Non-exhaust traffic-induced emissions are a major source of particle mass in most European countries and have become relatively more important due to strict regulations on the exhaust emissions. Non-exhaust and exhaust sources are found to contribute about equally to total traffic-related emissions in European cities, Querol et al. (2005). The non-exhaust emissions are particularly important in Nordic and Alpine countries where winter time road traction maintenance occurs, e.g. salting and sanding, and where studded tyres are used. Modelling these non-exhaust emissions is a challenging task as they are sensitive to environmental factors such as road surface moisture, road maintenance activities (salting and sanding) and tyre and vehicle types. The ability to model these emissions is desirable as this provides the potential for more effective road management and improved assessment of mitigation strategies for reducing emissions. These are all important applications relevant to the European AQ Directive.

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Current models for road dust emissions are generally based on emission factors from local measurements and conditions, Gehrig et al. (2004) coupled with for instance ADT and traffic patterns,

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Reference

Gehrig, R., Hill, M., Buchmann, B., Imhof, D., Weingartner, E., Baltensperger, U., (2004). Non-exhaust traffic-induced emissions are a major source of particle mass in most European countries and have become relatively more important due to strict regulations on the exhaust emissions. Non-exhaust and exhaust sources are found to contribute about equally to total traffic-related emissions in European cities, Querol et al. (2005). The non-exhaust emissions are particularly important in Nordic and Alpine countries where winter time road traction maintenance occurs, e.g. salting and sanding, and where studded tyres are used. Modelling these non-exhaust emissions is a challenging task as they are sensitive to environmental factors such as road surface moisture, road maintenance activities (salting and sanding) and tyre and vehicle types. The ability to model these emissions is desirable as this provides the potential for more effective road management and improved assessment of mitigation strategies for reducing emissions. These are all important applications relevant to the European AQ Directive.

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INTRODUCTION

Road dust sub-model

This predicts the road dust and salt loading through a mass balance approach as well as the emission through direct wear and through suspension of these loadings. Mass is deposited on the surface by wear (road, tyre and brake) and by the addition of salt and sand. Mass is removed by suspension, drainage, splash/spray and by road maintenance activities.

Road surface moisture sub-model

This determines road surface conditions (water and ice) essential for the prediction of suspension from the road surface. A surface mass balance approach is also applied here, including evaporation/condensation, drainage, splash/spray, precipitation, refreezing and road maintenance activities.

ROAD DUST MITIGATION

Mitigation strategies for reducing the road dust are in place in the Nordic countries, but to actually show the effect of different measures can be difficult. The NORTRIP model have the possibility to give an answer by: quantification of salt and sand contribution to PM, showing impact of salting and sand binding, impact of studded tyres, impact of cleaning, impact of traffic speed and impact of meteorological conditions.

THE MODEL CONCEPT

Environment and Health Protection Administration of the city of Stockholm, Sweden; (6) Nordic Environmental Agency, Helsinki, Finland; (7) Swedish National Road and Transport Research Institute (VTI), Sweden

THE STUDDED TYRE BAN IN HORNSGATAN IN STOCKHOLM

A ban was introduced against studded tyres in Hornsgatan, a street with dense traffic in the inner city of Stockholm , on January 1, 2010. The total studded tyre season was also reduced by two weeks in the whole city. The ban reduced the share of cars with studded tyres from 60%-70 % to 30% on Hornsgatan (inner city 50%, access roads 60%). It also reduced the traffic by 15 % on the yearly average. The reduction of PM_{10} for the annual emissions was 50%.

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Figure showing observed (blue) and modelled (red) concentrations for Hornsgatan.

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