

CISMOB
Interreg Europe

Intelligent Transportation Systems for a safe, smooth and less polluted road environment

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PETRA Conf., 22nd of June 2017

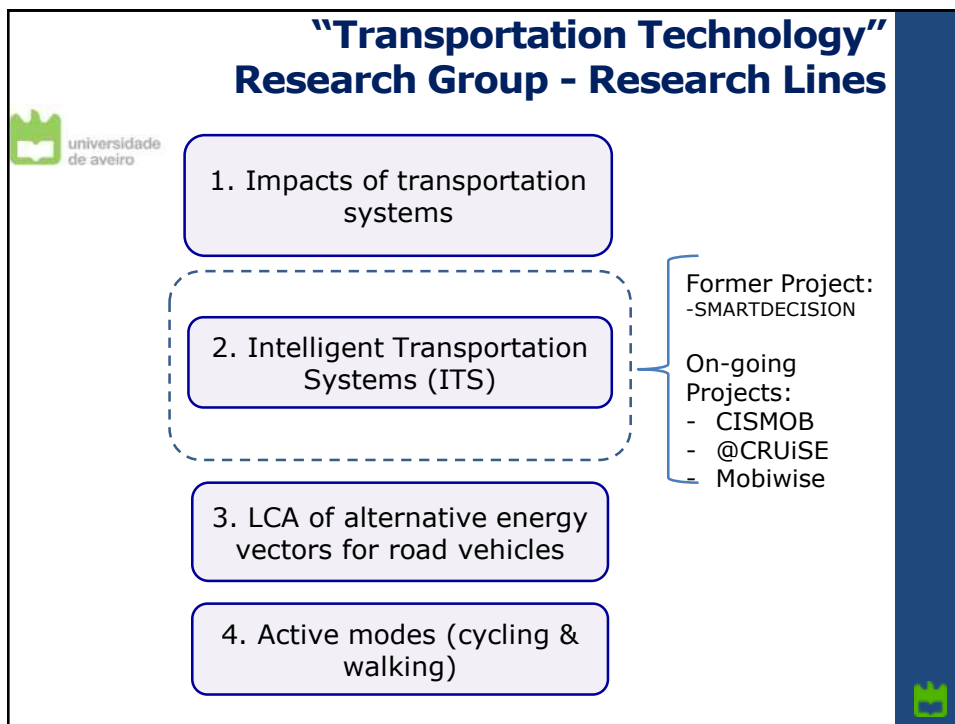
<http://transportes-tema.web.ua.pt>

Where is located University of Aveiro?

TEMA Centre for Mechanical Technology and Automation


Portugal

Dir. Sub. de Tecnologia e Inovação de Ageda (29.6%)
Dir. Sub. Aveiro-Mora (40 km)



Motivation

- Europe: ~33% of energy consumption from transportation sector
- ~73% of transportation-related GHG are from road transport
- Vehicle emissions → important source for air pollution (NO_x, PM)
- Hydrocarbon fuels are expected to remain predominant over the next decades

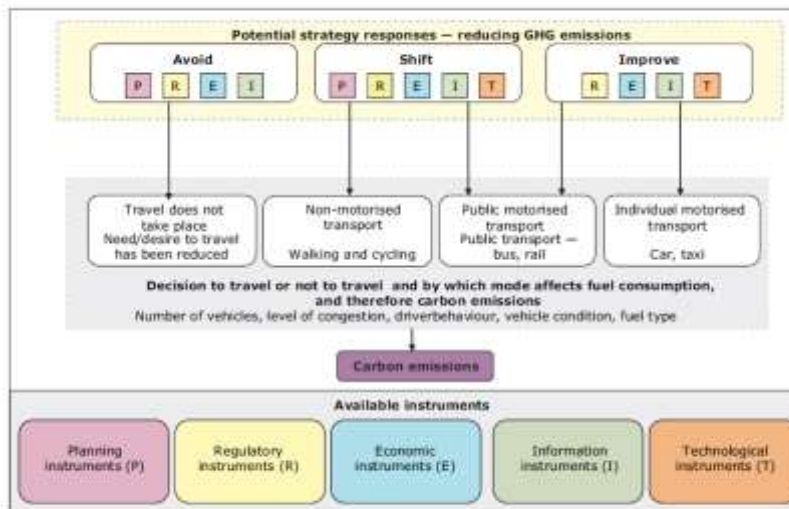


Motivation



STRATEGIES TO REDUCE GHG EMISSIONS

Figure 8.2 Potential strategies for reducing GHG emissions – 'avoid', 'shift' and 'improve'

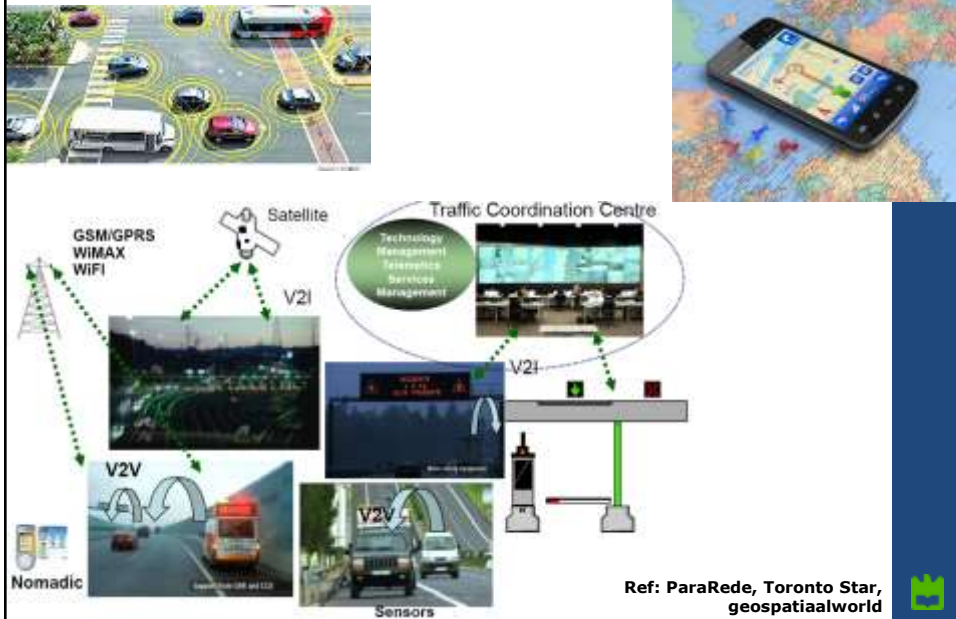


Source: Dalkmann and Brannigan, 2007.

Reference: European Environment Agency



What are ITS?



Challenges & Opportunities

Where are the traffic congestion and emissions hotspots?

What are the most critical links in terms of congestion?

Where we should reduce pollution?

What are the most vulnerable areas?

Increasing availability of sensor technology to record large amounts of data

- ✓ Smartphone location data
- ✓ GPS (probe vehicle data)
- ✓ Cell phone density
- ✓ Traditional traffic road monitoring network



ITS & Eco-Driving Projects

SMARTDECISION: Intelligent Vehicle Routing System for Enhanced Air Quality in Urban Areas (2011-2014)



Objective: Assessment of the impact of route choice and ITS on traffic performance, road safety and fuel consumption / emissions.

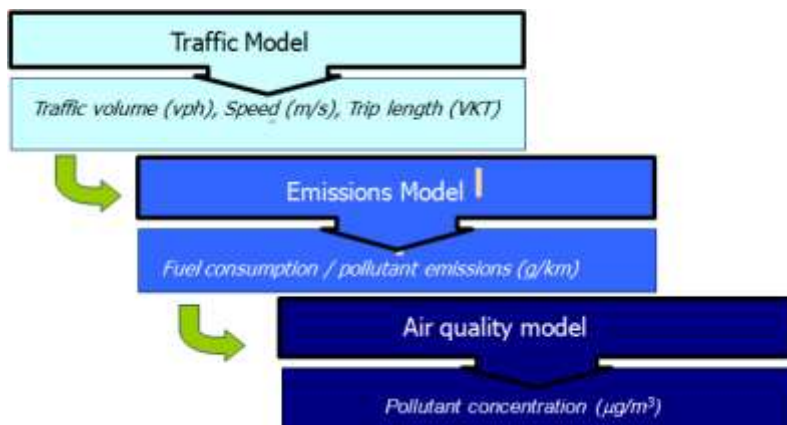


Ref: J.M. Bandeira, D.O. Carvalho, A.J. Khattak, N.M. Roupail, T. Fontes, P. Fernandes, S.R. Pereira & M.C. Coelho. Empirical assessment of route choice impact on emissions over different road types, traffic demands, and driving scenarios, International Journal of Sustainable Transportation, Volume 10, No. 3, pp. 271-283, 2016.



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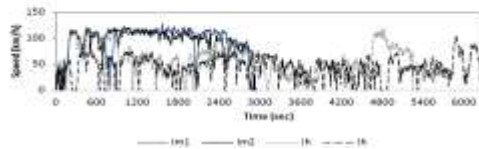
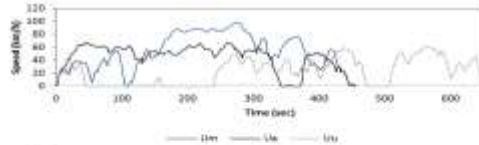
SMARTDECISION: Intelligent Vehicle Routing System for Enhanced Air Quality in Urban Areas (2011-2014)



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SMARTDECISION: Intelligent Vehicle Routing System for Enhanced Air Quality in Urban Areas (2011-2014)

Experimental measurements



Ref: J.M. Bandeira, D.O. Carvalho, A.J. Khattak, N.M. Roupail, T. Fontes, P. Fernandes, S.R. Pereira & M.C. Coelho. Empirical assessment of route choice impact on emissions over different road types, traffic demands, and driving scenarios, *International Journal of Sustainable Transportation*, Volume 10, No. 3, pp. 271-283, 2016.



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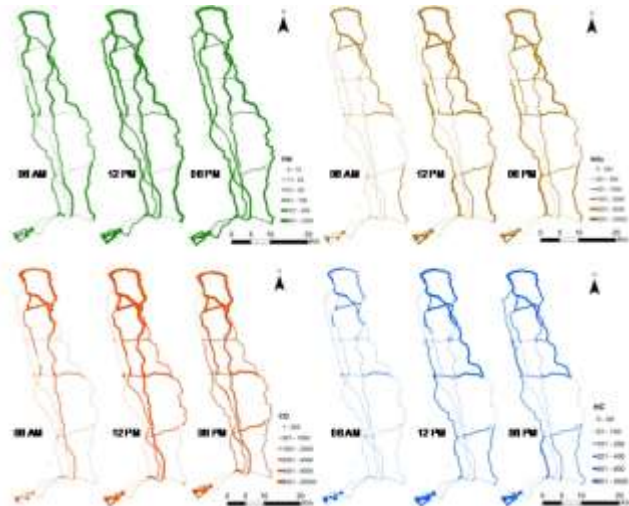
Traffic modeling



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Emissions modeling



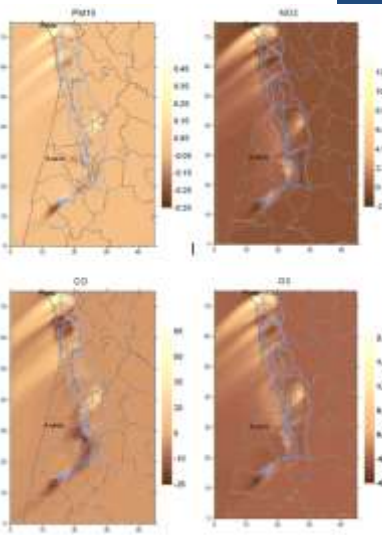
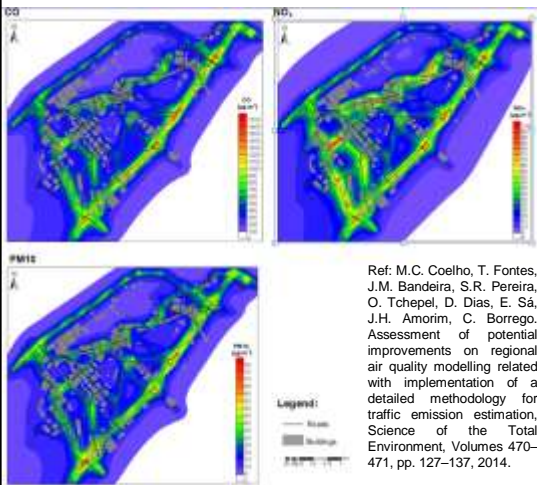
Ref: M.C. Coelho, T. Fontes, J.M. Bandeira, S.R. Pereira, O. Tchepel, D. Dias, E. Sá, J.H. Amorim, C. Borrego. Assessment of potential improvements on regional air quality modelling related with implementation of a detailed methodology for traffic emission estimation, Science of the Total Environment, Volumes 470-471, pp. 127-137, 2014.



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SMARTDECISION: Intelligent Vehicle Routing System for Enhanced Air Quality in Urban Areas (2011-2014)

Air quality modeling



Ref: M.C. Coelho, T. Fontes, J.M. Bandeira, S.R. Pereira, O. Tchepel, D. Dias, E. Sá, J.H. Amorim, C. Borrego. Assessment of potential improvements on regional air quality modelling related with implementation of a detailed methodology for traffic emission estimation, Science of the Total Environment, Volumes 470-471, pp. 127-137, 2014.

FCT Project SMARTDECISION

Some **conclusions**:

- The **eco-route** could **depend on the type of vehicle** used
 - In the intercity OD pair, a **trade-off between CO₂ vs. local pollutants minimization** has been observed:
Intercity routes that yield CO₂ savings might also lead to substantial increases in other pollutants (CO and NO_x)
For all case studies, the routes that lead to a minimization of local pollutants are those that mainly cross urbanized areas, avoiding motorways.
- ⇒ **Selection of the eco-friendly route is not always obvious.**
- ⇒ Concept of "eco-friendly" should **not be strictly confined to CO₂/fuel consumption.**
- ⇒ **Careful assessment of potential externalities** that may arise from a purely dedicated navigation system based on emissions minimization, since higher volumes of traffic crossing urban areas may lead to urban environmental degradation and worse levels of road safety.

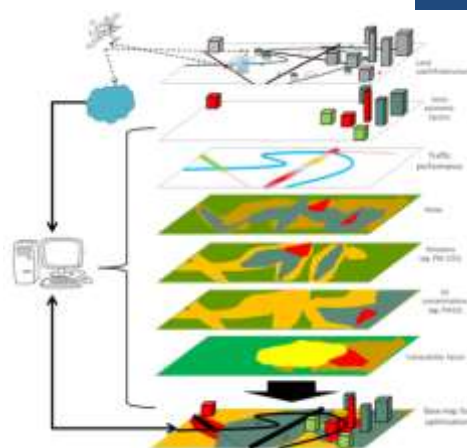


FCT Project "@CRUISE: Advanced Impact Integration Platform for Cooperative Road Use"

Goal: To integrate road traffic impacts into a single analytical framework for use in advanced traffic management systems (ATMS).

3 main pillars:

- Designing a conceptual methodology for assigning a **link-based indicator** that can evaluate **different traffic-related externalities**, adjusted to **local contexts of vulnerability**;
- Improving the interoperability between traffic-related models and new sources of traffic information;
- Optimizing the network operations by means of a decision support system.



FCT
Fundação para a Ciência e a Tecnologia



Consortium: TEMA, CESAM, IT, ITRE-NCSU

FCT Project "@CRUISE: Advanced Impact Integration Platform for Cooperative Road Use"

<http://project-cruise.weebly.com/>

- Task 1 • Literature review and experimental setup
- Task 2 • Experimental work - Road and environmental conditions monitoring
- Task 3 • Development, integration and validation of related-traffic models
- Task 4 • Dynamic link-based eco-indicator
- Task 5 • Data fusion and data management
- Task 6 • Network optimization and design of a decision support system
- Task 7 • Prototype / Software and applications development
- Task 8 • Dissemination and Reports

Main deliverable: Prototype of an integrated decision support system for selecting the appropriate traffic management measures.



FCT Project "@CRUISE: Advanced Impact Integration Platform for Cooperative Road Use"

Experimental measurements



MobiWise: from mobile sensing to mobility advising

Project PAC (FCT/COMPETE)

Objective: To add value to mobility in the cities through the development of a 5G platform that encompasses the access infrastructure filled of sensors, people and vehicles, a flexible SDN control infrastructure, and network and cloud optimization.

Start: January 2017

End: January 2020

Partners: IT Aveiro and Porto, CISUC, CMUC, TEMA



Active mobility – Safe routes to the University



Active mobility – Safe routes to the University

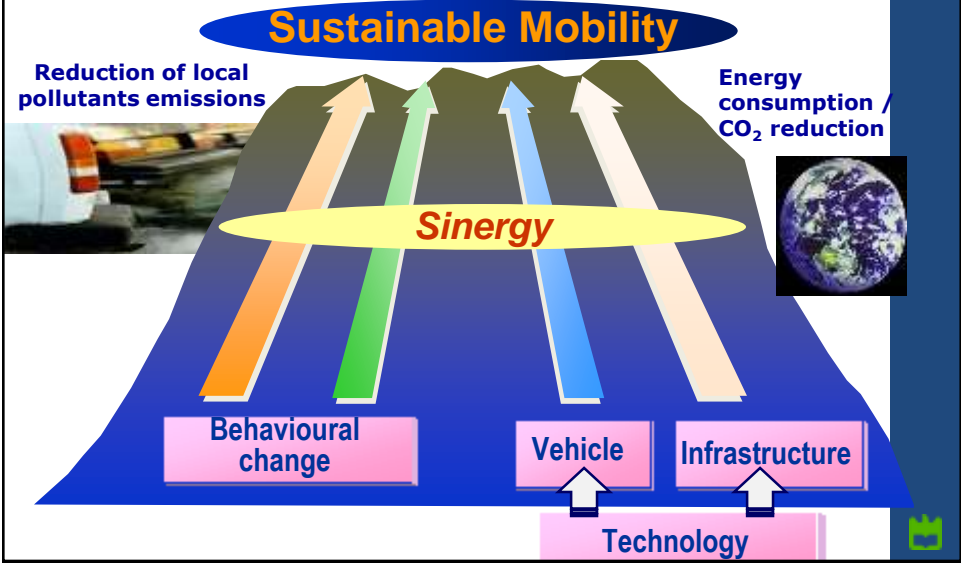
On-Board Platform of Sensors for Enhancing Safety of Cyclists

MENU 1	MENU 2	Hours
Speed	Time	19:54:47
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ITS Projects - Partnerships

CESAM - Centro for Environmental and Marine Studies
 ITRE
 THE UNIVERSITY OF TENNESSEE KNOXVILLE
 UNIVERSITÀ DEGLI STUDI DI SALERNO
 Technische Universität Braunschweig
 instituto de telecomunicações
 TOYOTA Caetano Auto
 UNIVERSIDADE DE COIMBRA
 ÁGUEDA CÂMARA MUNICIPAL
 Stockholm University
 Romania
 AMTB
 ece

ITS as a strategical choice to help decarbonising the transportation sector



Acknowledgements

This block contains several logos and text. On the left is the "Interreg Europe" logo with the text "European Union | European Regional Development Fund". To its right is the "CISMOb Interreg Europe" logo. In the center is the "FCT" logo with the text "Fundação para a Ciência e a Tecnologia" and "Instituto Nacional de Estatística". At the bottom are logos for "REPÚBLICA PORTUGUESA", "EUROPEAN UNION", and "COMPETE 2020". A small green logo is in the bottom right corner.

Thank you!



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<http://transportes-tema.web.ua.pt> / <http://www.interregeurope.eu/cismob/>

