

**WestminsterResearch**

<http://www.westminster.ac.uk/westminsterresearch>

**Activity location and mobility costs**

**Nuzzolo, A., Coppola, P. and Papa, E.**

This is an electronic version of a paper presented at *XIX Convegno annuale seminario scientifico Società Italiana Docenti di Trasporto*, Padova, 18-19 October 2012 .

---

The WestminsterResearch online digital archive at the University of Westminster aims to make the research output of the University available to a wider audience. Copyright and Moral Rights remain with the authors and/or copyright owners.

---

Whilst further distribution of specific materials from within this archive is forbidden, you may freely distribute the URL of WestminsterResearch: (<http://westminsterresearch.wmin.ac.uk/>).

In case of abuse or copyright appearing without permission e-mail [repository@westminster.ac.uk](mailto:repository@westminster.ac.uk)



# SIDT2012

XIX Convegno Annuale e Seminario Scientifico della  
Società Italiana Docenti di Trasporti

“La riduzione delle risorse nel settore del trasporto collettivo:  
effetti economici, sociali, ambientali e possibili soluzioni”

Padova 18, 19 Ottobre 2012



con il patrocinio di



DICEA  
Dipartimento di Ingegneria  
Civile, Edile e Ambientale



e con il supporto della





## 18 October 2012 – Auditorium Centro Culturale “Altinate San Gaetano”

Registration (8:00 – 9:30)

Opening (9:30 – 10:00) SIDT President

### Session 1 (10:00 – 11:00) Transportation Planning

**Traffic basins of Calabria region: methodology and application**

PAVONE G., Chilà G., Filella A., Meduri G., Trecozzi M.R.

**LUTI and DEA for simulation and evaluation in urban transport planning**

Musolino G., RINDONE C.

**Strategies to implement a transportation-efficient regional development**

Cappelli A., Libardo A., NOCERA S.

**Public engagement for planning and design transportation systems: tools and experiences**

Cascetta E., PAGLIARA F.

**Towards lean transportation infrastructures: defining value and identifying MUDA**

Cascetta E., DA GIAU A., Furlan A., Macchion L., Vinelli A., ZANOTTO M., Binotto F., Fioratti M.

### Session 2 (11:00 – 12:00) Public Transport

**Key factors affecting rail service quality. A decision tree approach**

DE OÑA R., Eboli L., Mazzulla G.

**The local public transport in Italy: state, prospects and international comparisons**

Cascetta E., PAPOLA A.

**Application aspects of the tram-train system. The case of Brescia**

Maternini G., RICCARDI S., Cadei M.

**Classification of urban settlements and public transport improvement**

Carrese S., SALES A.

**Change to survive: public transport and new technologies for Europe global competition**

CAPPELLI A., Libardo A., Nocera S.

### Session 3 (12:00 – 12:50) Travel Behaviour

**On the attributes and influencing factors of end-users quality perceptions in urban transport: an exploratory analysis**

BARABINO B., Corona G., Deiana E.

**User empowerment and advanced public transport solutions**

FILIPPI F.

**An experimental analysis of the propensity for voluntary travel behavior changes**

Meloni I., SANJUST B., Sottile E.

**The value of aesthetics in railway stations: a quantitative analysis of perceived quality for travellers**

Cascetta E., CARTENÌ A.

Buffet (12:50 – 13:45)

### Session 4 (13:45 – 14:35) Network Design

**Models and algorithms for solving the combined assignment-control problem**

GALLO M., D’Acerno L.

**Stability of traffic lights as dynamic switching systems and sensitivity of the performances**

Di Febbraro A., SACCO N.

**Experimental analysis of the performance of an urban road system: an innovative approach using data envelopment analysis**

FANCELLO G., Uccheddu B., Fadda P.

**Stochastic equilibrium assignment with variable demand: two variables solution algorithm performance and effects of choice models**

CANTARELLA G.E., de Luca S., Di Gangi M., Di Pace R.

### Session 5 (14:35 – 15:35) Sustainable Mobility

**A dynamic simulation based model for optimal fleet repositioning in bike-sharing systems**

CAGGIANI L., Ottomanelli M., Sassanelli D.

**"ELEbici@Roma3": an innovative project for sustainable mobility**

Carrese S., CIAFFI F.

**Strategies to achieve an "ecological airport urbanism": the Venice airport case**

CIPRIANI L.

**An innovative car-sharing system for sustainable mobility in urban area**

Gattuso D., Pietrafesa M., Pudano A., RESTUCCIA A.

**Driving behaviour, slope and vehicle load factor impacts on bus fuel consumption: real case application in the city of Rome**

Carrese S., LA SPADA S.

### Coffee break (15:45 – 16:00)

### Session 6 (15:50 – 16:50) Logistics I

**City logistics planning and urban freight transport modelling: recent trends**

NUZZOLO A., Comi A.

**ITS technologies for logistics. A state of the art**

Gattuso D., PELLICANÒ D.S.

**Trip chain behaviour of commercial vehicles in urban areas: the Parma case study**

TOZZI M., Corazza M.V., Musso A.

**Statistics for simulation of logistic platform**

Gattuso D., CASSONE G.C.

**A DSS for the assessment of city logistics measures**

Nuzzolo A., Crisalli U., COMI A., Rosati L.

### Session 7 (16:50 – 17:25) Logistics II

**A model for reserved lanes design for freight vehicles**

Polimeni A., VITETTA A.

**Mode choice models for the assessment of italian freight transport policies**

Nuzzolo A., CRISALLI U., Comi A., Rosati L., Panico F.

**Indicators for city logistics**

Musolino G., OTTOMANELLI M.

### Session 8 (17:25 – 18:00) Travel Demand I

**Evaluation of travel demand impacts in the case of rail system failures**

D'ACIerno L., Gallo M., Montella B., Placido A.

**Road transport elasticity: how fuel price changes can affect individual traffic demand**

Musso A., PICCIONI C., Tozzi M., Godard G., Lapeyre A., Papandreou K.

**An analysis of a suburban rail demand in the city of Naples**

Biggiero L., CORAPI G.

## 19 October 2012 – Aula Magna “Galileo Galilei”, Palazzo del Bo’

### Session 9 (14:15 – 15:15) Accessibility

**Bus rapid transit vs regular bus system: comparing the impact on urban accessibility by public transport**

Capri S., Ignaccolo M., INTURRI G., Rubulotta E.

**A tool for an evaluation of reachability of an airport area**

CONCA A., Papa F., Rubino S., Vignolo M.G.

**Activity location and mobility costs**

Nuzzolo A., Coppola P., PAPA E.

**New measures of accessibility based on perceived opportunities**

Cascetta E., Carteni A., MONTANINO M.

**Assessing a general method to enhance airport passenger accessibility and resources optimization**

Gualandi N., MANTECCHINI L., Paganelli F., Tagliazucchi C.

### Session 10 (15.15 – 15.50) System Vulnerability

**Ranking links in a road transport network: an application of Spearman’s correlation coefficient**

ANGELINI S., Danesi A., Rossi G., RUPI F.

**Travel time forecasting for vehicle routing: the case of urban evacuation**

MUSOLINO G., Polimeni A., Vitetta A.

**Demand simulation and planning for evacuation conditions**

RUSSO F., Rindone C., Chilà G.

### Coffee break (15:50 – 16:05)

### Session 11 (16.05 – 16:30) System Efficiency

**Energy efficient speed profiles for suburban train operation: a simulation model**

DE MARTINIS V., Gallo M.

**Effects of full automation on technical-economic efficiency in metro systems**

ANTOGNOLI M., Ricci S.

**A model for transit design with choice of vehicle type and energy charging system**

FUSCO G., Alessandrini A., Cipriani E., Colombaroni C., Messina G., Valentini M.P.

### Session 12 (16:30 – 16:55) Road Intersections Analysis

**Warning sound to affect perceived speed in approaching roundabout: experiments with a driving simulator**

Rossi R., GASTALDI M., Biondi F., Mulatti C.

**The analysis of roundabouts through visibility**

MUSSONE L.

**Optimal setting of traffic signals through the artificial bee colony algorithm**

Dell’Orco M., Başkan Ö., MARINELLI M.

### Session 13 (16:55 – 17:20) Transportation System Monitoring

**Annual average daily traffic estimation from seasonal traffic counts**

Gastaldi M., Rossi R., GECHELE G., Della Lucia L.

**A new classification of Italian ports based on the value added concept**

Lupi M., FARINA A.

### Session 14 (17:20 – 17:55) Travel Demand II

**Experimental analysis of day-to-day route choice dynamics in a three-link network without information provision**

MENEGUZZER C., Olivieri A.

**Influence of information on users’ behaviour: a day-to-day model for route choice updating**

DE MAIO M.L., Vitetta A., Watling D.

**The value of en-route information on the accessibility to concurrent transit system services**

GORI S., Nigro M.L., Mannini L.

### Closure (17.55) SIDT President



# ACTIVITY LOCATION AND MOBILITY COSTS

*Agostino Nuzzolo*

*Dept. of Enterprise Engineering - University of Rome "Tor Vergata"*

E-mail: [nuzzolo@ing.uniroma2.it](mailto:nuzzolo@ing.uniroma2.it)

*Pierluigi Coppola*

*Dept. of Enterprise Engineering - University of Rome "Tor Vergata"*

E-mail: [coppola@ing.uniroma2.it](mailto:coppola@ing.uniroma2.it)

*Enrica Papa*

*Dept. of Enterprise Engineering - University of Rome "Tor Vergata"*

E-mail: [enpapa@uniroma2.it](mailto:enpapa@uniroma2.it)

## 1 INTRODUCTION

The paper fits into the general themes of land use - transport planning (Nuzzolo and Coppola, 2008a and 2008b) and accessibility (Geurs and van Wee 2004) in urban areas. It's widely recognized in academia the need for integration between mobility and land use policies in accordance with the objectives of environmental sustainability and quality of life in urban areas (Nuzzolo and Coppola, 2007; te Brömmelstroet and Bertolini, 2011). Furthermore, in recent years travel behaviours are changing in urban areas due to the increase in oil prices, the recession of Western economies, the resulting lack of financial resources for public transport subsidies. For this reasons, technicians and scientists are trying to find solutions in the short and long term to make existing transport system more efficient. In this sense the search for integrated solutions including systems engineering, transport and urban planning is a priority not only in the scientific debate but also in the operative field. Despite an extensive literature on the land use-transport interaction has been produced, simple tools for land - use transport integrated planning are not as much used; in particular tools that can support the choices of location of new activities in the definition of urban or regional plans are not widely applied (Hull et al. 2012).

According to this premise, the goal of the work is to develop a tool to support the choices of activities location, which is based on accessibility and transport costs indicators. Assuming that one of the goal of integrated land use – transport planning is the minimization of generalized transportation costs (Nuzzolo and Coppola, 2010), in compliance with the objectives of environmental sustainability and quality of life, the tool computes the “access cost” of activities, providing an estimation in monetary terms of the advantages and disadvantages of locating an activity in a particular zone of the urban area; the tool provides



also thematic GIS maps of territorial activity access cost, which identify the areas where access costs of located activity are lower.

The article is structured into three parts. The first part offers an overview of the literature on land use - transport planning, accessibility, and activity access cost, while the second part describes the methodology for estimating access cost to activities; in the third part we propose an application of the methodology to the metropolitan area of Rome and some conclusion remarks.

## **2 METHODOLOGY: ESTIMATING THE ACTIVITY ACCESS COST**

The methodology for estimating the “access cost” to activities starts from the consideration that an activity entails itself a mobility cost in relation to the trips it generates. These trips are related to the commuting of the activity’s workers (work trips) and to the flows of users attracted by this activity; for example, a shop attracts trips for purchase purpose. To calculate these costs, the activity demand flows to the zone in question, for various available transportation modes, the flows on the network arcs and its related times and travel costs (transport costs for users) can be estimated through a transportation system model (Cascetta, 2009).

The flows on the network links allow also an estimation of the transport external costs, which constitute an important component of the access cost, connected to:

- Environmental pollution
- Noise pollution
- Energy consumption
- Road accidents.

There are other cost components which are related to the management costs of the transportation system, such as maintenance (and construction) of infrastructures or public transport subsidies; these costs are typically funded by transport agencies and local administrations.

The sum of the three cost components described (transport costs for users, external costs for the community and costs for agencies and administrations) of a zone in a given sector (for example shopping) provide the average access cost to that activity. The access cost will be different for each activity category (shopping, education, services, etc..) because each activity attracts specific trips flows, from different origin zones and with different modal share.

Several types of cost indicators can be calculated, as for example the marginal activity access cost, considering just a single new employee located in the zone and constant the distribution of other activities and the supply of transport services and infrastructure, independently to the location of a new employee in the area. Dividing by the number of employees of an area in a given sector, the average access cost (cost per employee) to the activity of that sector is obtained.

The "access cost" allows the analysis and identification of some critical issues related to the activities locations in the study area and can provide useful information to guide the land use planning process.

### **2.1 The application in the metropolitan area of Rome**

The article proposes the application of the methodology to the metropolitan area of Rome, estimating the access cost to new development areas (centralities) located in different suburban areas, as defined by the new Master Plan of Rome with the aim of decongesting the central area and of creating new functional centers. The measure of the access cost for new activities in "centralities" areas is useful to validate or not the location choices proposed by the Master Plan, from an access cost point of view.

## **3 CONCLUSIONS**

The work provides a useful tool to assess the location choices of new activities, estimating the access cost to urban functions using the existing transport supply. This indicator, which is proportional to the spatial impedance to reach an activity and that takes into account the different cost components (internal and external costs), provides a useful indicator for identifying the best location of a new activity in the study area, to which correspond a suitable access cost. The application illustrates the usefulness of the tool for land use –transport planning processes.

## **REFERENCES**

Cascetta E. (2009) *Transportation Systems Analysis: Models and Applications*, Springer

Geurs K.T., van Wee B. (2004) Accessibility evaluation of land-use and transport strategies: review and research directions *Journal of Transport Geography* 12 (2004) 127–140

Hull A., Papa E., Silva C., Joutsiniemi A. (2012) Discussion on accessibility instruments in Hull A., Silva C., Bertolini L. *Accessibility Instruments for Planning Practice* © COST Office

Nuzzolo A, Coppola P. (2010). Pianificazione dei Trasporti. Paper written for the Italian Encyclopedia of the New Millennium: Istituto della Enciclopedia Italiana Treccani. XXI secolo - L'Universo fisico. p. 545-556 © Treccani, Roma

Nuzzolo A., Coppola P (2008a). Infrastrutture di trasporto e assetto territoriale nell'area metropolitana di Roma. In: Marescotti L. E Mussone L. *Grandi infrastrutture per la mobilità di trasporto e sistemi metropolitani*: Milano, Roma e Napoli. p. 29-53, MILANO: Libreria Clup, ISBN/ISSN: 9 788870 909579

Nuzzolo A., Coppola P (2008b). Livelli di pianificazione integrata trasporti-territorio per uno sviluppo sostenibile delle città del XXI secolo, *I trasporti nella città del XXI secolo: scenari per l'innovazione*. Venezia, Novembre 2007, ROMA: Aracne,

Nuzzolo A., Coppola P (2007). Regional accessibility and socioeconomic activities location: from empirical evidences towards a modelling framework. *WCTR Proceedings*. Berkeley, Giugno 2007, Berkley, CA

te Brömmelstroet M., L. Bertolini (2011). A transition towards sustainable strategy making: integrating land use and transport knowledge types. In J.A.E.E. van Nunen, P. Huijbregts & P. Rietveld (Eds.), *Transitions towards sustainable mobility: new solutions and approaches for sustainable transport systems* pp. 19-40. Berlin: Springer.

te Brömmelstroet M. Bertolini L. (2010) Integrating land use and transport knowledge in strategy-making *Transportation* 37, pp.85–104