

Grant Deliverables and Reporting Requirements for UTC Grants

UTC Project Information	
Project Title	Optimal Ventilation Control in Complex Urban Tunnels with Multi-Point Pollutant Discharge
University	Cornell University
Principal Investigator	H. Oliver Gao
PI Contact Information	hg55@cornell.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	USDOT: \$30,444 Cornell: \$31,331
Total Project Cost	\$61,775
Agency ID or Contract Number	Sponsor Source: Federal Government CFDA #: 20.701 Agreement ID: 69A3551747119
Start and End Dates	Start date: 11/30/2016 End date: 10/31/2017
Brief Description of Research Project	<p>We propose an optimal ventilation control model for complex urban vehicular tunnels with distributed pollutant discharge points. The control problem is formulated as a nonlinear integer program that aims to minimize ventilation energy cost while meeting multiple air quality control requirements inside the tunnel and at discharge points. Based on the steady-state solutions to tunnel aerodynamics equations, we propose a reduced form model for air velocities as explicit functions of ventilation decision variables and traffic density. A compact parameterization of this model helps to show that tunnel airflows can be estimated using standard linear regression techniques. The steady-state pollutant dispersion model is then incorporated for the derivation of optimal pollutant discharge control strategies. A case study of a new urban tunnel in Hangzhou, China will be conducted to demonstrate that the scheduling of fan operations based on the proposed optimization model can effectively achieve different air quality control objectives under varying traffic intensity.</p>

Describe Implementation of Research Outcomes (or why not implemented)
Place Any Photos Here

This research project has led to a manuscript submission to the 2018 American Control Conference. In the project we developed optimization algorithms and computing codes for optimal ventilation control for complex urban vehicular tunnels with distributed pollutant discharge points. A case study was conducted, but the research outcomes have not been implemented in real practice. We hope that presenting/publishing the paper at the American Control Conference will draw attention from practitioners and relevant agencies.

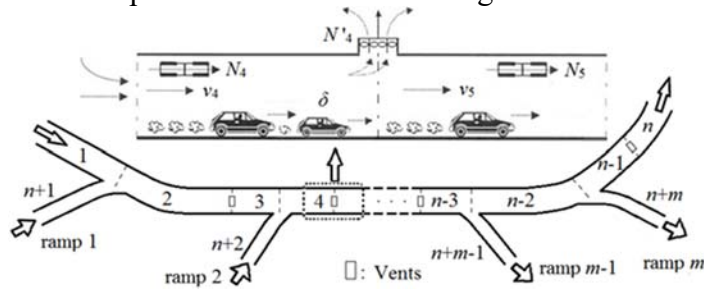


Fig. 1. Complex urban tunnel system

Impacts/Benefits of Implementation (actual, not anticipated)

Not implemented yet.

Web Links^[1]_{[5][EP]}

- Reports
- Project website

<http://ctech.cee.cornell.edu/final-project-reports/>