Weber, B. Heller-Schuh, H. Godoe, R. Roeste, ICT-enabled system innovations in public services: Experiences from intelligent transport systems, Telecommunications Policy, Volume 38, Issues 5–6, June–July 2014, Pages 539-557.

[81] J. S. Salcedo, O. C. Battistuti, Unscheduled Public Transport Intelligent Navigation System, Procedia Computer Science, Volume 35, 2014, Pages 614-623.

[82] D. López, A. Lozano, Techniques in Multimodal Shortest Path in Public Transport Systems, Transportation Research Procedia, Volume 3, 2014, Pages 886-894.

[83] C. P. Milioti, M. G. Karlaftis, Estimating multimodal public transport mode shares in Athens, Greece, Journal of Transport Geography, Volume 34, January 2014, Pages 88-95.

[84] Y. Hadas, Assessing public transport systems connectivity based on Google Transit data, Journal of Transport Geography, Volume 33, December 2013, Pages 105-116.

[85] T. Liu, A. Ceder, J. Ma, W. Guan, CBVC-B: A System for Synchronizing Public-transport Transfers Using Vehicle-to-Vehicle Communication, Procedia - Social and Behavioral Sciences, Volume 138, 14 July 2014, Pages 241-250.