MIRIAM
Models for rolling resistance in road infrastructure asset management systems

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Photo by Ulf Sandberg over Connecticut Ave Washington, DC
MIRIAM

What is MIRIAM?

Project started in 2009 by 11 partners from Europe, incl two from USA

Pooled, internal funding (so far)

Aims at providing a sustainable, environmentally friendly road infrastructure .......

by reducing rolling resistance – hence lowering CO₂ emissions and increasing energy efficiency
Road transport is the second largest contributor to Green House Gas emissions (GHG)

Passenger cars, for example, have a significant impact on climate change in Europe: approx. 12% of total CO₂ emission

Emissions from transport in the EU have increased by 26% from 1990 to 2004

EU Commission focuses on reducing the GHG by tighter regulations for vehicles through regulations Euro 5 and 6 for cars and Euro VI for trucks

The rolling of tires is one of the major sources of energy losses in road vehicles; thus must be part of a policy aiming at reducing energy and GHG emissions
Overall objectives of the project

- To help providing a sustainable and environmentally friendly road infrastructure
- To develop an integrated methodology for improved control of road transport CO₂ emissions
- To implement the methodology in road asset management systems, to optimize the reduction of CO₂ emission related to the interaction vehicle/tire/pavement
- To optimize pavement quality and condition in relation to CO₂ emission and energy consumption
- To provide better quality of life for society in general
More concrete objectives

To develop models for:

The sources
Rolling resistance model, as related to pavement properties, with consideration of tires and vehicles

The effects
Model for energy consumption and CO$_2$ emissions due to rolling resistance

Integration and implementation
Transport infrastructure operation and management as related to rolling resistance
Participating countries and states
Phase 1: 2010-2011
Sub-projects (preliminary)

1 Measurement methods and source model(s)
   (Leader: VTI, Sweden)

2 Influence of pavement characteristics on energy efficiency
   (Leader: AIT, Austria)

3 Importance of Rolling Resistance on efficiency within an
   LCA framework (Leader: UC Davis, USA)

4 Constraints / Requirements to implementation in Asset
   Management and LCA systems (Leader: DRI, Denmark)

5 External funding and raising awareness
   (Leader: DRI, Denmark)
What is rolling resistance?

\[ C_R = \frac{P_f}{F_z} = \tan \Theta \approx \Theta \]
Measurement methods and equipment

Four main methods in our work:

Rolling resistance: Measurement on drum (ISO 18164)
Fuel consumption: Measurement with instrumented car
Rolling resistance: Measurement with test tire on trailer
Rolling resistance: Coast-down with car or truck
Measurement of rolling resistance according to ISO 18164 .... intended mainly for tire testing

Facility at the Technical University of Gdansk (TUG), Poland
Car used for fuel consumption and coast-down RR measurements

Volvo 940 GL

Photo: Harry Sörensen, VTI
Test tire used in this application

Michelin Energy MXT
185/65R15 88 T
VTI’s truck "RDT" performing coast-down measurements
Trailer constructed at TUG used for measurements at VTI in Sweden
Compensation for effect of gradients/slopes by "counterweight system" (to be patented)

Compensation for acceleration/deceleration by same system
Effect on fuel consumption of tyre inflation pressure

15% reduction in inflation corresponds to 2.6% increase in FC or approx. 10-15% RR.
Correlation between rolling resistance and pavement texture

\[ y = 0.0024x + 0.0083 \]

\[ R^2 = 0.988 \]
Some recent advances in Europe with respect to rolling resistance
REGULATION (EC) No ???./2009

Labelling of tyres with respect to fuel efficiency and other essential parameters