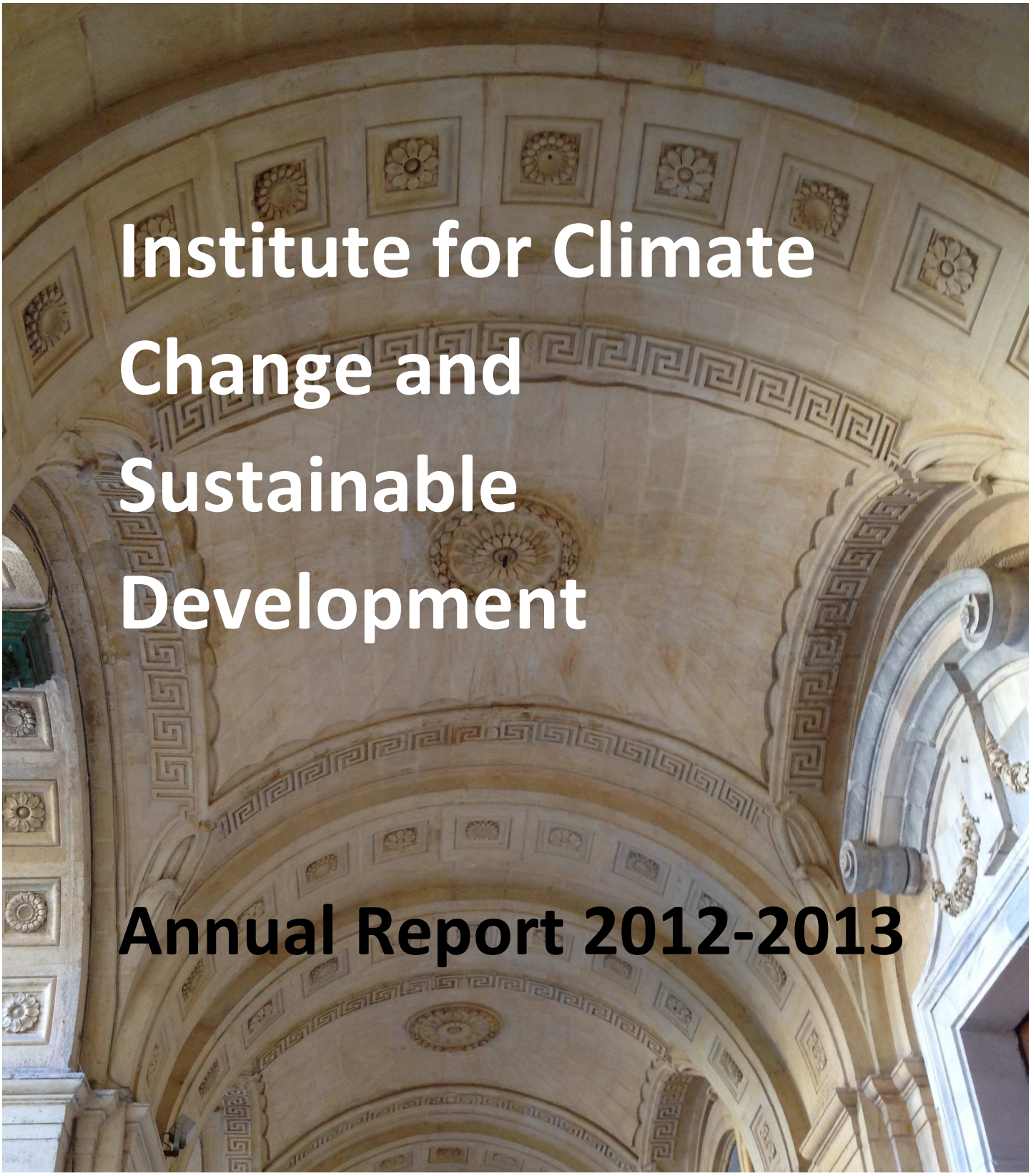


# Institute for Climate Change and Sustainable Development

## Annual Report 2012-2013

University of Malta
L-Università ta' Malta

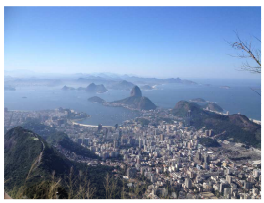
## Foreword

This has been a busy year for the Institute with even greater exposure locally and internationally. We have changed the name of the Institute to include Climate Change, produced more research outputs, obtained international funds for research and set up formal research themes. The report will highlight in detail the events, conferences and fora in which the Institute's members of staff participated actively. Much effort was made in outreach to both government and industry. This work will serve us well for the future in applying for funding under the various programmes. It was also very satisfying to see the Institute, with its partners, being recognized for some of its initiatives in public fora. The Institute welcomed another set of MSc students as well as prepared three students for graduation. The 2013 Graduation Ceremonies will be particularly special since I have been invited by Senate to deliver the oration. In addition we increased the number of staff to support the growing activities and research interests. The collaboration between the Institute and the Cleaner Technology Centre was further intensified with the Institute participating actively in the Centre's events and initiatives. Other projects which the Institute is coordinating, such as the Green Travel Plan, have continued to contribute to a better quality of life on campus.

I take the opportunity to thank our supporters, being the staff at the Institute, industry partners, government and the academic staff that have formally accepted to collaborate with us from the various University departments and international institutions.

**Dr Maria Attard**

Director, Institute for Climate Change and Sustainable Development

## Introduction

The Institute for Sustainable Development was established in 2009. In July 2013, the Institute's remit was extended to include the area of Climate Change. Through a Council decision, the Institute's name was changed to *Institute for Climate Change and Sustainable Development.*

During 2012-2013 the Institute strengthened its research areas, prepared a number of project proposals for funding, and continued with its research efforts to promote interdisciplinarity.

The Board of the Institute met regularly during this year where a number of key decision where taken with respect to the work of the Institute and the development of study programmes and projects.

**THE BOARD OF THE INSTITUTE 2012-2013**

Chairman **Dr Simone Borg**

Vice-Chair and Director **Dr Maria Attard**

Members:

**Prof. Richard Muscat**
**Mr Godfrey Vella**
**Dr Gordon Cordina**
**Prof. Simon Fabri**
**Prof. Alex Torpiano**
**Dr Sandro Lanfranco**
**Dr Ing. Saviour Zammit**
**Dr John A. Schembri**
**Dr Anton Bartolo**

The Director would like to thank the contributions of the Rector, Prof. Juanito Camilleri who served as Chairman until July 2013 and Dr Mario Tabone who served as Council Representative until March 2013.

This report outlines the work and achievements of the Institute for Climate Change and Sustainable Development during the period October 2012 and September 2013.

The change in the Institute name has also been an opportunity to refine the aims of the Institute, to not only include climate change research, but also to focus the remit of the Institute with respect to social sustainability (the lesser studied pillar of sustainable development), and the use of tools for monitoring and analysis for decision making and strategic planning. This will reflect better the interdisciplinary role and function of the Institute within the University and in international research arenas, but also as a think-tank on local policy and an agent for change within our society.

During this academic year the University also set up the Centre for Entrepreneurship and Business Incubation, removing therefore, the responsibility for Science and Technology Entrepreneurship from the Institute's functions.

## AIMS OF THE INSTITUTE

(a) to perform and promote interdisciplinary research on issues related to sustainable development, social sustainability, and climate change including mitigation and adaptation strategies;

(b) to provide consultancy, advice and assistance on sustainable development and climate change including mitigation and adaptation strategies;

(c) to provide continuous education, undergraduate, and postgraduate courses within the scope of the Institute subject to the Statutes and Regulations of the University;

(d) to act as host institution for scholars, professors and chairs of international repute, as well as programmes, networks and fora, that aim to enhance the profile of the Institute within the regional and European research area, in areas related to sustainable development and climate change including mitigation and adaptation strategies;

(e) to use telemetry, IT tools, intelligent systems, and modelling for monitoring, research, decision support and strategic planning;

(f) to engage in knowledge transfer and awareness raising initiatives on sustainable development and climate change with companies, organisations and other institutions outside the University to promote best-practice (e.g. to promote the uptake of cleaner technologies; to mitigate and adapt to impacts of climate change on business operations and markets);

(g) to network and liaise with similar or complementary, university institutions and centres for sustainable development or climate change; and

(h) to disseminate acquired knowledge through online media, publications, seminars, conferences and teaching programmes.

## The University of Malta Institute for Climate Change and Sustainable Development

*The Administrative Office*

During 2012-2013 the Institute was located in Regional Building, Triq l-Imhallef Paolo Debono, outside the University Msida Campus. This temporary office housed the administrative as well as the academic staff, whilst also offering space for interns, students and project work which the Institute maintained and ran throughout the year.

*The Institute's Human Resources*

**Dr Ing. Saviour Zammit** (Lecturer in the Faculty of Information and Communication Technology and previous Head of the Entrepreneurship Unit within the Institute) has now moved on to become the Director of the Centre for Entrepreneurship and Business Incubation. We would like to congratulate Dr Zammit and look forward to collaboration in this exciting and essential field for sustainable development. During this academic year Dr Zammit has continued to contribute to the Institute through his position as member of the Institute's Board.

During this academic year the Institute also engaged a number of Research Support Officers to work on the STREETS project which is funded under the Italia-Malta Programme. **Ms Deborah Mifsud**, **Ing. Luana Chetcuti Zammit** and **Ms Nicolette Formosa** joined the Institute throughout this academic year.

**Ms Thérèse Bajada**, Assistant Lecturer and **Ms Margaret Camilleri Fenech**, Assistant Lecturer (TR4) have continued to pursue their PhD studies, as well as supporting the growth in the Institute's projects, teaching and administration.

**Mr Raphael Mizzi** has continued to work on the Green Travel Plan as well as pursuing his Master's research with the Institute.

### *Staff at the ICCSD*







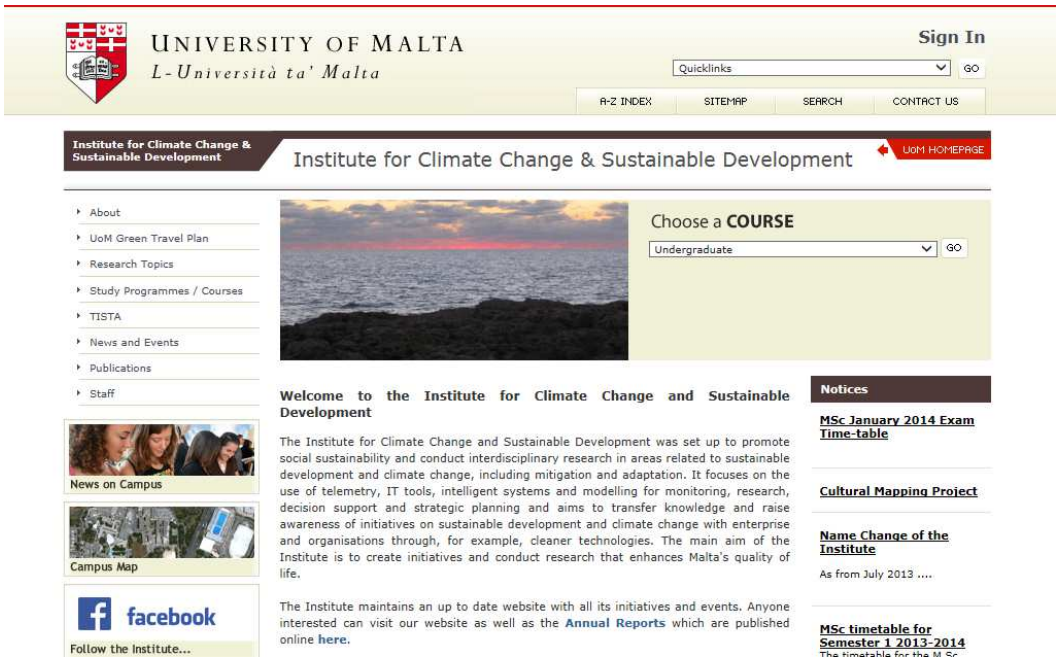

## Community Outreach

*The Institute Website*

The Institute website has continued to act as a medium for communication with the University community and the general public. The Institute's website contains reference to almost all the work that the Institute engaged in since its opening in 2009. Throughout this year, the structure of the website has been changed to reflect the new aims of the Institute.

Sections in the website include:

- The Homepage which provides an introduction to the Institute, the latest news, and direct links to the study programmes (Courses) offered by the Institute;
- An About page containing the link to the Institute Statute and Board
- A UOM Green Travel Plan Initiative page where staff and students at the University can refer to the developments on the University's Green Travel Plan.
- A Research Topics page identifying the three research areas of the Institute: Sustainable Mobility, Cleaner Technology and Climate Change
- A page for the Institute's Study Programme and Courses
- A page providing information about the Institute's Transport Information Systems and Telematics (TISTA) Research Group;
- A News and Events page listing all the news events held and published by the Institute;
    - The ICCSD Conference page has been added to promote and facilitate access to the Conference information;
- A Publications page to showcase the outputs of the Institute and its staff. This link also contains the Annual Reports of the Institute since its inception.
- A Staff page containing the contact details and links to personal pages of the staff compliment of the Institute;



*The Institute in the Media*

The **Institute for Sustainable Development**
National Conference

# Sustainable Mobility in Malta
## Transport Research in Practice

SmartCity Malta, Ricasoli - 30th November 2012

University of Malta
L-Università ta' Malta

The National Conference was covered by a number of newspapers prior to and after the event.

**Times of Malta**
23/12/2012 *Where we must go sustainably*
11/11/2012 *Sustainable mobility in Malta*
01/11/2012 *Transport research in practice event*
**Times of Malta Business Supplement**
01/11/2012 *Transport research in practice event*
**Sunday Times (Technology on Sunday Supplement)**
25/11/2012 *Achieving sustainable mobility through research*

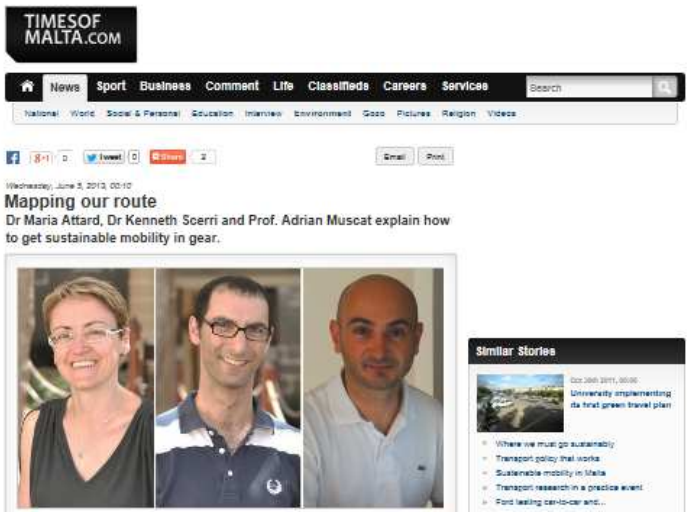
**The Malta Independent on Sunday**
21/10/2012 *First National Conference by the Institute for Sustainable Development*
**The Malta Independent**
18/10/2012 *National Conference on Sustainable Mobility*

**The Malta Business Weekly**
18/10/2012 *First National Conference organised by the Institute for Sustainable Development*

**MaltaToday**
17/10/2012 *SmartCity Malta - Institute for Sustainable Development Conference*

**Mapping Our Route – The Times Environment Supplement 05/06/2013**

*http://www.timesofmalta.com/articles/view/20130605/environment/mapping-our-route.472655*




**Promoting greener travel by encouraging bus use – The Sunday Times 14/07/2013**


As part of the University's Green Travel Plan (GTP), the Institute for Sustainable Development in collaboration with Arriva Malta is sponsoring a free one-week saver card to newly recruited academic and administrative staff of the University.

University GTP coordinator Raphael Mizzi distributed the saver cards and provided route information to the staff. The University's goal is to encourage and support sustainable mobility through the promotion of alternative modes of transport, in this case the bus, thereby decreasing the number of private car trips to and from the University, contributing to better air quality for staff and students around the Msida campus and reducing the need for parking infrastructure through better demand management. For further information, visit www.um.edu.mt/iccsd/greentravel or e-mail greentravel@um.edu.mt

*http://www.timesofmalta.com/articles/view/20130714/environment/Promoting-greener-travel-by-encouraging-bus-use.477886*

*Participation in conferences and events*

**23-24 October 2012 Pre-Waste: Improving the effectiveness of waste prevention policies in EU Territories. Interreg IVC Project Conference**


Ms Margaret Camilleri Fenech delivered a presentation focusing on the relationship between waste and economic growth.

**5-7 November 2012 1st International Conference on Urban Sustainability and Resilience organised by University College London (UCL), London, UK.**

**Dr Maria Attard** delivered a presentation entitled *The sustainability of transport systems in island settings: the case of Malta*. She was also given the opportunity to participate in the poster session.

**12 November 2012 BikePAL Project (European Transport Safety Council)**

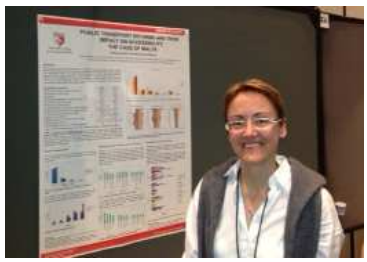
The ICCSD and the Geography Department represented by **Ms Thérèse Bajada** hosted the ETSC (European Transport Safety Council) to disseminate the BikePAL project and encourage students to participate. BikePAL is a three-year pan European project aimed to offer cyclists information, resources and awareness raising experiences to help improve safety on roads.

**30 November 2012 1st National Conference of the Institute for Sustainable Development: Sustainable Mobility in Malta: Transport Research in Practice, SmartCity, Malta.**

Staff and students participated actively in this conference with presentations and posters.

**12-17 January 2013 Transportation Research Board Annual Meeting, Washington, D.C., USA.**

Dr Maria Attard attended this conference with a paper entitled *Effects on service quality following regulatory reforms in public transport in Malta*. She presented a poster, co-authored with Deborah Mifsud entitled *Public transport reforms and their impact on accessibility: the case of Malta*.



**6 February 2013 Faculty of Arts Conference: The New Humanities: Relevance and Renewal in Today's Society, University of Malta, Valletta, Malta.**

**Dr Maria Attard** coordinated and chaired the conference which brought together all the members of the Faculty of Arts, to discuss the strengths and challenges of Arts and Humanities disciplines at the University. She also delivered a presentation entitled *Developing General and Subject Specific Skills and Competences for the Humanities*.

**20 February 2013 D-Air Project Malta Seminar, St George's Bay, Malta.**

Staff from the Institute delivered presentations at the D-Air Project Malta Seminar on various topics related to sustainable mobility. **Raphael Mizzi** and **Dr Maria Attard** delivered a presentation about the Green Travel Plan initiative at the University of Malta, **Thérèse Bajada** delivered a presentation about Travel Planning whilst **Prof. Adrian Muscat** presented his work on shared dynamic taxi systems. The D-Air Project is an EU funded project and the Institute was invited by Transport Malta (project partner) to support the Malta seminar.



**22 February 2013 Waste Minimization Awards organised by the Cleaner Technology Centre, Malta in collaboration with Wasteserv, Rabat, Malta.**

Dr Maria Attard acted as Chair of the Adjudicating Committee alongside Mr Anton Pizzuto, Director of the Cleaner Technology Centre and other members.

**25-27 March 2013 Royal Geographic Society with the Institute of British Geographers (RGS-IBG) Mid-term Conference Post-Graduate Forum *Geographical Transitions*, London, UK**

**Thérèse Bajada** attended and presented a poster entitled *The Case of Malta's Bus Reform: Its Impact on People's Attitudes to Bus Travel and Implications for Policy.*

**10 April 2013 YLE Green Entrepreneurship Conference, University of Malta, Msida.**

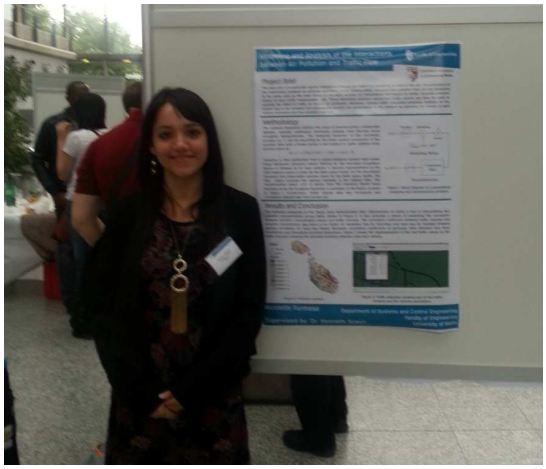
**Dr Maria Attard** delivered a presentation entitled *Understanding the principles of Sustainability***.**

**3 May 2013 GRISI PLUS Seminar, St George's Bay, Malta.**

**Dr Maria Attard** delivered a presentation entitled *GIS and its use in Malta* at the GRISI+ Seminar organised as part of the GRISI+ (Geomatics Rural Information Society initiative PLUS) Project. GRISI+ is funded by the European Union Regional Development Fund under the INTERREG IVC Programme. Dr Attard was invited by the Local Councils Association, partners in the project.


**21-24 May 2013 1st Summer School on Autonomic Road Transport Support Systems: foundations and techniques, Paris Marne La Valle, France.**

**Ms Nicolette Formosa** attended the Summer School. The main aim was to obtain grounding in modelling of road traffic and several techniques being currently used in the implementation of road networks. A poster was also presented which provided an opportunity to meet and share ideas with other early stage researchers in the same field.



**Ms Nicolette Formosa** also presented a poster entitled *Modelling for Marine Pollution* at the Engineering Research Conference in May 2013.

**31 May 2013 Annual Commonwealth Training Programme on Coastal Recreational Resources, Malta.**

The Annual Training Programme is organised by the University's Euro-Mediterranean Centre on Insular Coastal Dynamics (ICOD). **Thérèse Bajada** delivered a presentation entitled *Sustainable Development in Vulnerable Environments: The case of islands.*

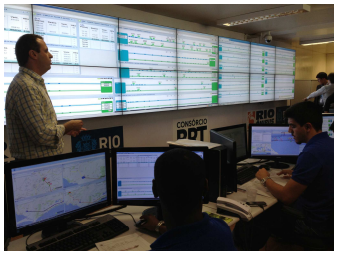
**16-18 June 2013 NECTAR 2013 International Conference Dynamics of Global and Local Networks, Network on European Communications and Transport Activities Research (NECTAR), University of the Azores, Sao Miguel Island, Azores.**

**Dr Maria Attard** and **Ms Thérèse Bajada** actively participated in this bi-annual International Conference. Dr Attard is the co-chair of the Cluster 2 Policy and Environment within NECTAR and coordinated four sessions of the conference. She sat on the Scientific Committee of the Conference as well as presented a paper entitled *Policy development and sustainable transport systems – the case of Malta*. Thérèse Bajada also participated in the conference and presented a paper entitled *The Malta Bus Reform: Implications for policy from a 'natural experiment' of perceived bus service quality & attitudes towards modal shift*.


Dr Maria Attard and Prof. Yoram Shiftan (Technion, Israel) are editing a book from the conference proceedings.

**15-18 July 2013 World Conference on Transport Research (WCTR2013), Rio de Janeiro, Brazil.**

Dr Maria Attard participated at this conference with two single author papers and two co-authored papers. The paper entitled *The performance of Park and Ride within the context of a changing transport infrastructure: the case of Malta* was chosen for inclusion in the Selected Conference Proceedings. The paper entitled *Parking charges versus road user charging: the case of Valletta, Malta* co-authored with Prof. Stephen Ison (Loughborough University, UK) has been selected for inclusion in a Special Issue of the Journal *Case Studies on Transport Policy*. The paper entitled *The Smeed report and road pricing: the case of Valletta, Malta* co-authored with Prof. Stephen Ison was subsequently published in the Bank of Valletta Reviews and the paper entitled *Understanding the performance of the first five years of the Valletta road pricing scheme* was included in the conference proceedings.


**Dr Maria Attard** (fourth from left) at the Conference dinner with other distinguished delegates, including WCTR President Prof Tony May (second from right). Also in the photo, Prof. Greg Marsden (Director of ITS, Leeds), Dr Robin Hickman and Dr John Ward (Bartlett School, UCL) and Prof. Roger Mackett (UCL).

**28-30 August 2013 Royal Geographic Society with the Institute of British Geographers (RGS-IBG) Annual International Conference, London, UK.**

Prof. Adrian Muscat (Faculty of ICT, UoM) and Dr Maria Attard attended the conference and presented a paper which they co-authored with Dr Kenneth Scerri (Faculty of Engineering, UoM) entitled *The feasibility of a Dial-a-Ride Dynamic Shared Taxi System – A case for Malta*.

**17-19 September 2013 Seminar on Sustainable Development for the Postal Union of the Mediterranean, St Julian's, Malta.**

**Dr Maria Attard** delivered a presentation entitled *Research as an opportunity for Sustainable Development.* The International Seminar on Sustainable Development was organised by Maltapost in conjunction with the Postal Union for the Mediterranean (PUMed), Universal Postal Union, La Poste, ILO and UNI Post & Logistics, Malta.

**23-24 September 2013 Horizons for Social Sciences and Humanities Conference, Mykolas Romeris University, Vilnius, Lithuania**

**Dr Maria Attard** was invited to support this conference, organised under the Lithuanian Presidency of the Council of the European Union 2013. Dr Attard delivered a statement about the position and role of Social Sciences and Humanities in the Transport Work Programme for Europe's new funding programme Horizon 2020. She accompanied Prof. Peter Nijkamp (Netherlands), under the chairmanship of Prof. Aura Reggiani (Italy).

Copy of the **Vilnius Declaration** is available at http://horizons.mruni.eu/wp-content/uploads/2013/09/Vilnius-declaration.pdf

**Ms Thérèse Bajada** attended the following events during the period September 2012 to July 2013.

- Seminar on Concept Mapping, University of Malta – This seminar was attended for continued professional development as concept maps are described as a powerful and effective metacognitive tool to help student participation during the learning process.

- Transport Statistics User Group (TSUG) Seminar on Walking with presentations by Prof Miles Tight (Birmingham University) and Ms Fay Tuddenham (DfT).

- Transport Economist Group (TEG) Seminar with presentations on Modelling Smarter Choices by Stephen Joseph (Campaign for Better Transport) and Prof Phil Goodwin (UWE Bristol).

- UCL Space TimeLab Launch Event with a keynote speech by Prof Michael Goodchild.

- CTS (Centre for Transport Studies) Seminar on Inclusive Design of Pedestrian Areas by Dr Catherine Holloway (UCL).

- TEG Seminar on current issues in local bus industry structure and regulation, by Prof Peter White (University of Westminster).

- CTS (Centre for Transport Studies) Seminar on developing education based 'Nudges' to increase cycling, by Dr Talia McCray (University of Texas). Dr McCray presented her research based in Austin, Texas (US) and Glasgow, Scotland (UK) on interventions to encourage bicycle use.

- UCL PAMELA laboratory open day. Ms Bajada attended the open day of the Pedestrian Accessibility and Movement Environment Laboratory (PAMELA) at Tufnell Park, London UK. Research was presented and those present had the opportunity to experience the tools used for related experiments.

**Ms Margaret Camilleri Fenech** attended the following events between March 2012 and June 2013.

- 15th March 2013 Training Session: Mediterranean Eco-Industrial Development organised by Fondazzjoni Sir Temi Zammit

- Workshop entitled 'Islands as catalysts for sustainable innovation and economic development', organised by the North Sea Commission as part of the European Maritime Day, May 21st – 22nd May.

- Seminar for the Educational Campaign to promote energy saving in the Domestic Sector organised by the Malta Resources Authority 27th May 2013;

- Public Lecture on Environmental Compliance organised by the Department of Biology and the Institute of Earth Systems 21st June 2013

- In July 2013 Ms Camilleri Fenech prepared and presented the formal position of the Institute with regard to the Issues Paper *Towards Sustainable Waste Management,* published for consultation by the Ministry for Sustainable Development, the Environment and Climate Change (MDEC).

**Ms Deborah Mifsud** attended the following events between November 2012 and June 2013.

14th-15th November 2012 Transport and Ageing Research Summit – TRACY Conference – Committee of the Regions, Brussels, Belgium.

Ms Mifsud was invited to attend this conference in view of her Master research into elderly mobility. The TRACY Project was funded by the European Commission's Seventh Framework Programme. The project's main aim was to develop an action plan that can help tackle the challenges of providing transport in an ageing society. The conference provided a forum for constructive exchange on the political challenge and opportunities of an ageing European society, the state of the arts and analyses in EU27 and preparatory steps for the development of an action plan including guidelines and recommendations for specific research topics and future transport strategies.


29 March 2013 Seminar on Sustainability in Industrial Areas organised by Fondazzjoni Temi Zammit in Attard, Malta

10 April 2013 COST Kick-Off Meeting Action TU1209 (Transport Equity Analysis: Assessment and integration of equity criteria in transportation planning), Brussels, Belgium

10 June 2013 Seminar on Active Ageing, organised by the National Commission for Active Ageing at The Palace Hotel, Sliema, Malta

# Sustainable Mobility in Malta

## Transport Research in Practice

SmartCity Malta, Ricasoli - 30th November 2012

In November 2012 the Institute organised its first national conference on Sustainable Mobility. Over 80 participants attended the full-day conference which brought together academics, government and industry to discuss various aspects of sustainable mobility research.

The morning session was opened by Mr Manuel Delia (Ministry for Infrastructure, Transport and Communications) whilst the afternoon session was opened by the Hon. George Pullicino, Minister for Resources and Rural Affairs.

Two international keynote speakers were invited for the conference.

**Stephen Ison**, Professor of Transport Policy and Director of the Centre for Innovative and Collaborative Construction Engineering (CICE), Loughborough University, UK

Dr Stephen Ison is Professor of Transport Policy and Director of the Centre for Innovative and Collaborative Construction Engineering (CICE) in the School of Civil and Building Engineering at Loughborough University. An economist by training, he has extensive experience of research in traffic demand management, surface access to airports, transport policy and sustainable transport. He has published some 85 referred journal papers and over 90 refereed conference papers. The book edited by Ison and Rye entitled 'The Implementation and Effectiveness of Transport Demand Management Measures: An International Perspective, was published in 2008. He is co-editor of the Journal of Research in Transportation Business and Management (Elsevier), Associate Editor of Transportation Planning and Technology (Taylor and Francis), Co-editor of the book series Transport and Sustainability (Emerald) and a member of the Editorial Board of the Journal of Transport Policy. He is a member of the Scientific Committee of the World Conference on Transport Research Society and Chair of the WCTRS Special Interest Group (SIG10) on Urban Transport Policy. He is a member of the Ground Access and Transportation and Sustainability Committees of the Transportation Research Board (TRB), Washington D.C.

**His presentation was entitled *Acceptance of road pricing: Lessons from past experience***

**Cathy Macharis**, Associate Professor of Transport Economics and Operational Research at MOSI – Transport and Logistics, Vrije Universiteit Brussel, Belgium

Cathy Macharis is Professor at the Vrije Universiteit Brussel. She teaches courses in operations and logistics management, as well as in transport and sustainable mobility. Her research group MOBI – (Mobility, Logistics and Automotive Technology) is an interdisciplinary group focusing on sustainable logistics, electric and hybrid vehicles and travel behaviour. She has been involved in several regional, national and European research projects dealing with topics such as the location of intermodal terminals, assessment of policy measures in the field of logistics and sustainable mobility, electric and hybrid vehicles, etc. She is the chairwoman of Brussels Mobility Commission.

Website: www.mobi.vub.ac.be

**Her presentation was entitled *Market potential of electric vehicles: ready for takeoff?***

Other presentations were made during the conference and these included:

**Dr Maria Attard**, Institute for Sustainable Development, UoM - *The performance of Park and Ride within the context of a changing transport infrastructure: the case of Malta*

**Ms Thérèse Bajada**, Institute for Sustainable Development, UoM - *Modelling Public Perception of Modal Choice: the case study of a bus reform in Malta*

**Mr Peter Paul Barbara**, ITS Directorate, Transport Malta - *Electro Mobility in Malta*

**Ms Luana Chetcuti and Dr Ing. Kenneth Scerri**, Department of Systems and Control Engineering, Faculty of Engineering, UoM - *Eliciting a Data-Driven Bayesian Hierarchical Model for Traffic Flow in Malta*

**Dr Angelo Dalli**, Traffiko - *Computer Vision Technology for Traffic Junction Safety*

**Dr Christoph Demuth**, CONNECTBALTICA and Tallinn Technical University, Tallinn, Estonia - *CONNECTBALTICA A platform for research and collaboration in transport*

**Perit Odette Lewis**, Department of Civil and Structural Engineering, Faculty of the Built Environment, UoM - *Road Transport Information Sharing: A stakeholders' network analysis*

**Prof. Adrian Muscat**, Department of Communications & Computer Engineering, Faculty of ICT, UoM - *Demand Responsive Public Transport Systems: An Alternative to the Private Car?*

**Mr Alfred Quintano**, Institute for Tourism, Travel and Culture, UoM - *Low Cost Carriers: The Malta Experience 2005-2011*

**Prof. Emmanuel Sinagra**, Department of Chemistry, Faculty of Science, UoM - *Diurnal Cycles of Traffic Related Pollutants in Msida*

A number of posters were prepared and exhibited. These included:

James Cassar - Effectiveness of green travel planning measures: a case study of students' travel behaviour at the University of Malta, Msida Campus

Rebecca Pirotta - Mobility amongst Maltese children and youths: an in-depth study on transport mode choice

Deborah Mifsud - Public transport as a tool towards sustainable mobility for the elderly population

Nicolette Formosa - Assessment of traffic simulation software

Annalisa Farrugia - Towards sustainable development in the Maltese Islands: Using GIS to manage air quality

Nicolette Formosa - Modelling and analysis of the interactions between air pollution and traffic flow

Maria Attard - The Sustainable of Transport Systems in Island Settings: the case of Malta

Raphael Mizzi - Implementing a Green Travel Plan for the University of Malta

Rosalie Camilleri - Nitrogen Dioxide in the Local Atmosphere in Relation to Road Transport

Svetozar Hegyi - Automatic system for data acquisition and real time processing of traffic data: a case study

Roads and Infrastructure Directorate (RID), Transport Malta - Road Infrastructure in Malta: Opportunities for Research

## Cleaner Technology

As the relationship grows between the Institute for Sustainable Development and the Cleaner Technology Centre, the Institute supported a number of activities organised by the Cleaner Technology Centre.

**Events**

Following facilitation by the CTC a Memorandum of Understanding between the Regional Activity Centre for Cleaner Production of the Catalan Waste Agency (CP/RAC), the CTC and the Procurement Directorate of the University of Malta was signed by the Rector Prof. Juanito Camilleri and Mr E. de Villamore in October-November 2012. The MOU stipulates that the Procurement Directorate of the University of Malta and CP/RAC agree to cooperate with respect to the project entitled *Sustainable Procurement in the Mediterranean Universities* which has the objective to promote sustainable public procurement through capacity building, networking and assistance on the implementation in Malta. The project shall also promote the exchange of experiences between Mediterranean universities, strengthening the exchange of methodology, know-how, experience and instruments.

At the end of October 2012, and as part of the implementation process of the project "**Greening of the University**" the CTC organised the first workshop for senior procurement directorate staff. This was held over 2 days and the objective was to introduce the concept of sustainable public procurement. The lecturers came from the Autonomous University of Barcelona and CP/RAC.

In January 2013 a second 3-day workshop was organised by the CTC in connection with the above project, this time for all the Procurement Directorate staff. Apart from lecturers from CP/RAC and AUB there was also a presentation from an official of the Directorate of the Environment outlining Malta's Public Procurement Policy. At the end of the Workshop a Draft Procurement Policy for the University was produced and presented to the Rector for the University's approval and subsequent implementation.

During the period under review the CTC in conjunction with WasteServ organised the **2nd Waste Minimisation Awards**. This scheme was launched at a specially organised seminar on Waste Minimisation with the presentation ceremony taking place in February 2013. The awardees were chosen by an adjudicating committee under the chairmanship of Dr Maria Attard. The specially designed trophies manufactured partly from recycled glass were presented by Perit Ben Farrugia. Ms Margaret Camilleri Fenech acted as Secretary to the Adjudicating Board.

In the last week of June 2013 the CTC launched the **7th Environment Award for Industry (Enterprise) scheme**. The applications closed at the end of August 2013. This bi-annual award seeks to acknowledge and reward those organisations whose efforts are to minimise their environmental loading through their activities, which merit recognition. An adjudicating committee is appointed to assess all the applications and the award ceremony usually takes place in November/December. Awardees are eligible to participate in the European Business Environment Award Scheme run by the EU commission. Ms Margaret Camilleri Fenech acts as Secretary to the Adjudicating Committee


**Representations**

In May 2012 Anton Pizzuto, as member of the Steering Committee of the European Business Environment Award, was invited to attend the Award ceremony in Brussels.

In November 2012 Anton Pizzuto was invited to participate in a seminar entitled *Waste management past, present future* organised by GreenSkips Ltd to celebrate their 20th Anniversary.

In December 2012 Anton Pizzuto attended the Steering Committee Meeting of the European Business Environment Award Scheme in Rome. He also attended the Italian Environment Award Ceremony held under the auspices of the Italian Chamber of Commerce.

In June 2013 Anton Pizzuto was invited to form part of the official Maltese delegation to the 15th Meeting of the Mediterranean Commission for Sustainable Development. This was held in Malta between the 10 - 12 June with the theme *A strategic process to consolidate the Mediterranean's world leading role in the shift to Sustainable patterns of Consumption and Production*.

Between the 17 and 21 June Anton Pizzuto attended the joint meeting of the National Focal Points for Cleaner Production and the National Focal Point for the UNEP Mediterranean Action Plan, held in Barcelona.

**Other activities**

In 2012 Anton Pizzuto was appointed member of the Impartiality Committee of the Malta Competition & Consumer Affairs Authority.

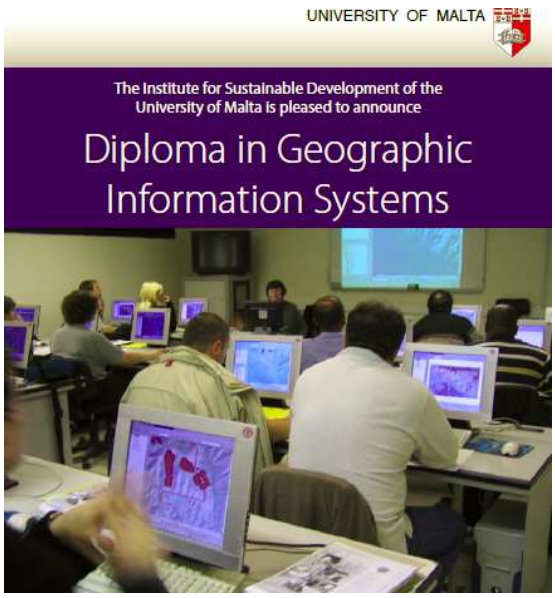
In March 2013 Anton Pizzuto was appointed member of the selection board by the PSC for the promotion of Advanced Allied Health Practitioners.

In April 2013 Anton Pizzuto and Margaret Camilleri Fenech organised a study visit to the Maghtab Waste Management Facility for final year students of the Diploma in Env. Health.

In July 2013 Anton Pizzuto was appointed member of the electoral commission to organise, conduct and monitor the election of seven members on the Council for Professions Complementary to Medicine.

## The Institute's Study Programmes

### *The Diploma in Geographic Information Systems*




The Diploma in Geographic Information Systems is the first opportunity for formal training for those interested in developing skills in this very specialised discipline. This is a part-time (evening) course over six semesters and falls under the Get Qualified funding scheme where students get financial support to undertake their studies.

**YEAR ONE**
ISD1100 Basic Skills in Geographic Information Systems (Lab Practicals) 6 ECTS
ISD1101 Basic Concepts of Geographic Information Systems 4 ECTS
ISD1102 Introduction to Geographic Information 4 ECTS
ISD1103 Introduction to Geographic Analysis 4 ECTS
ISD1104 Introduction to Database Management Systems for GIS 4 ECTS
ISD1105 Remote Sensing and Applications 4 ECTS
ISD1106 Mobile Geographic Information Systems 4 ECTS

**YEAR TWO**
ISD1203 Intermediate Skills in Geographic Information Systems (Lab Practicals) 6 ECTS
CRM1001 Geographic Information Systems and Crime Mapping 4 ECTS
ISD1200 Geovisualisation 4 ECTS
ISD1201 Programmable Aspects of Geographic Information Systems 4 ECTS
ISD1202 Cartography and Digital Mapping 4 ECTS
ISD1204 Geographic Information Systems and Geodemographics 4 ECTS
ISD2205 Geographic Information Systems and Databases 4 ECTS

**YEAR THREE**
ISD2000 Long Essay 8 ECTS
ISD2305 Advanced Skills in Geographic Information Systems (Lab Practicals) 6 ECTS
ISD2301 Web Mapping 4 ECTS
ISD2302 Geographic Information Systems in Transportation 4 ECTS
ISD2303 Managing Geographic Information Systems 4 ECTS
ISD2304 Advanced Geographic Analysis and Mapping 4 ECTS

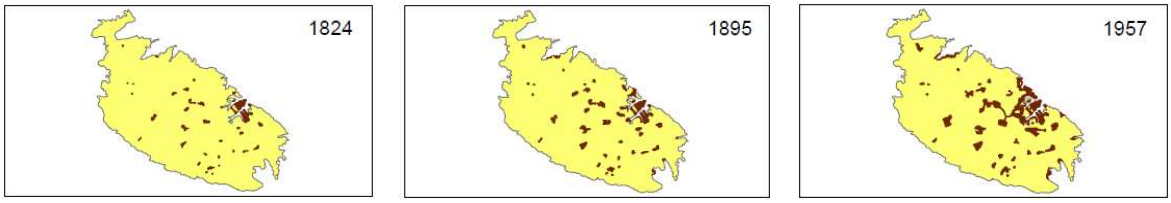
## *The Diploma in Sustainable Land and Real Estate Management*

The Diploma in Sustainable Land and Real Estate Management is an interdisciplinary study programme bringing together the main aspects related to land and estate management. The study programme is designed in such a manner as to effectively develop skills and knowledge required by land managers to understand the complexities of rural and urban management and development. The study programme includes a number of study units aimed at the teaching of basic concepts of economics, law, geography, environment, finance, planning, management, architecture, marketing, ICT tools and statistics. This is a part-time (evening) over six semesters.

**YEAR ONE**
CVL110 Law of Ownership and Property Law Relating to Sustainable Estate Management 4 ECTS
MGT1013 Fundamentals of Management 4 ECTS
ISD1110 Principles of Sustainability 6 ECTS
ECN1003 Introductory Economics for Land and Real Estate Management 4 ECTS
GEO1042 Socio-geographic Aspects of Land Management 4 ECTS
ISD1108 Geographic Information Systems for Land Management 4 ECTS
ISD1109 Quantitative Techniques for Land Management 4 ECTS

**YEAR TWO**
CVL1109 Legal Anthropological Perspectives on Land, Property and the Environment 4 ECTS
GEO1041 Urban and Rural Geography 4 ECTS
RFS1400 Rural Policy and Land Use Management 6 ECTS
EMP1201 Impact Assessment and Monitoring 4 ECTS
LIN1063 Academic Reading and Writing in English 2 ECTS
MRK1011 Introduction to the Marketing Concepts 6 ECTS
SPI1011 Development and Spatial Planning 4 ECTS

**YEAR THREE**
BKF2200 Real Estate Finance 4 ECTS
CIS1043 Information Systems for Land Management 4 ECTS
CNM1041 Property Valuation 4 ECTS
ERL1000 Principles of Environmental and Development Planning Law in relation to Estate Management 4 ECTS
MGT1052 Leadership and People Management 4 ECTS
ISD1205 Project 10 ECTS



## *The Postgraduate Certificate in Geographic Information Systems*

The Postgraduate Certificate in Geographic Information Systems covers the principles of the Geographic Information Science, such as spatial databases, programming, remote sensing and digital cartography and the technology supporting Geographic Information Systems such as principles, management and applications. It is a part-time (evening) course over two semesters.

**YEAR ONE**

ISD5001 Principles of Geographic Information Systems 5 ECTS
ISD5002 GIS and Databases 5 ECTS
ISD5003 Applying GIS (Lab Practicals) 5 ECTS
ISD5004 Geographic Information, Remote Sensing and Digital Cartography 5 ECTS
ISD5005 Managing Geographic Information Systems 5 ECTS
ISD5006 Programming in GIS 5 ECTS

## *The Master of Science by Research (Sustainable Development)*

The Master of Science (Sustainable Development) is a research programme enabling researchers to focus on a variety of topics to be studied in depth through full-time or part-time study. The study programme is over three semesters or equivalent in part-time.

Research conducted by MSc students is outlined in Annex 1.

| **YEAR ONE** |
| --- |
| ISD5100 Dissertation 80ECTS |
| ISD5101 Research Methods 5ECTS |
| ISD5102 Principles of Sustainability 5ECTS |

*Student Intake 2012-2013*

| **Student** | **Dissertation Title** |
| --- | --- |
| Ms Elaine Pace (Full-time) | Analysis of Sustainable Development in Malta using a Multi Criteria Model<br>Supervisor: Dr Maria Attard |
| Ms Sara Hazzard (Full-time) | Towards Sustainable Transport Options: Analysing a Modal Shift to decrease dependency on personal car use in Malta<br>Supervisor: Dr Maria Attard |
| Mr Raphael Mizzi (Full-time) | Enhancing the Parking Scheme of the University of Malta through the use of Transport Demand Measures<br>Supervisor: Dr Maria Attard<br>Co-supervisor: Ms Thérèse Bajada |

## New Research Activity

The Institute has continued to work on the projects awarded in the previous year. It has also succeeded to submit and participate in project proposals, both locally and abroad. Table 1 shows the projects which were developed by the Institute and its partners and the outcome of the funding applications.

**New Project - Powered by Island Festivals**

This project, entitled *Powered by Island Festivals focusing on Malta, Samsoe (DK) and Vlieland (NL) Island regional creative Festivals for a joint practice based development and exchange programme contributing to the EU 2020 vision via Distributed Innovation* is presently being conducted together with the Province of Fryslan in The Netherlands and it involves the examination of various festivals, their impact on the environment and the various innovative actions taken by the festival organisers, with regard to the environment. The research included a two week visit to the island of Samsoe in Denmark which is known as the energy island because its energy supply is provided 100% through renewable sources (wind energy).

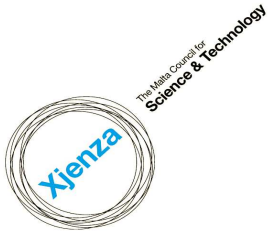
The research was developed during a visit in May 2013 by Professor Han Brezet from Delft University, Simon Tisjma from the Province of Fryslan and a number of other people. An informal meeting was conducted at the Senior Common Room at the University of Malta with Mr Anton Pizzuto whereby various possibilities of collaboration were discussed.

The innovative Nabro (Neigh) bridge placed in Viby Rengvej as part of the 2010 Neighbours Festival (Aarhus Festival, Denmark). The bridge can be used both by pedestrians and bikers to facilitate passage to a nearby school and to date is still in place and used regularly by students.

Table 1. Proposals for funding applied for during the period 2012-2013.

| **Funding Programme** | **Title of Project** | **Project Partners** | **Outcome and Value** |
|---|---|---|---|
| UOM R&I | Transport Models: Capacity Building and Application Potential for Malta (YR2) | Dr Maria Attard, Institute for Climate Change and Sustainable Development; Dr Kenneth Scerri, Faculty of Engineering, Dr Adrian Muscat, Faculty of ICT | NOT AWARDED |
| UOM R&I | Measuring Sustainable Development in Malta | Dr Maria Attard, Institute for Climate Change and Sustainable Development | NOT AWARDED |
| MCST R&I Programme | IShare | Dr Ing. Adrian Muscat, Dr Ing. Saviour Zammit, Dr Maria Attard University of Malta; Pierre Mallia, IMovo | NOT AWARDED |
| ERA Chair Pilot Call | Mitigation and Adaptation Programming for Climate Change (MAP-CC) | Dr Maria Attard, Institute for Climate Change and Sustainable Development | Awaiting result of awarding body |
| Intelligent Energy Europe – STEER | SEAM Islands | ARDITI (PT), AREAM (PT), RAEE (FR), FernUni (DE), CPMR (BE), CMF (PT), HF (PT), ICI (IS), **UoM (MT)**, UniSS (IT), UniCA (IT), INE (IS), LM (CY) | Awaiting result of awarding body |
| Fryslan Province, The Netherlands | Powered by Island Festivals | University of Malta, Delft University, Province of Fryslan | EUR5,000 |
| SIMIT | Costituzione di un sistema integrato di protezione civile transfrontaliero italo-maltese. | Dr Pauline Galea, Department of Physics (Lead), Prof. Alex Torpiano, Faculty of the Built Environment, Dr Maria Attard, Institute for Climate Change and Sustainable Development | EUR2.4M<br>UoM Contribution EUR370,000 |
| V18 Cultural Mapping | Mapping of Cultural Infrastructure | Dr Maria Attard, Institute for Climate Change and Sustainable Development | EUR30,000 |


University of Malta
L-Università ta' Malta




## On-Going Projects


STREETS (STRatEgia IntEgrata per un Trasporto Sostenibile Italia-Malta) is a 3-year project partly financed by the EU under the Operational Programme Italia-Malta 2007-2013. The project aims to contribute to the improvement of the transport and to enhance the integration of multi-modal transport between Sicily and Malta, in support of the TEN-T corridor 5. This will be developed through a joint mapping of the transport network, aiming at an improved internal/external accessibility, while overcoming the current bottlenecks identified between the two islands. The project aims to develop a web-GIS platform by collecting geo-referenced data about the transport system, while making it available to the Public Administration of the involved territories. This will in turn enhance the quality and safety standards and the communication with citizens and stakeholders.

STREETS involves six partners, with the leading partner being the Dipartimento Regionale Delle Infrastrutture, della Mobilità e dei Trasporti di Sicilia, together with Collegio Universitario ARCES, Vittoria Local Council, Catania Port Authority, University of Malta (coordinated by Dr Maria Attard) and Transport Malta.


The University of Malta, represented by the Institute for Climate Change and Sustainable Development is responsible for the joint mapping of the transport system between Malta and Sicily, amongst other tasks.

The University is leading the team to draw up a detailed analysis to investigate the urban road access to the port of Malta and its traffic flows in and out of the port area of Catania and Malta. A map will be developed to provide efficient connections between the ports, land and air transport, superimposed on a topographic map of the Maltese Islands. An analysis of the road supply-demand relationship within the traffic network between the two islands will also be analysed and will serve as a unified strategy between Catania and Malta.

A detailed analysis will be carried out to determine current territorial problems, any economic and social issues, or critical infrastructures or strategies currently in action. Guidelines will be established for efficient flow of origin-destination passengers and goods within a certain time schedule.

Intermodal means of transport connecting Malta and Sicily will be identified while keeping in mind the short-medium and long-term infrastructures and services currently available to provide an integrated logistics platform within the Sicilian-Maltese environment.

An analysis of what data is required to efficiently capture the flow of passengers and goods between Malta and Sicily will be investigated. This will also incorporate analysis of the data available from local operators or surveys to be distributed to passengers, to capture the flow of passengers and goods between the two islands.

To enhance the working progress between all project partners, several meetings are planned to take place. The first Steering Committee meeting took place in Palermo on the 7 - 8 March 2013, with the Institute for Climate Change and Sustainable Development being represented by Dr Maria Attard, Project Coordinator, Ms Boglarka Toth, Project Administrator and Ms Deborah Mifsud, Research Support Officer. During the meeting, the project partners were introduced and presentations were made about the project's strategic activities. The project is set to be launched later in 2013.


Project co-financed by the European Union – European Regional Development Fund

## Student Quality of Life Research collaboration

The Institute for Climate Change and Sustainable Development is collaborating with the Geography Department at the University of Malta and the Geography Department at the University of Innsbruck on research into the Quality of Life of students. This research is based on a methodology developed by Prof. Lars Keller one of the leaders of the project. Other members in the project include Dr John A. Schembri (Geography), Dr Maria Attard (Geography, ICCSD), Ms Thérèse Bajada (ICCSD), Mr Andrea Pace (graduate of the MSc Sustainable Development programme). A questionnaire was developed and distributed to University of Malta students.

Prof. Lars Keller has been the beneficiary of Erasmus Mobility Funds to visit Malta for the past three years and develop this collaboration. In 2013 it is expected that the mobility is reciprocated with a visit by Dr Maria Attard to Innsbruck.

Further research and a publication are expected in 2013-4.

**Assessment of key success indicators for the Public Transport Reform in Malta**

Following the agreement reached between the Institute for Climate Change and Sustainable Development and Transport Malta in 2010, work has continued on this project. The project aims to collect information about success indicators for public transport and analyse their progress over a period of five years. Key indicators include emissions, travel time, bus journey time and reliability and customer perception of the bus service. This project will see the Institute carry out surveys throughout the five year period (2011-2016) and produce reports analysing the data and comparing them temporally. This project is also being complemented with student research and publications.

**Travelling Smart – The Green Travel Plan Committee at the University of Malta**

Following from last year Dr Maria Attard continues to chair the Green Travel Plan (GTP) Committee which aims to implement the University Green Travel Plan approved in 2011. Mr Raphael Mizzi, the GTP Coordinator within the Institute is the administrator of the GTP work as well as secretary to the GTP Committee.

The GTP Committee for 2012-13 was made up of:

| | |
|---|---|
| Dr Maria Attard (Chair) | Perit Christopher Spiteri (Director Estate & Works) |
| Mr Joseph Camilleri (Precincts Officer) | Ms Nathalie Cauchi (UHM) |
| Mr Mario Cachia (President, KSU) | Mr Henry Aquilina (Office of Human Resources) |
| Prof. Luciano Mulé Stagno (UMASA) | Ms Thérèse Bajada (Travel Plan Expert, ICCSD) |
| Mr Raphael Mizzi (Secretary) | |

During 2013 a number of initiatives were undertaken by the GTP Coordinator in order to improve travel to the University.

***Cycling***

With respect to cycling, a geographical analysis of the location of bicycle racks around the campus was carried out by the GTP Coordinator. Some of the bicycle racks were relocated and new locations were identified to improve access for students and staff.

Leaflets produced by the Bicycle Advocacy Group entitled "*A pocket guide to safe cycling in Malta*" were disseminated around University to increase safety awareness, along with other cycling promotional posters and stickers.


In October 2012, on the 'Monthly Safety Tip' newsletter, Mr James Wightman, PRO of Bicycle Advocacy Group (BAG), acknowledged the increase of the number of cyclists at the UoM especially with the access of more showers and facilities.

On 12 November 2012, the Institute for Climate Change and Sustainable Development in collaboration with the Geography Department of the Faculty of Arts hosted the European Transport Safety Council (ETSC) to give a talk to students about the BIKE PAL project. The lecture was chaired by Ms Thérèse Bajada, Assistant Lecturer at the Institute for Climate Change and Sustainable Development and the speaker was Mr Mircea Steriu, Communications Officer at ETSC.

The BIKE PAL project is a three-year pan European project. Its aims are to offer cyclists a package of information, resources and awareness raising experiences to help improve safety on roads. The project is divided in four stages, which involve:

- A scientific review and country ranking

- Lectures to Universities across the European Union

- BIKE PAL camp

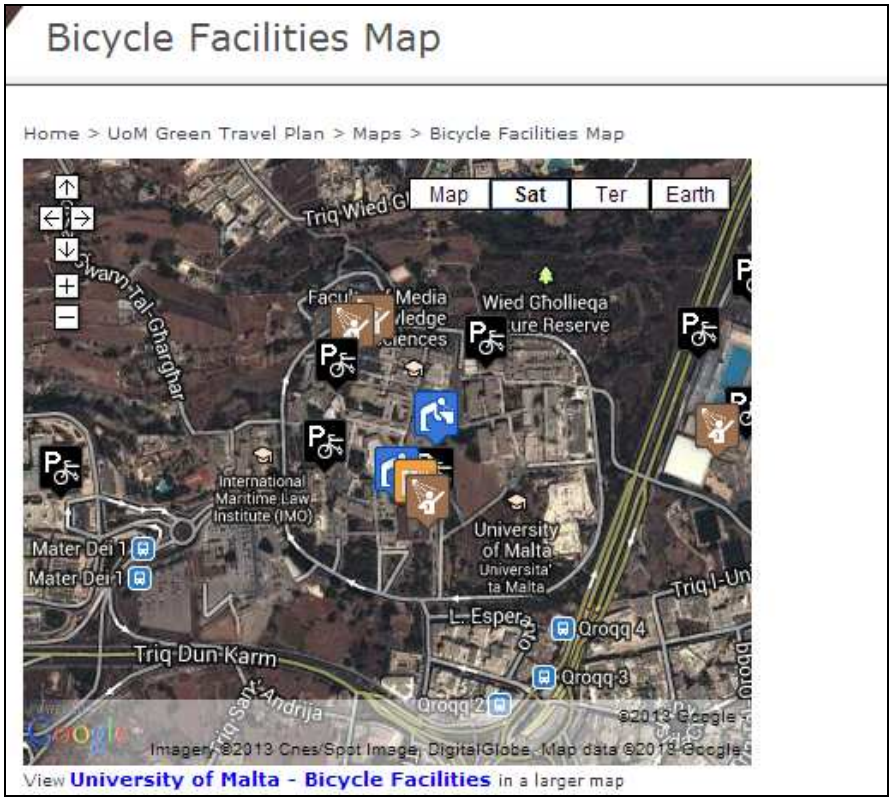
- European BIKE PAL competition and projects evaluation

Similar to their fellow counterparts across the EU, UoM students now have the opportunity to submit project ideas regarding cycle safety to the ETSC. The ETSC will invite the best teams from across the EU and students will be able to participate in the BIKE PAL safe cycling camp in Brussels. More information about the project is available from the ETSC website: http://www.etsc.eu/bike-pal.php

In March 2013 the GTP Committee requested the Work Resources Funds Committee to consider supporting the purchase of cycling equipment for staff from WRF funds. In May the Committee received a positive reply and a new sub-category in the WRF application for staff included the 'Purchase of an Adult Bicycle & Cycling Equipment', and allocated the sum of EUR235 for the purchase of one adult bicycle and EUR120 for cycling equipment.

In order to celebrate the Bike to Work Day a small group of University employees together with the GTP Coordinator teamed up to cycle from their home to the UoM. Bike to Work Month and Bike to Work Day were celebrated on 8 May 2013. The main message is that when the number of cyclists increases on the road, accident figures usually go down. People feel safer and therefore cycle more.

In parallel to these initiatives, the GTP Coordinator collected useful information for cyclists such as the location of showers, lockers and bicycle racks and displayed this data on an interactive Google map. This map was subsequently uploaded on the UoM website.



***Pedestrian Safety***

The GTP Coordinator is collaborating with technical experts at Transport Malta to redesign the University ring road and produce a traffic management scheme, which will ensure that safety standards are achieved in the ring road for both cars and pedestrians. Regular surveys are carried out to highlight and remediate obstruction for pedestrians such as overgrown trees and illegal parking. Appropriate measures are undertaken by the Precincts Office.



Mr Mizzi attended a lecture delivered by Mr Tim Pharoah, a transport and urban planning consultant organised by 'Kamra tal-Periti' on 12 June 2013.

***Public Transport***

Links have been established with ARRIVA Malta, the national public transport operator to provide information about public transport for University staff, students and visitors. A number of promotional posters have been distributed to all faculties to increase the visibility of public transport information.

In July 2013 the Institute for Climate Change and Sustainable Development in collaboration with ARRIVA Malta sponsored a free one-week saver card to newly recruited academic and administrative staff of the University. Mr Raphael Mizzi distributed the saver cards and provided route information to the new staff members.

In February 2013 the GTP Coordinator conducted a customer satisfaction survey about public transport services at the UoM. The sample included 338 students who regularly use the bus to commute to and from the University. Mr Mizzi presented the results to ARRIVA Malta. Results of the survey can also be found at https://www.um.edu.mt/iccsd/greentravel/research/public_transport

***Other GTP initiatives***

The Institute for Climate Change and Sustainable Development was invited by Transport Malta to give presentations during a meeting of the D-Air project. The project meeting in Malta looked at sustainable mobility projects and research in Malta. Mr Mizzi contributed to this meeting by sharing his experience with the GTP at the University. The ICCSD has been identified as a stakeholder in terms of the goals of the D-Air project and Mr Mizzi was subsequently invited to the first stakeholders' forum meeting on 4 June 2013.


A slight increase in motorcycles was also noticed at the University. Two designated parking areas were allocated in Car Park 5, which is a safe and central location and adequate to accommodate staff and students who make use of this alternative mode of transport.

***Outreach***

In order to maintain communication throughout the University community, the Green Travel website (http://www.um.edu.mt/iccsd/greentravel) is updated on a regular basis with useful information and links about green travel to University. Currently the GTP Coordinator is working on a "Custom Travel Information" website which will provide various transport options to both students and staff on how to reach University. Further useful links and information will be made available through this website and publicised from time to time internally within the University community.

**Implementing a Green Travel Plan at the University of Malta**

Raphael Mizzi B.Sc. (Bus. & Comp.), P.G. Cert. GIS., GTP Coordinator
Institute for Sustainable Development, University of Malta

University of Malta
L-Università ta' Malta

**Abstract**

There is general consensus on the role of Green Travel Plans (GTPs) to achieve sustainable mobility. The University of Malta published its first Green Travel Plan in 2011 and has committed itself to implement and encourage campus wide practices that contribute to the achievement of sustainability goals specifically were related to mobility of its staff and student population. Mobility studies were undertaken by the Institute for Sustainable Development over the period 2010-11 to understand the travel behaviour of the university population and it was evident that the main objective of the first GTP would be to reduce the car dependence exhibited by many that travel to university by promoting alternative transport. A Green Travel Plan Coordinator has been appointed in 2012 and a number of measures have already been implemented to encourage staff, students and visitors to use public transport, cycling, carpooling and walking. This poster presents a summary of the GTP and highlights some of the measures already undertaken at the University of Malta Msida Campus.

TRAVELLING SMART

Percentage of participants

Car driver | Bus | Car Passenger | Walk | Bicycle | Motorcycle/Scooter

Transport Mode

Safer infrastructure has been installed in Wied Għollieqa which is a main pedestrian route for staff and students living in the San Gwann/Kappara area.

Arriva were present on Fresher's week and students had the opportunity to apply for the Saver Card and top it up instantly with SmartCard. Arriva stand included also a Questions Desk and leaflets with route information.

Collaboration with technical experts from Transport Malta to re-design the University ring road and produce a traffic management scheme that will ensure safety standards for both cars and pedestrians.

GTP Committee is looking at means to facilitate car-pooling amongst staff and students, through the development of a web facility.

**Benefits of car-pooling:**
- Less traffic congestion
- Improved air quality
- Reduce fuel costs
- Make new friends

Relocating and installing new bicycle racks to increase visibility and accessibility.

Promoting intermodal transportation

Geographic Information Systems (GIS) software was used to map the current bicycle rack locations and identify new places by performing a buffer analysis.

The work of the Green Travel Plan Committee was also presented in poster format at the Institute's National Conference on Sustainable Mobility.

***Flexibility & Tele-Working***

In the latest Collective Agreement the University approved the Tele-Working Policy for the Administrative, Industrial and Technical Staff. The document is published online on the UoM Human Resources website at https://www.um.edu.mt/hrmd/secure/supportstaff/CollectiveAgreement.pdf (pg. 118-138). This can be considered as a great milestone in reaching the UoM GTP goals as it gives employees the flexibility of working from home, thus, reducing transport costs by reducing vehicular travel.

**Transport Information Systems and TelemAtics (TISTA) Research Group**

The TISTA Group continued its collaboration during the academic year 2012-13 with an application for funding under the MCST R&I 2012 Programme and the University R&I programme. Despite being unsuccessful, the team continued to strengthen its main areas of research, and through the employment of new research officers, new areas of research have been developed.

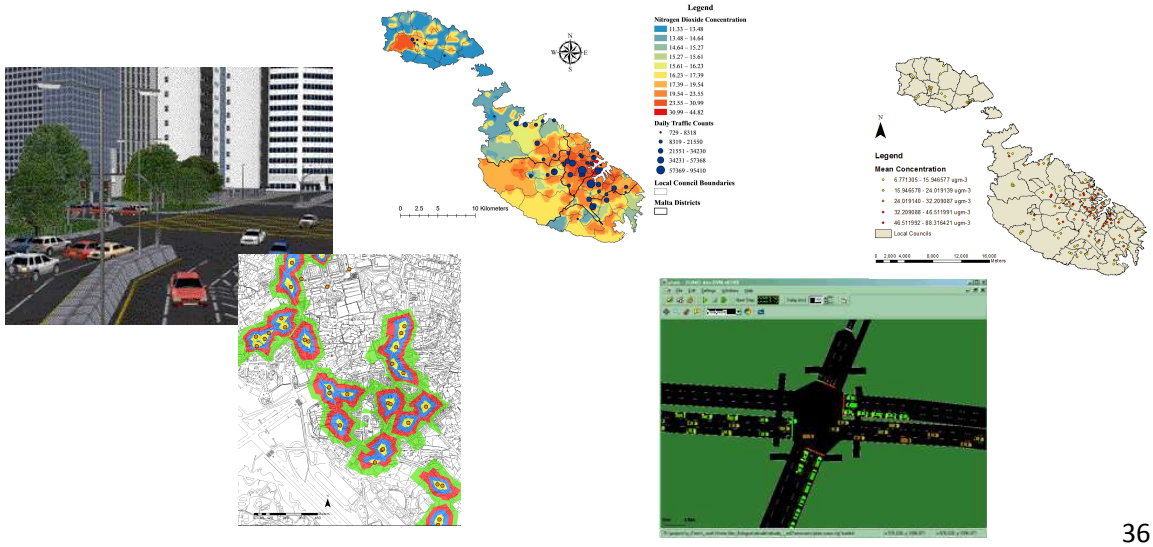
During this academic year collaboration was also initiated with Dr Frank Bezzina from the Department of Management in FEMA. Dr Maria Attard and Dr Frank Bezzina have used the Household Travel Survey data to establish gender difference in travel behaviour in Malta. The work will be subsequently presented at the 4th Women's Issues in Transportation (WiiT) International Conference in Paris in 2014.

Prof. Adrian Muscat, Dr Maria Attard and Dr Kenneth Scerri continued with the work on Demand Responsive Transport and delivered a presentation about the research at the Royal Geographical Society Annual Meeting in London in a special session dedicated to *New Paradigms in Conceptualising Shared Mobility* (http://tgrg.wordpress.com/2013/09/17/new-paradigms-in-conceptualising-shared-mobility/#more-279) as well as at the EC Malta Representation Office in Valletta during their seminar on *Eco-sustainability aspects of the Country-Specific Recommendations for Malta*. Further work on the final publication is underway.

The research contributions of Ing. Luana Chetcuti Zammit and Ms Deborah Mifsud, for their Masters dissertations, have also been published in Xjenza, the Journal of the Malta Chamber of Scientists.

In order to reach out to the community, the team has also contributed to local press and media in several occasions. This was done with the aim of increasing awareness of transport research but also to highlight the valuable contributions of University research in practice.

The vibrant collaboration between this interdisciplinary team is very encouraging and further engagement with industry and government is envisaged to not only reach out but also to support national policy.



**Participation in International Scientific Committees**

Academic members of staff of the Institute have participated and contributed to a number of scientific committees and conferences during the period under review.

**Ms Thérèse Bajada** acted as paper reviewer for the UDMS (Urban Data Management Society) 2013 in December 2012. UDMS symposia are forums where development of information systems for local authorities are presented and discussed.

At the WCTR Conference in Rio in July 2013, **Dr Maria Attard** was appointed co-chair of the Special Interest Group (SIG) 10 on Urban Transport Policy. The World Conference on Transport Research Society (WCTRS) is organised in a number of SIG's that are also responsible for organising mid-term conferences. Dr Attard has offered the SIG10 Committee to organise and host the 2015 mid-term conference in Malta. The proposed title of the conference will be *Transport and Climate Change*.

**Dr Maria Attard** coordinated Cluster 2 session at the NECTAR 2013 International Conference on *Dynamics of Global and Local Networks,* organised by NECTAR (Network on European Communications and Transport Activities Research) in St Miguel, Azores Islands (Portugal) between June 16-18, 2013. Proceedings from the conference are being edited with Prof. Yoram Shiftan (Technion University, Israel) in a book on sustainable urban transport published by Emerald under their Transport and Sustainability Book Series.

During the period under review **Dr Maria Attard** acted as paper reviewer to a number of academic journals including the Journal of Transport Geography (Elsevier), ICE (Institute of Civil Engineers) – Transport (ICE) and Transportation and Research Part A: Policy and Practice (Elsevier).

## Other Initiatives

*Participation in COST*

In the period under review, **Dr Maria Attard** continued to serve as member of the Transport and Urban Development Domain Committee within COST. Other members of the Institute or affiliated academics have participated in COST Actions and events.

**Dr Maria Attard** and **Dr Vincent Buhagiar** (Faculty of the Built Environment) were members of a COST Action TU0803 Cities Regrowing Smaller - Fostering Knowledge on Regeneration Strategies in Shrinking Cities Across Europe (CIRES) which came to an end in September 2013. Dr Attard is co-editing a book from this Action.

**Dr Maria Attard** continued to act as DC Rapporteur on the COST Action TU1102 Towards Autonomic Road Transport Support Systems (ARTS) (2011-15). **Dr Kenneth Scerri** and **Ing. Luana Chetcuti Zammit** (Faculty of Engineering) are the MC members on this Action. Both are represented in the TISTA research group at the University.

**Dr Maria Attard** and **Dr Matthew Montebello** (Faculty of ICT) continued to participate in COST Action IC1203 ENERGIC (European Network Exploring Research into Geospatial Information Crowdsourcing): software and methodologies for harnessing geographic information from the crowd (2012-17).

**Ms Thérèse Bajada** and **Ms Deborah Mifsud**, both from the Institute for Climate Change and Sustainable Development, joined COST Action TU1209 Transport Equity Analysis (TEA) as MC members.

**Ms Nicolette Formosa** attended the Summer School organised by the COST Action TU1102 Towards Autonomic Road Transport Support Systems (ARTS) in 2013.

During academic year 2011-2012 Dr Attard attended several COST events:

- TUD Domain Committee Meeting, Vienna 12-13 March 2013

- COST Action TU1102 Autonomic Road Transportation Systems Prague MC Meeting 20-21 March 2013 (Rapporteur)

- TUD Domain Committee Meeting and Annual Progress Conference, Rijeka, Croatia 3 - 6 July 2013

- TUD Domain Committee Meeting, Brussels 9 – 10 September 2013

## Staff Publications for 2012-13

1. **Chetcuti Zammit, L., Scerri, K., Attard, M. and Bajada, T.** (2013) Computationally Efficient Estimation on High-Dimension Autoregressive Models – with Application to Air Pollution in Malta. In Xjenza Online Vol. 1, Issue 1. Available online: http://issuu.com/maltachamberofscientists/docs/xjenza-2013-1-1?e=6159151/1970157#search

2. **Mifsud, D. and Attard, M.** (2013) The role of public transport in addressing sustainable mobility in the elderly population in Malta. In Xjenza Online Vol. 1, Issue 2. Available online: http://issuu.com/maltachamberofscientists/docs/xjenza_-_october_2013/1?e=6159151/5642662

3. **Schembri, J.A., Attard, M.** *In press* The Foreigner Counts: a spatio-temporal analysis of occupiers, immigrants and expatriates in Malta. Arts & Humanitas: Journal of Arts and Humanities.

4. **Ison, S.G., Attard, M.** (2013) The Smeed Report and Road Pricing: the case of Valletta, Malta. Bank of Valletta Reviews. Vol. 47(Spring) pp 1-23.

**Ing. Luana Chetcuti Zammit** was runner up of the Present Around the World Competition (PATW 2013) Malta, organised by the Malta Group of Professional Engineering Institutions (MGPEI). A 10-minute presentation entitled 'Scrap your car?' was given at the Radisson Hotel on 28th February, 2012, presenting some of the research findings related to traffic and air pollution spatio-temporal modelling results for Malta.

---

**Participation in Local and Community Events**

Dr Maria Attard delivered presentations at a number of seminars on Sustainable Development. These seminars, organised by the Centre for Development, Research and Training (CDRT) within the Office of the Prime Minister and funded through the European Social Fund, aimed at raising awareness about sustainable development. These seminars were aimed for the general public service (all scales), middle and senior management.

Dr Maria Attard contributed to local debates on sustainable development on radio through programmes such as “Ghandi xi Nghid” conducted by Dr Andrew Azzopardi on the 20th April 2013 with the theme “Mill-MEPA sal-Land Reclamation”.
http://andrewazzopardi.org/ghandi-x-nghid-radio-show/

Dr Attard was also invited to monitor the development of an office building in Ta’ Xbiex that aimed to adopt sustainable and green practices in planning, construction and management. The development, Quantum House, was eventually nominated by the Chamber of Architects for the 2013 European Mies van der Rohe Award.

Ms Margaret Camilleri Fenech was invited to make an intervention on the 26th March 2013, to primary school children of St Therese College in Sta Venera about waste management in Malta, as part of the school’s efforts in the Comenius Programme.

Kulleġġ Santa Tereża
PARVA PARVORUM PULCHRA

Education and Culture DG
Lifelong Learning Programme

## Annex 1

**Research Article: The role of Public Transport in addressing Sustainable Mobility for the Elderly Population in Malta**

by Deborah Mifsud B.A. Hons (Melit.), M.Sc. (Melit.)

One main goal of sustainable mobility is to meet the travel demands and needs of the population. One major demographic group which has specific mobility needs is the elderly population. Globally those over 60 years, currently amounting to 800 million people (11 per cent of the global population) will increase to two billion in 2050 representing 22 per cent of the global population (Bloom et al., 2011). The last Maltese census preliminary report (2011) showed that the number of elderly people in Malta over 65 years of age was 67,841, representing 16.3 per cent of the whole population, compared to 13.7 per cent in 2005. Projections reveal that the elderly population in the Maltese Islands shall increase by 72 per cent in 2060 when compared to this segment of the population in 2010 (NSO, 2011). Therefore, with such a continuous increase in the elderly people, it is fundamental to analyse their mobility needs because as Hess (2009) comments such growth will challenge the transport and urban planners to provide equal travel opportunities that support independence.

Any form of sustainable mobility requires the need to promote travelling by an accessible and reliable public transport (Gutierrez et al., 2011). The elderly people are one of the "transport disadvantaged groups" in society which refer to people that use public transport because they have no other choice due to various factors, mainly age, disability, income and no access to private means of transport (Beimborn et al., 2003). Hence, one main contribution of public transport is to potentially minimise social exclusion and increase social justice for those in need (Farrington and Farrington, 2005). Lucas (2012) in Figure 1 explains the interrelationship between transport disadvantage and other key issues that can lead to social exclusion.

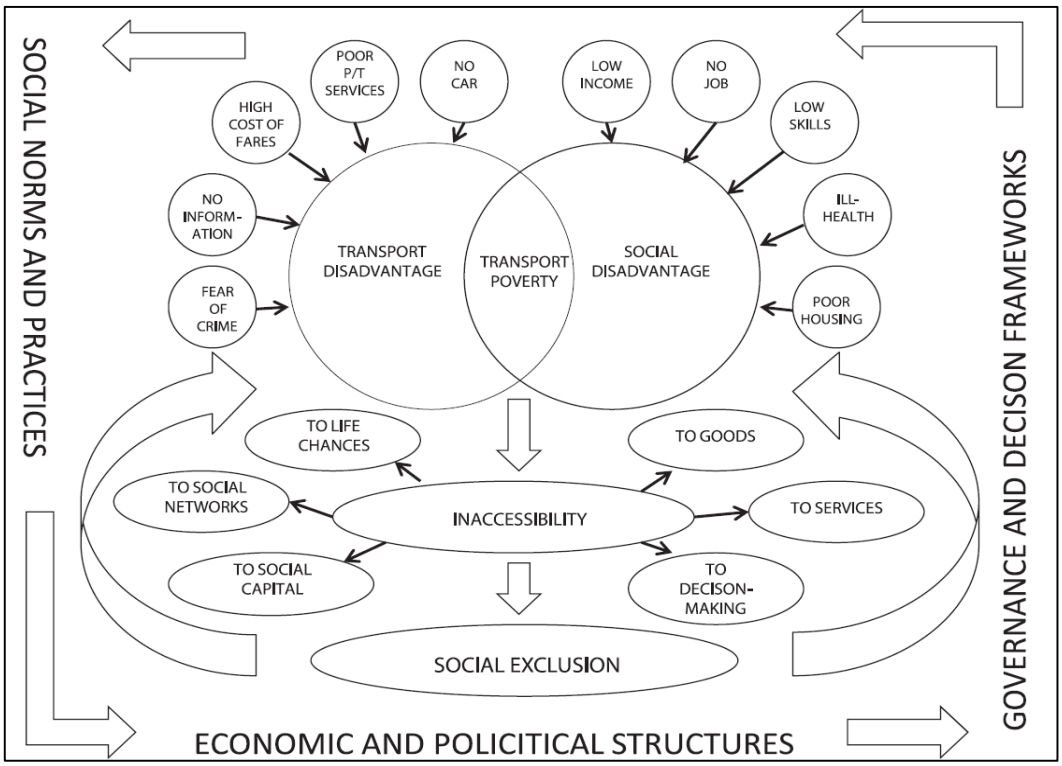



**Figure 1: The relationship between transport disadvantage, social disadvantage and social exclusion (Source: Lucas, 2012)**

Consequently, accessible and reliable public transport is essential to provide the necessary mobility for the transport disadvantaged elderly. Marsden et al. (2007) describe that for older people the travel itself and the feeling of freedom it produces, are often more important than the actual destination. Consequently, lack of access to transport among older persons is accompanied by social isolation, lower self-esteem, feelings of uselessness, loneliness, unhappiness, low levels of physical activity, reduced independence and depression, which contribute to further poorer health conditions and risks (Victor et al., 2005; Hess, 2009). Shergold and Parkhurst (2010) explain that public transport, in the form of buses, is a key measure to support social sustainability as it helps to avoid social exclusion.

However, public transport is not always a reasonable substitute for private transport for the older people (Hess, 2009). The use of public transport by the elderly is negatively affected by several reasons such as physical limitations, lack of accessibility (e.g. absence of low floor buses, dangerous busy roads and high curbs), fear of falling, safety matters, bus design, bus driver behaviour, and declining quality of public transport systems (Wixey et al., 2005; Marsden et al., 2007). Also, public transport is often oriented towards commuters travelling during peak hours for work.

In this research, the relationship between the two research areas of the study (i.e. elderly people and public transport accessibility) was tackled through the analysis of spatial and temporal accessibility together with the analysis of barriers that elderly encounter when using public transport. Spatial and temporal accessibility (the first and third research question respectively) are two main factors that affect public transport usage (Murray and Wu, 2003) and which fit into the multidimensionality of accessibility as a means to measure equity (Tribby and Zandbergen, 2012). However, good accessibility is usually hindered with several barriers. For this reason, the second research question dealt with highlighting these obstacles (and whether they are leading to social exclusion) and in providing suggestions to minimise them.

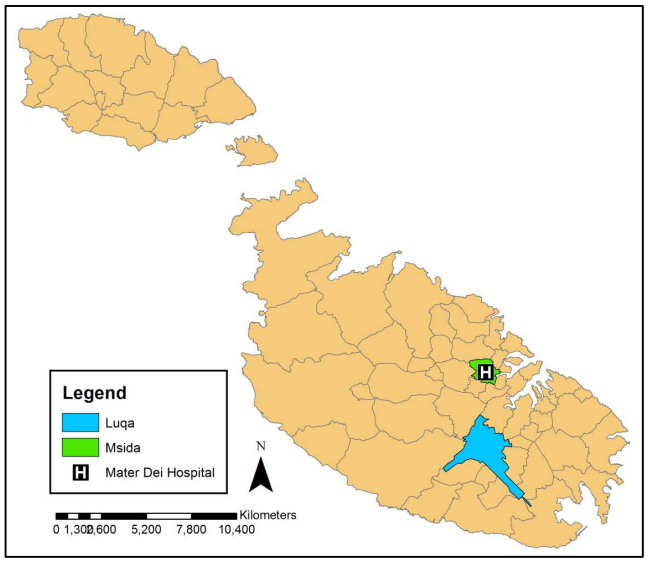
This research project used Luqa, a town in the South East of Malta as its case study and the State's general hospital, 'Mater Dei' Hospital located in Msida as the targeted destination for analysing temporal accessibility to hospital (Figure 2). The latter was chosen as the destination for the third research question because with ageing and the related health issues, one of the very common travel purposes for elderly people is to obtain medical care (Fuchs, 1999).

The main data collection methods used were telephone surveys to the elderly, geographic positioning system (GPS), travel time and bus frequency surveys. Eventually the IBM Statistics 20 Software was used to carry out the main statistical analysis. The Pearson Chi-Square Statistical Test was used to analyse the relationship between various variables and the Kruskal Wallis Statistical Test was used to statistically analyse the effect of proximity to bus stop on public transport use. The ArcGIS 10 Software (particularly the Network Analyst Extension) was used both as a visualisation and as an analytical tool. The main secondary sources were the Melitensia Section at the University of Malta, the National Statistics Office (namely census and transport statistics reports), MEPA topic papers, Electoral Commission Register and Word Wide Web.

The study confirmed that the elderly population in Luqa was also transport disadvantaged with only 35.5 per cent possessing a driving licence. In addition to this, 12.5 per cent of the males and 35 per cent of the females who held a valid driving licence did not own a car. Sixty-six per cent of the transport disadvantaged elderly were weekly-bus users. This confirmed their high dependence on public transport. Nonetheless, this study also showed the high car availability because although 85.5 per cent of the elderly in Luqa did not own a car, they had access to one. In fact, the elderly population in this research study was quite mobile and the two main travel purposes were shopping and medical care. The modes of transport used were walking and by car, respectively. The bus was mainly used by the older old, particularly by females for medical purposes. Therefore, the study showed that mobility only reduced with age.

The research established that the three main determinants affecting public transport use amongst the elderly people in Luqa were age, health condition and car availability. The latter two issues together with long waiting times were indeed amongst the highest reasons given by the non-public transport users for not using this mode of transport. It was indicated that the gender, status and household type of the elderly did not affect their public transport use.

**Figure 2: The location of Luqa and Mater Dei Hospital in Msida (Source: Drawn by author)**




Spatial accessibility is one of the primary determinants of public transport use and only in the presence of such accessibility will a user consider other factors such as cost, comfort and security (Beimborn et al., 2003). It is nearly universally accepted that a 400 metres walking distance to the nearest bus stop is the maximum distance that people of all ages are willing to comfortably walk to access public transport (Murray and Davis, 2001; Zhao et al., 2003). However, these figures are not applicable to the local context due to the small size of the Maltese Islands. The average service area distance for Malta to access a bus stop is only of 150 metres (MEPA, 2003). Obviously, this issue is more critical for the elderly population due to their age and related physical constraints. The literature review showed that the distance decay notion applies to public transport patronage as the latter decay exponentially with increased walking distance from the bus stop (Biba et al., 2010; Gutiérrez et al., 2011). Nonetheless this research highly contrasted this fact.

Both when analysed statistically and spatially, proximity to bus stops did not affect public transport usage among the elderly population in Luqa. The Kruskal Wallis p-value read 0.239, which indicated that the mean duration (in minutes) to reach the nearest bus stop did not vary much between the elderly people who use public transport daily, weekly, infrequently and never. In order to analyse this issue spatially, the Network Analyst Extension in ArcGIS10 was used to create the pedestrian network and eventually formulate service areas based on distance impedances. This determined whether elderly living closest to bus stops were frequent bus users or not (Figures 3). It resulted that the highest percentage of all elderly people fell within the 200 metres service area, meaning that for most of the elderly population in Luqa, the 150 metres national threshold was exceeded. Moreover 66 per cent of the frequent bus users were also within the outer buffers which showed that proximity was not a crucial determinant for public transport use. Therefore through statistical and spatial results it was concluded that proximity to bus stops was not a determinant factor affecting public transport use for the elderly population in Luqa.

With reference to the second research question of the study, the research showed that 72 per cent of the elderly people in Luqa encountered barriers when using public transport. The two most common barriers were long waiting times followed by high criticism on the bus stops' infrastructure and comfort. These two issues are highly correlated to each other especially for the older adults waiting in different weather conditions. Other drawbacks mentioned were the frequency of the buses and the fact that bus stops are located too far away from home. When neighbourhood barriers were analysed, a considerable percentage (37 per cent) of the frequent users also complained that bus stops are not well distributed to cater for the needs of users from different zones and are also difficult to access due to traffic passing by. Therefore, although proximity did not result to significantly affect public transport use, it was highly criticised by the elderly. Other barriers were buses not sticking to schedules, the lack of accessibility, non-updated and inaccessible travel information, lack of safety, fear to travel alone and inappropriate driver

behaviour (Figure 4). Nonetheless these barriers were not the main reason leading to social exclusion. The main issues that limited the elderly population's mobility were related to their age and health.

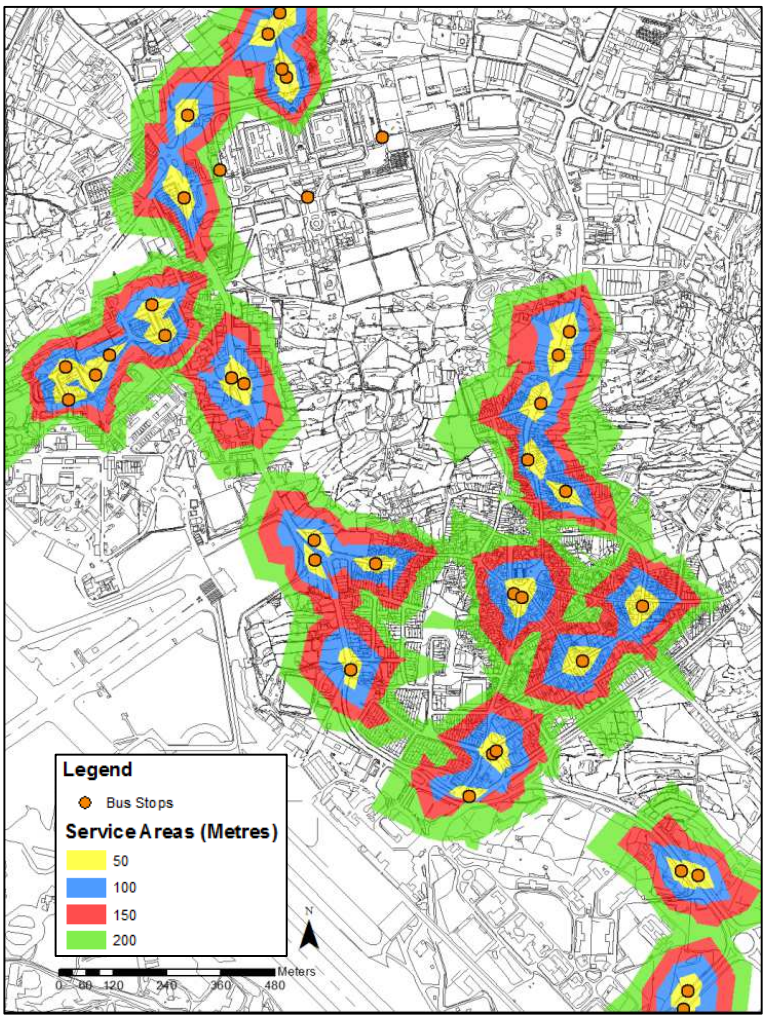



**Figure 3: Distance in metres (50, 100, 150, 200 metres) around the bus stops in Luqa and Hal Farrug (Source: Drawn by author)**

Another issue which is highly interrelated to spatial studies is temporal accessibility. The frequency of the bus service and for how long the users are willing to wait, are indispensable considerations to attract people to use public transport (Polzin et al., 2002). Travel time is in fact one of the most important transport costs, hence time savings are one of the vital benefits of transport projects both for the operators and users, particularly in a region trying to foster a modal shift to public transport (Newman and Kenworthy, 1999). Additionally, although healthier than European average, in 40 years' time in Malta the elderly can reach up to 108,000, of which 20 per cent are expected to require hospitalisation. Hence, in line with the third research question, the dissertation studied temporal accessibility by bus for elderly in Luqa to Mater Dei Hospital (which covers a distance of around eight kilometres). Indeed, medical trips together with shopping were the two most common purposes why elderly people in Luqa travel. In this study, the desired time budget of 64 per cent of the elderly was of 20 to 30 minutes. However, all the routes from Luqa to Mater Dei Hospital exceeded this time budget. The shortest route was Route 117 with an average travel time of 36.7 minutes in the peak hours and 35.3 minutes in the off-peak hours. This was followed by Route 118 and 135.

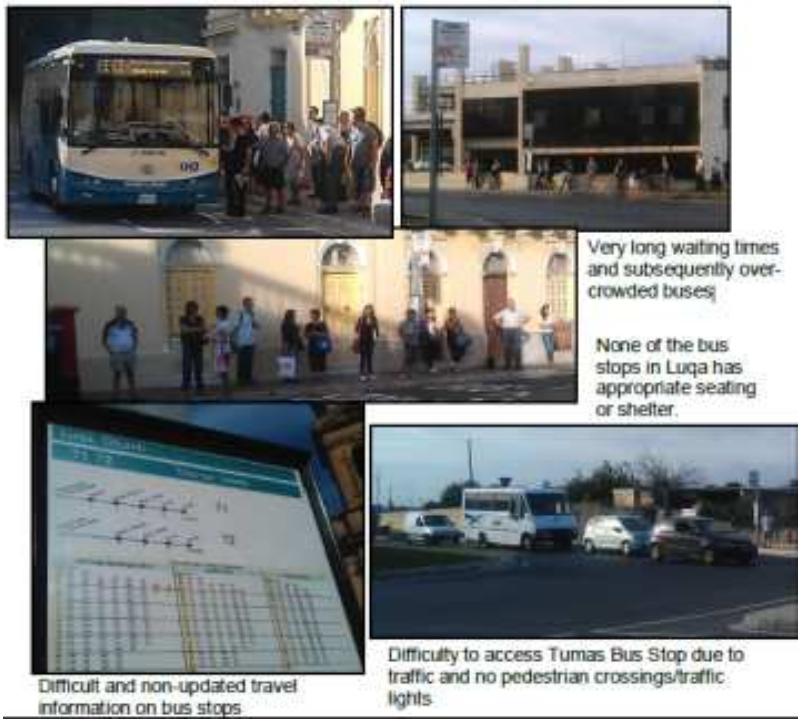



**Figure 2: Some of the barriers encountered in Luqa when using public transport (Photos taken by author, 11th October 2012)**

This showed that the direct routes to hospital provided a shorter travel time than those which involved an interchange. The longest route was route X4/210 (involving an interchange at Marsa Park and Ride) which exceeded the one hour travel time. Subsequently, when travel time was analysed cumulatively, the common pattern that emerged from all routes was that the highest amount of time spent, was in waiting on the bus stops particularly at the Marsa Park and Ride Interchange (Figure 5). The main reason for long waiting times at this interchange was not just the delay, but the lack of coordination between the schedules of the routes arriving and those departing from the interchange. Ultimately, the bus frequency surveys showed that only few routes operated according to the published schedules (mainly Route 117). Most routes, particularly Route X4 arrived early, delayed or failed to pass (Figure 6).

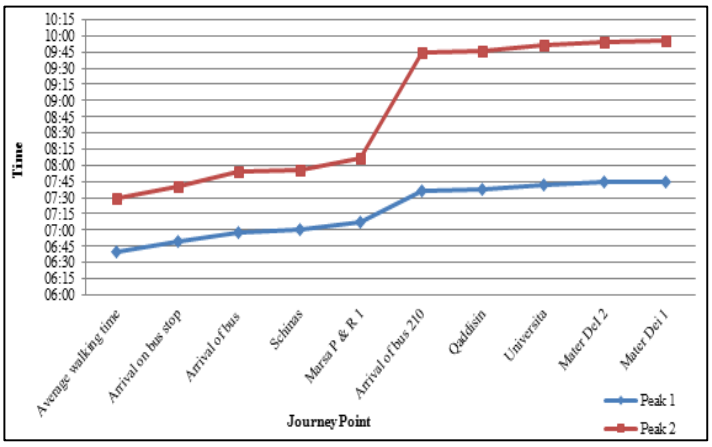



**Figure 3: Cumulative travel time graphs showing the very long waiting time spent at Marsa Park and Ride Interchange (in two different peak times).**

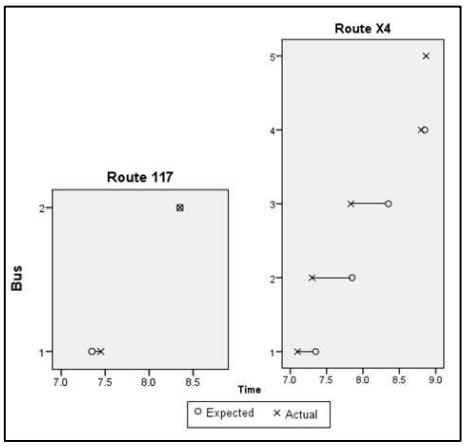



**Figure 6: Expected vs. Actual time for Routes 117 and X4.**

The chosen area of study is of significant relevance to the national social, economic and health status. This study was the first to tackle the elderly people and public transport accessibility in Malta. It is fundamental for policy makers and planners to target their future development in public transport whilst taking in consideration the needs and suggestions made by elderly people. Therefore this research could serve as an incentive for further studies both on a local or national level, and help to develop national policies or programmes targeting the mobility needs of an ageing society. The needs of the elderly are not so different from those of the rest of the population. They just become more critical with age. Hence helping old people to meet their needs makes travelling for *all* the society much easier. The study wants to convey that it is not an issue of "us" and "them" because if transport investments are oriented towards the elderly people, the current younger generation will benefit from them in the near future.

Although a general rule cannot be drawn from this research study (as it focuses on one case study in Malta), its results could be highly transferable to other demographic groups and other areas in Malta. Particularly, the results could be transferable to other "transport disadvantaged groups" such as the disabled people or women with young children. Additionally, since in Malta we just have one public transport operator, some of the results could also be easily transferable to other localities. Besides, the methods used for data collection could easily be transferable to other countries too. Although the methods used for data collection and analysis (particularly the creation of service areas) were already used by other researchers, they were modified and adapted in a way to give a simple but effective representation of the situation under study in Luqa. Based on the findings, this study also gives several recommendations for improvements such as on improving the bus stop design, comfort and accessibility, on minimising the barriers that elderly encounter, on improving the travel information, on introducing more safety measures and on introducing more government incentives, policies and research towards an ageing society. All this therefore shows that this study gives room for more intensive research that could be carried out in the future on the area under study.

Deborah Mifsud completed her MSc research in 2013 under the supervision of Dr Maria Attard and Ms Thérèse Bajada (co-supervisor).

**References:**

Beimborn, E.A., Greenwald, M.J. and Jin, X., 2003. Transit Accessibility and Connectivity Impacts on Transit Choice and Captivity. *Transportation Research Record*. 1835, 1 - 9.

Biba, S., Curtin, K.M. and Manca, G., 2010. A new method for determining the population within walking access to transit. *International Journal of Geographical Information Science*. 24 (3), 347 – 364.

Bloom, D.E., Boersh-Supan, A., McGee, P. and Seike, A., 2011. *Population Aging: Facts, Challenges and Responses*. Program on the Global Demography of Aging: Working Paper No.71. Available at: http://www.hsph.harvard.edu/pgda/WorkingPapers/2011/PGDA_WP_71.pdf [Accessed 19th December 2011].

Farrington, J. and Farrington, C., 2005. Rural accessibility, social inclusion and social justice: towards conceptualisation. *Journal of Transport Geography*.13 (1), 1 - 12.

Fuchs, V.R., 1999. Health Care for the Elderly: How much? Who will pay for it? *The Business of Medicine*. 1(1), 12 - 16.

Gutiérrez, J., Cardozo, D.C. and Garcïa-Palomares, J.C., 2011. Transit ridership forecasting at station level: an approach based on distance-decay weighted regression. *Journal of Transport Geography*. 19 (6), 1081 - 1092.
Hess, D., 2009. Access to Public Transit and Its Influence on Ridership for Older Adults in Two U.S. Cities. *Journal of Transport and Land Use*. 2 (1), 3 - 27.
Lucas, K., 2012. Transport and Social Exclusion: Where are we now? *Transport Policy*. 20, 105 - 113.
Marsden, G., Jopson, A., Cattan., M. and Woodward, J., 2007. Transport and Older People: Integrating Transport Planning Tools with User Needs. In: Proceedings of the *11th World Conference on Transport Research*, 24th - 28th July, Berkeley, California, US.
MEPA (Malta Environment and Planning Authority), 2003. *Transport Topic Paper*. MEPA, Floriana, Malta.
Murray, A.T. and Davis, R., 2001. Equity in Regional Service Provision. *Journal of Regional Science*. 41, 577 - 600.
Murray, A.T. and Wu, X., 2003. Accessibility tradeoffs in public transit planning. *Journal of Geographic System*. 1 (5), 93 - 107.
Newman, P. and Kenworthy, J., 1999. *Sustainability and Cities: Overcoming Automobile Dependence*. Island Press, Washington D.C., United States.
NSO (National Statistics Office), 2011. *Demographic Review 2010*. NSO, Valletta, Malta.
Polzin, S., Pendyala, R. and Navari, S., 2002. Development of time-of-day-based transit accessibility analysis tool. *Transportation Research Record*. 1799, 35 - 41.
Shergold, I. and Parkhurst, G., 2010. Operationalising 'sustainable mobility': the case of transport policy for older citizens in rural areas. *Journal of Transport Geography*. 18 (2), 336 - 339.
Tribby, C.P. and Zandbergen, P.A., 2012. High-resolution spatio-temporal modeling of public transport accessibility. *Applied Geography*. 34, 345 - 355.
Victor, C.R., Scambler, S.J., Bowling, A. and Bond, J., 2005. The prevalence of, and risk factors for, loneliness in later life: a survey of older people in Great Britain. *Ageing and Society*. 25 (3), 357 - 375.
Wixey, S., Jones, P., Lucas, K. and Aldridge, M., 2005. *Measuring Accessibility as Experienced by Different Socially Disadvantaged Groups: Working Paper 1*. Transport Studies Group, University of Westminster. Available at: http://home.wmin.ac.uk/transport/download/SAMP_WP1_Literature_Review.pdf [Accessed 2nd November 2011].
Zhao, F., Chow, L.F., Li, M-T., Ubaka, I. and Gan, A., 2003. Forecasting Transit Walk Accessibility: A Regression Model Alternative to the Buffer Method. In: Proceedings of the *82nd Annual Meeting of Transportation Research Board*, Washington D.C.

**Research Article: The spatial distribution of nitrogen dioxide in Malta**

by Rosalie Camilleri B.Sc. Hons (Melit.), M.Sc. (Melit.)

The growth of urban settlements, fast rates of development and the enduring demographic increase have been characteristics of the recent decades (United Nations, 2010). These activities are an important aspect of economic development. On the other hand, they contribute to increasing pressures on the natural resources (Frumkin, 2002; Schweitzer & Zhou, 2010). The realisation of such resource consumption growth has triggered concerns relating to the global capacity to sustain development without possible socioeconomic and environmental breakdown. In such situation, the view of sustainable development has been advocated as a priority for future development.

Malta has also experienced economic development and urban growth. The population of the island has increased significantly over the last decades (National Statistics Office, 2007) and with this increase came higher requirements for energy and transport. Emissions of air pollutants related to the transport and energy sectors have augmented as consequence (National Statistics Office, 2010). Such effects called for the set up of a sustainable development strategy for the Maltese Islands that amongst others, aims to limit the negative effects of air pollution while at the same time ensuring efficient production, use of energy and a cost effective transport system (National Commission for Sustainable Development, 2006).

In achieving sustainability, the national strategy for sustainable development has identified the need to control the levels of nitrogen dioxide ($NO_2$) as one of the air pollutants (National Commission for Sustainable Development, 2006). The gaseous pollutant is known to be a strong respiratory irritant and an important precursor to another toxic pollutant, namely ozone (Chiusolo et al., 2011). Short-term and long-term exposures to $NO_2$ are known to cause complications to the respiratory and cardiovascular system. Furthermore, levels of nitrogen dioxide have also been associated with an increase in daily mortality (Samoli et al., 2006, Chen et al., 2012). Nitrogen dioxide emissions are closely linked to fossil fuel use particularly transport and energy generating activities, making the pollutant an important sustainability indicator (European Commission, 2009; National Statistics Office, 2010).

Given the significant impact of nitrogen dioxide on human health and its usefulness as a sustainability indicator, it is of utmost importance to monitor and model the concentration of the pollutant over space. Monitoring of nitrogen dioxide is extensively undertaken in Malta both through the automatic monitoring stations and the diffusion tube network (MEPA, 2008). The main objective of this research therefore was to map the concentration of nitrogen dioxide in the Maltese Islands and identify the patterns of distribution of the pollutant over space. Geographic Information Systems (GIS) was used as a tool to model the spatial variability of $NO_2$ and investigate factors that contribute to the observed nitrogen dioxide levels in the islands. Furthermore, the study also investigated the accuracy of the data collected through diffusion tube samplers which was used as the basis for studying the spatial distribution of nitrogen dioxide.

Diffusion tubes (as shown in Figure 1a) are simple and a cost-effective technique for air quality monitoring. The low operational costs and ease of usage make these passive samplers ideal for monitoring the concentration of air pollutants across large areas. This research showed that while these passive samplers are precise in determining the concentration of the gaseous pollutant, the technique was found to generally overestimate the concentration of $NO_2$ relative to the chemiluminescence technique, which is the reference method for the measurement of ambient nitrogen dioxide levels. This calls for the need to apply a correction factor to any data gathered by means of passive samplers. The research further demonstrated that the use of a protective shelter that houses the diffusion tube during exposure (as shown in Figure 1b) improves both the precision and accuracy of the measurements made by the passive samplers.

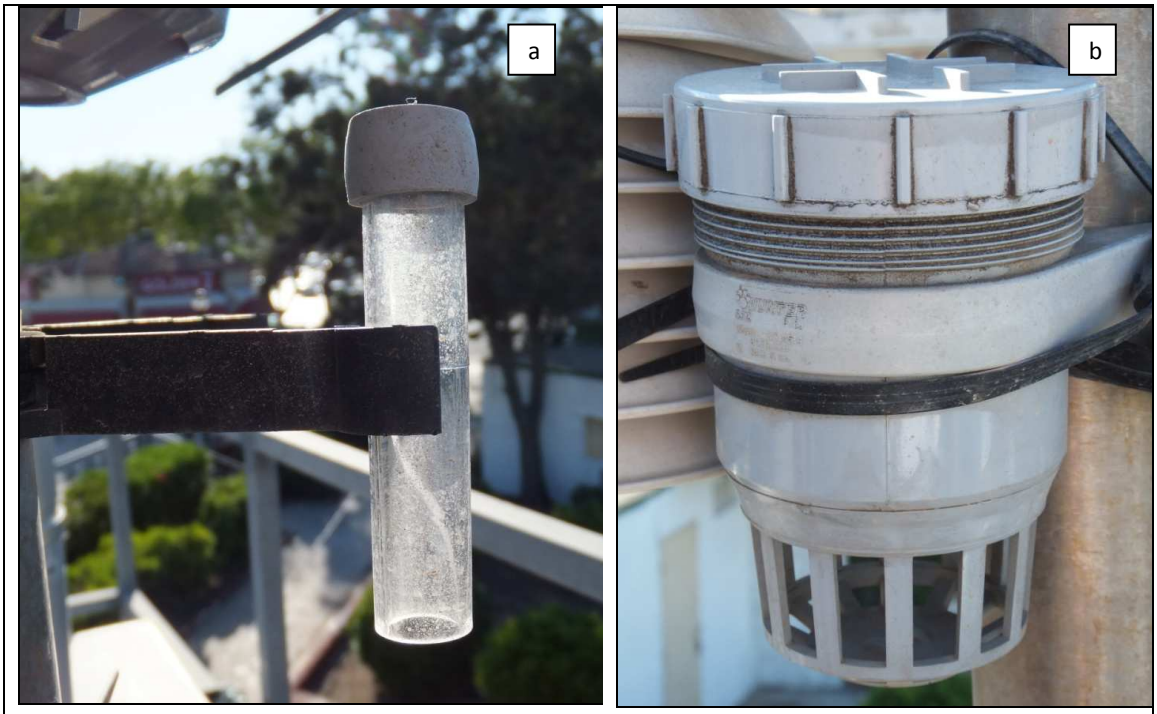



**Figure 1. Diffusion Tubes. Photos author's own.**

The levels of nitrogen dioxide in Malta and Gozo were found to be influenced by a number of factors that shape the distribution of the pollutant over space. Analysis of the NO2 data collected by diffusion tube samplers between the year 2004 and 2010, showed that population density, traffic volumes, land use characteristics and meteorological variables are all significant contributors to the concentration of the gaseous pollutant. However, the influence of these variables on the level of NO2 is also dependant on the characteristics of the site where air quality monitoring is undertaken. The research has illustrated that at traffic sites, the population density, traffic flows and land use characteristics are the most influential factors. On the other hand, wind speed and land use are significant in determining the concentration of NO2 at urban background locations. Urban background locations may be defined as sites which unlike the traffic sites are not under the direct influence of pollution from traffic or industrial sources but receive an influx of air pollutants through the process of diffusion. These results have important implications on the modeling of the spatial distribution of air pollution. Since the factors known to exert an effect on pollutant concentrations vary in the degree of influence at the two types of sites, the spatial distribution of NO2 at the different site types could not be modelled simultaneously. Rather, two sets of spatial distribution maps were created in this study, one that shows the levels of NO2 at urban background sites and one that illustrates concentrations at sites under the influence from traffic.

A number of spatial techniques were tested during the course of the research to determine the most suited method for modeling the spatial distribution of nitrogen dioxide in Malta and Gozo. The results from such investigation have shown that incorporating data on factors known to influence the levels of NO2 during the spatial modeling increases the accuracy of the prediction. Land use regression followed by kriging of the residuals proved to be the most accurate and best suited method for generating pollution surface maps from point measurement data. The technique relies both on regression analysis and geostatistics to predict the concentration of the pollutant at locations in which monitoring is not undertaken.

Pollution maps showing the distribution of nitrogen dioxide in the Maltese Islands indicate that the highest concentrations of NO2 at urban background levels occur in the Harbour region (Figure 2). This region is not only characterised by high density urban settlements but is also under the influence of air and sea transport and power generation activities which are all important contributors to NO2. Furthermore, Floriana and Ta' Xbiex were identified as areas with highest NO2 concentrations (Figure 3). At these sites traffic emissions are the major source for air pollution. These localities are also areas where the long term EU limit for nitrogen dioxide is breached and therefore need immediate measures that limit the negative impact of air pollution.

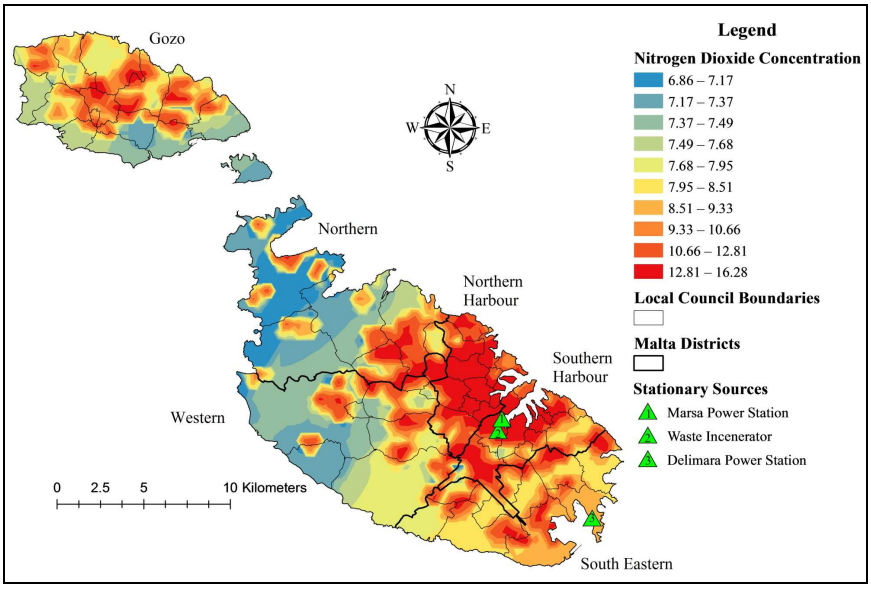



**Figure 2. Map showing the distribution of nitrogen dioxide concentrations (µg $m^{-3}$) for the urban background locations.**

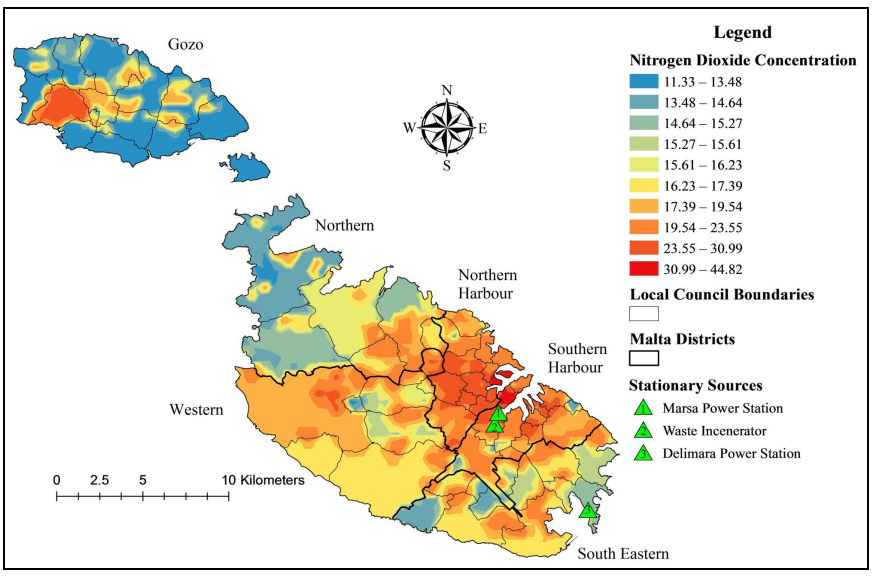



**Figure 3. Map showing the distribution of nitrogen dioxide concentrations (µg $m^{-3}$) for the traffic locations.**

This research has given an insight into the spatial distribution of NO2 in the Maltese Islands. The analysis and results presented help to identify more clearly the factors that are contributing to the levels of nitrogen dioxide in Malta. The study has demonstrated how spatial techniques and secondary data can be used to map the spatial distribution of air pollutants. The research is also key in providing information on the accuracy of diffusion tubes which are used extensively in Malta as part of air quality monitoring. This aspect of the research is important since it allows for more accurate inferences to be made from data collected through diffusion tube samplers.

The spatial analysis, which was at the centre of the study, is useful in illustrating the patterns of the pollutant concentrations. The pollution surface maps that were generated as part of the research serve as an important source to highlight the areas along the islands that suffer most from air pollution due to nitrogen dioxide. These maps add to the existing body of information that allows informed measures aimed at improving air quality to be taken. Policies and measures can therefore be more efficiently directed to specific locations that require the immediate attention of local authorities. The research therefore proves as important tool that assists policy makers in formulating policies targeted at achieving the sustainability goals for the Maltese Islands.

Rosalie Camilleri completed her MSc research in 2013 under the supervision of Prof. Emanuel Sinagra and Dr Maria Attard (co-supervisor).

**References**

Chen, R. et al. (2012) Associations between short-term exposure to nitrogen dioxide and mortality in 17 Chinese cities: The China Air Pollution and Health Effects Study (CAPES). Environment International, 45, pp. 32-38.

Chiusolo, *M. et al.* (2011) Short-Term Effects of Nitrogen Dioxide on Mortality and Susceptibility Factors in 10 Italian Cities: The EpiAir Study. Environmental Health Perspectives, 119(9), pp.1233-1238.

European Commission (2009) Sustainable development in the European Union, 2009 monitoring report of the EU sustainable development strategy [online]

Frumkin, H. (2002) Urban Sprawl and Public Health [online]

MEPA (Malta Environment and Planning Authority) (2008) Monitoring and Data Availability. [online]

National Commission for Sustainable Development (2006) A sustainable development strategy for the Maltese Islands 2007-2016 [online]

National Statistics Office (2007) Census of Population and Housing 2005. Volume 1 Population [online]

National Statistics Office (2010) Sustainable Development Indicators for Malta 2010 [online]

Samoli, E et al. (2006) Short-term effects of nitrogen dioxide on mortality: an analysis within the APHEA project. The *European Respiratory Journal,* 27, pp.1129-1138.

Schweitzer, L., and Zhou, J. (2010) Neighborhood Air Quality, Respiratory Health, and Vulnerable Populations in Compact and Sprawled Regions. Journal of the American Planning Association, 76(3), pp.363 —371.

United Nations (2010) World Urbanization Prospects. The 2009 Revision [online]

**Research Article: Assessing driver perception towards sustainable mobility. A case study of the University of Malta, Msida campus.**

by Mr James Cassar B.Ed. Hons (Melit.), M.Sc. (Melit.)

Travelling is an essential activity in everyday life. It is about going from one place to another in order to reach people, go to places and access services. Anable (2005) distinguishes between two types of travelling. Commuting is defined as travelling to and from work while maintenance trips are described as "journeys that include grocery/food shopping, ferrying children to and from school and leisure trips". Both types are essential in order to satisfy one's needs.

The last three decades have shown a sharp increase in total travel activity, underlined by the numbers of passenger kilometres travelled by motorized means of transport (Millard-Ball and Schipper 2009, p.5). This increase is triggered by a rise in the GDP, and this affluence leads to an increase in car ownership (Millard-Ball and Schipper 2009, p. 6). In the case of Europe in 2010, passenger cars accounted for 84.1 per cent of inland passenger transport among the European Member States. Between 2000 and 2010 there was a marked increase in the relative importance of the use of passenger cars among many of the Member States that joined the EU in 2004 and 2007 (European Commission 2012a).The increased use of the private car leads to a number of consequences, namely traffic congestion, parking difficulties, longer commuting, difficulties for non-motorized transport, loss of public space, land consumption, environmental impacts, accidents, loss of biodiversity, and energy consumption (Rodrigue2013).

These consequences have brought about the need to boost the use of sustainable transport. Sustainable mobility is built upon three main points. Firstly, a sustainable transport system permits the need for access of individuals and societies to be met both by present and future generations. Secondly, such a system has to be affordable, efficient, support the economy and offer various transport options to be used by the individual. Lastly, a sustainable transport system is one that has a sustainable level of emissions and waste, thus limited to what the earth can process without being permanently damaged, minimises the use of non-renewable resources and puts the use of renewable resources to a sustainable level. Furthermore it reuses and recycles its components and puts a check to use of land and noise pollution (Prillwitz 2008).

This study utilized the student scenario at the University of Malta as a case study. This university is the only university in Malta, which in the academic year 2012/13 had a student population of 10,997 (University of Malta 2013). The University of Malta is one of the larger generators of trips in the island. Furthermore, universities in small settings, such as in the case of Malta, have a large influence on their surroundings in issues such as transport. Any transport changes do not only affect the campus but also the transport situation in the neighbouring area (Delmelle and Cahill Delmelle 2008, p.1).

Commuting is very frequent amongst University students. Over 65 per cent of the students travel to University on a daily basis. Other students travel to University on certain days of the week only. The reasons included no lectures or other commitments elsewhere. As can be seen in Table 1, Monday and Thursday emerge as the busiest days (87%) whilst Friday attracts the lowest number (79%).

| Day of the week | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Percentage of daily commuters out of the total number of student respondents | 87.4 | 85.2 | 85.7 | 87.3 | 79.2 |

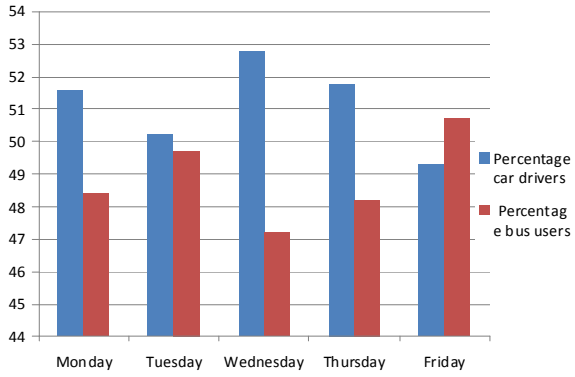
Table 1: Student commuters to University (data source: Institute for Sustainable Development 2010).

The amount of car drivers also fluctuates from one day to another. Table 2 shows how the highest percentage of car drivers occurs on Wednesday, when 40.1 per cent of the commuters choose to drive to University. On average, 39.1 per cent of the students drive their car to University.

| Day of the week | Monday | | Tuesday | | Wednesday | | Thursday | | Friday | |
|---|---|---|---|---|---|---|---|---|---|---|
| Percentage of car drivers (to/ from University) | 39.9 | 39.9 | 38.3 | 38.6 | 40.1 | 40.1 | 39.6 | 40 | 38.1 | 38.3 |

Table 2: Percentage of car drivers to total students travelling to/from University campus on the different week days (data source: Institute for Sustainable Development 2010).

Car driving is not the most popular transport mode during the whole week. Figure 1 and Figure 2 show the percentages of car drivers as compared to those of bus users. On most days car drivers are more frequent than public transport users, but the discrepancy decreases on Tuesdays when travelling towards University. On the other hand there are more students who use the bus on their way home on this day. On Fridays there are more bus users than car drivers both going to and coming from University. The number of bus users fluctuates more than that of car drivers.



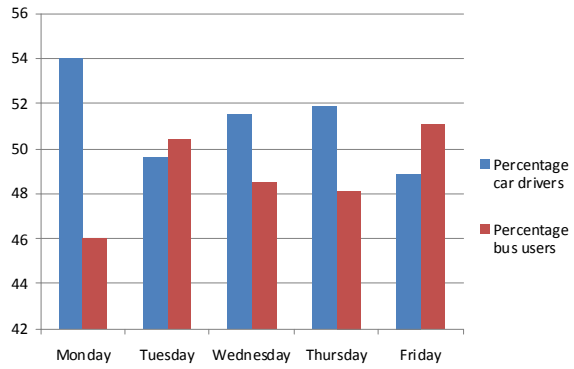




**Fig. 1: Comparison of car drivers and bus users towards University during a week (data source: Institute for Sustainable Development 2010).**

**Fig. 2: Comparison of car drivers and bus users from University during a week (data source: Institute for Sustainable Development 2010).**

There were a number of reasons why students preferred to use their private cars. Students gave a lot of importance to travel time. This was true both for students living far as for those living close to University. Taking the modal average for both the private car and public transport, travel time for car drivers was 30 minutes while the modal average for bus users was one hour. Other reasons included independence and flexibility, storage space and comfort.

Students also identified a number of improvements that would make alternative transport modes more attractive to current car drivers. They mostly focused on public transport and carpooling, as cycling and walking were limited by distance and the lack of proper infrastructure. In the case of public transport, the students suggested that the system needed to become more reliable, with the expected arrival times being more realistic. More frequent service on the routes and less distance to bus stops would also increase attractiveness of this mode. Furthermore students argued that information and promotion of benefits related to this mode needed to be disseminated on 'student friendly media' such as social networking.

Carpooling was the alternative which student drivers found the most attractive. They believed that this mode's popularity could potentially increase if a number of measures were taken, such as, providing a

guaranteed ride home for carpoolers in cases of emergency, setting up a network for carpoolers, providing dedicating lanes and a number of preferential parking slots as well as promoting the benefits of this mode.

From the study it was clear that the lifestyle of student drivers was car dependent and thus this discouraged interest in alternatives to this mode. Education was identified as necessary before any change in transport behaviour could be achieved. This included educating the general public, as the latter's attitudes influenced the students' perception. Students needed to be informed about alternative modes of transport before making their modal choices. Furthermore students suggested that this would be best achieved by student-led promotion of sustainable transport, for example by means of one-off events on campus. The media could then be utilised to attract the other students through a snowball effect. Finally the students suggested that promotion of sustainable transport modes should target students of very young age, as it is more difficult to shift the students away from their car when their lifestyles have become car dependent.

James Cassar completed his MSc research in 2013 under the supervision of Dr Maria Attard. The research project was funded by the Strategic Educational Pathways Scholarship (STEPS) programme, which is part financed by the European Union – European Social Fund (ESF). James has completed his B.Ed (Hons) degree in 2011 and is currently a Sixth Form teacher.

STEPS
Strategic Educational Pathways Scholarships

**References:**

Anable, J. (2005) 'Complacent Car Addicts' or 'Aspiring Environmentalists'? Identifying travel behaviour segments using attitude theory'. Transport Policy, 12, 65–78.

Delmelle, E.M. and Cahill Delmelle, E. (2012) 'Exploring spatio-temporal commuting patterns in a university environment'. Transport Policy, 21, 1-9.

European Commission (2012a) Passenger transport statistics, Eurostat Sept. 2012, available: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Passenger_transport_statistics#Road_passengers [accessed 3 February 2013].

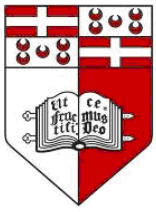
Institute for Sustainable Development (2010) UOM Green Travel Plan: Travelling Smart, available: http://www.um.edu.mt/iccsd/greentravel [accessed 17 February 2013).

Millard-Ball, A. & Schipper, L. (2009) 'Are we reaching a plateau or "peak" travel? Trends in passenger transport in six industrialized countries', Paper submitted to 2010 Transportation Research Board Annual Meeting, available: http://www.transportroundtable.com.au/courses/201008_hsst/references/millard-ball-schipper_2010_Peak_travel.pdf [accessed 13 February 2013].

Prillwitz, J. (2008) 'Sustainable Travel Behaviour', University of Exeter, Department of Geography ProST Working Paper, No. 1, available: http://geography.exeter.ac.uk/prost/Downloads/WP1-Sustainable-travel.pdf [accessed 1 May 2012].

Rodrigue, J.P. (2013) The Geography Of Transport Systems, 3rd edit., New York: Routledge, available: http://people.hofstra.edu/geotrans/eng/ch6en/conc6en/ch6c4en.html [accessed 3 June 2013].

University of Malta (2013) 'Facts and Figures', available: http://www.um.edu.mt/about/uom/facts [accessed 29 April 2012].



University of Malta
**Institute for Climate Change and Sustainable Development**
University of Malta, Msida, Malta

T: +356 2340 3403
E: iccsd@um.edu.mt
W: www.um.edu.mt/iccsd