EVALUATING THE EFFECT OF NEAR ROADWAY MITIGATION MEASURES

REGIONAL/STATE/LOCAL MODELER'S WORKSHOP
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Background

- Common Mitigation Measures to Reduce Exposure to Near Roadway Pollution
  - Vehicle exhaust controls
  - Buffer zones
  - Sound walls
  - Vegetated Barriers
  - Other?

How do we know if these work?

Evaluating Near Roadway Mitigation

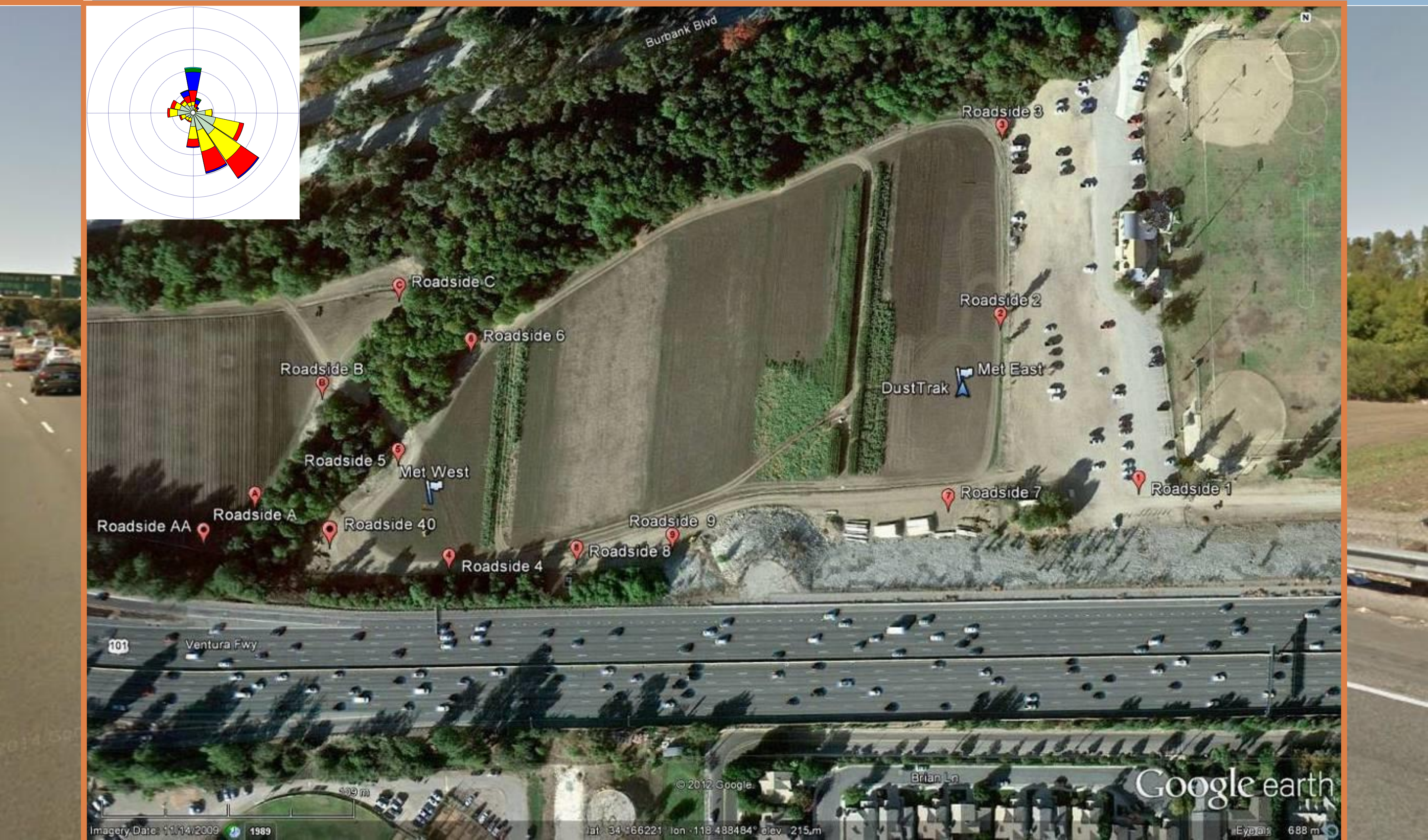
- Need
  - CEQA/NEPA
  - Transportation Conformity?
- Limitations with existing tools
  - Downwash in AERMOD limited to point sources
  - Limited ability of Gaussian dispersion models to handle complex urban airflow
  - Limited data and analysis available to improve model formulations

Recent SCAQMD Studies

- SCAQMD commissioned four studies to investigate new methods for evaluating near roadway mitigation
  A. Sierra Research – Monitoring/Modeling
  B. UC Riverside (Princevac) – Flow Tank
  C. UC Riverside (Venkatram) – Mathematical Modeling
  D. PlaceWorks – Alternative Technologies
- Hosted follow up Technology Forum 11/21/13
- Materials available here:

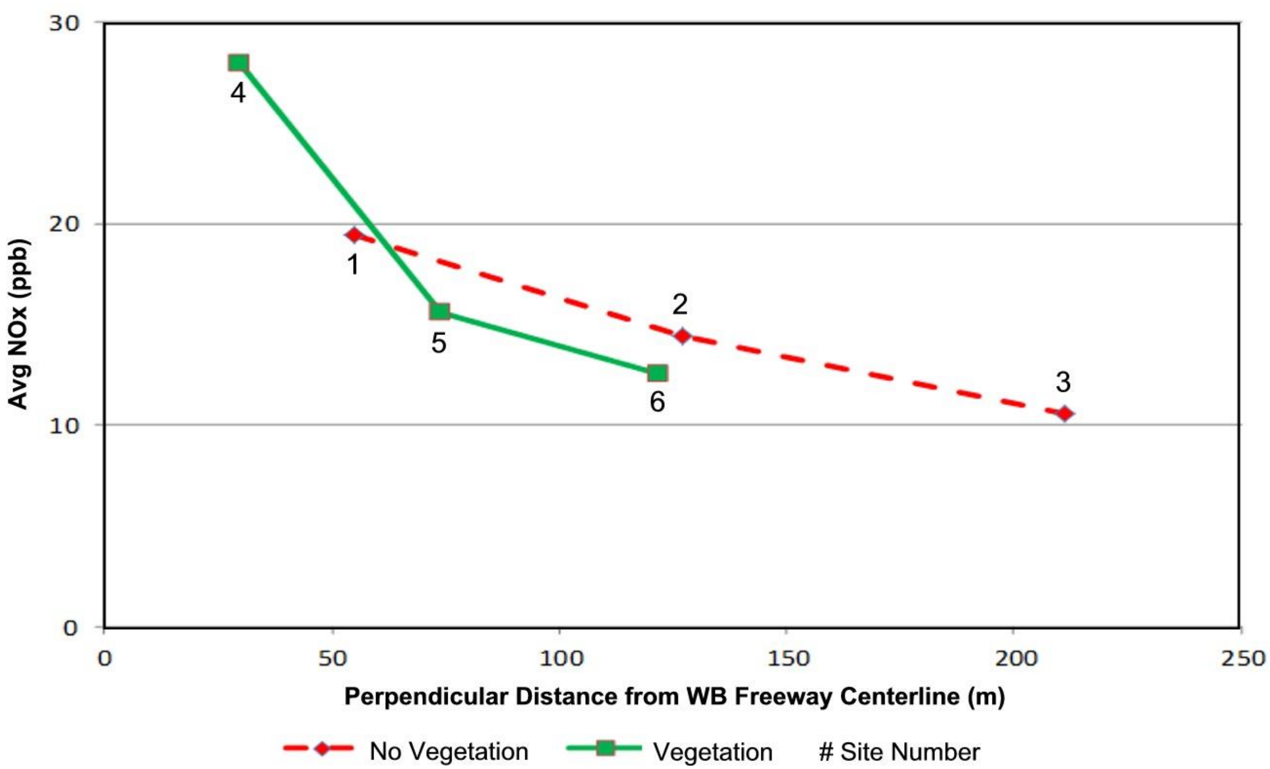
http://www.aqmd.gov/tao/ConferencesWorkshops/techforum.htm

Study A – Modeling/Monitoring With and Without Vegetation



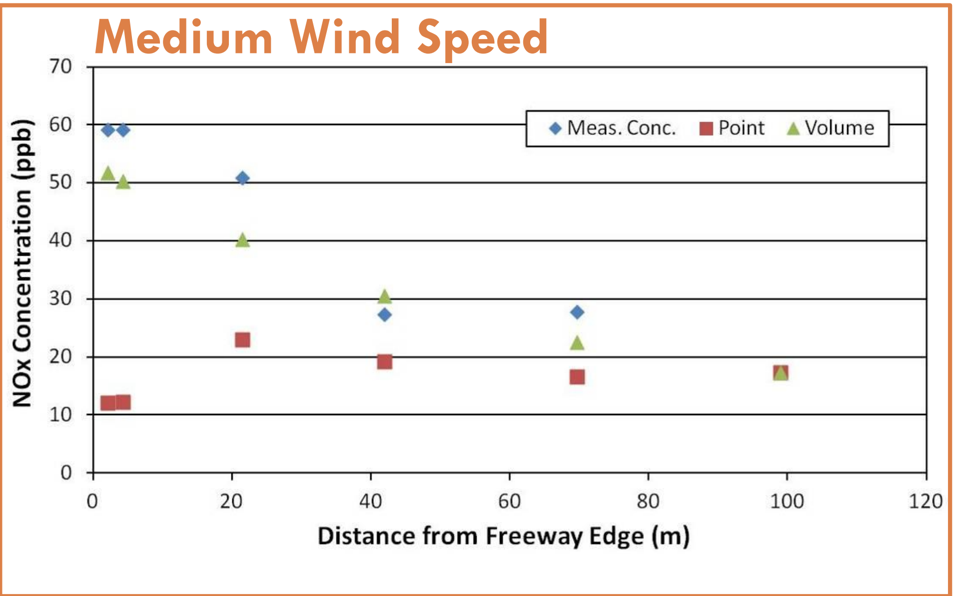
Study A – Modeling/Monitoring Results

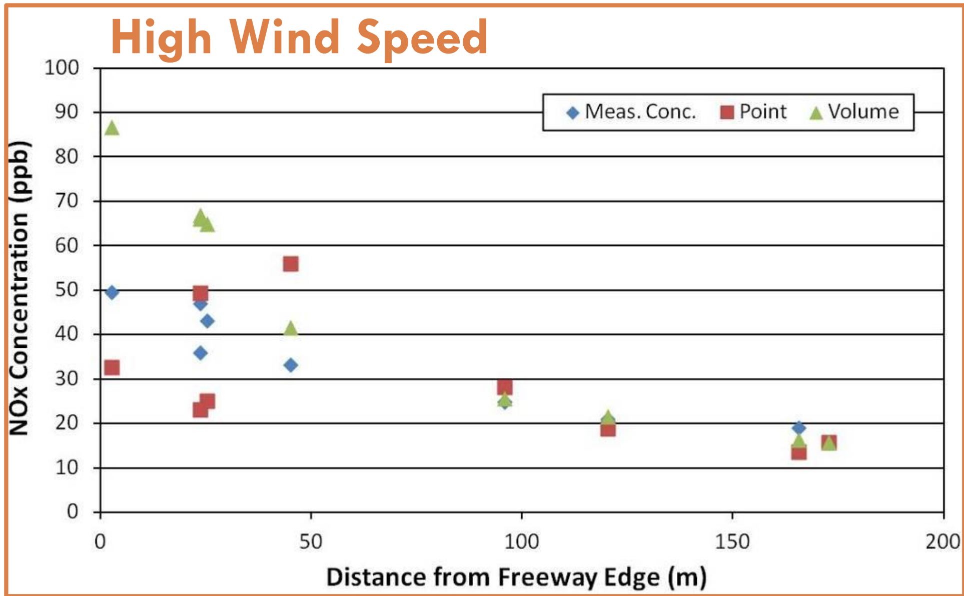
- Highest concentrations found behind barrier
  - Proximity?
  - Edge effects?



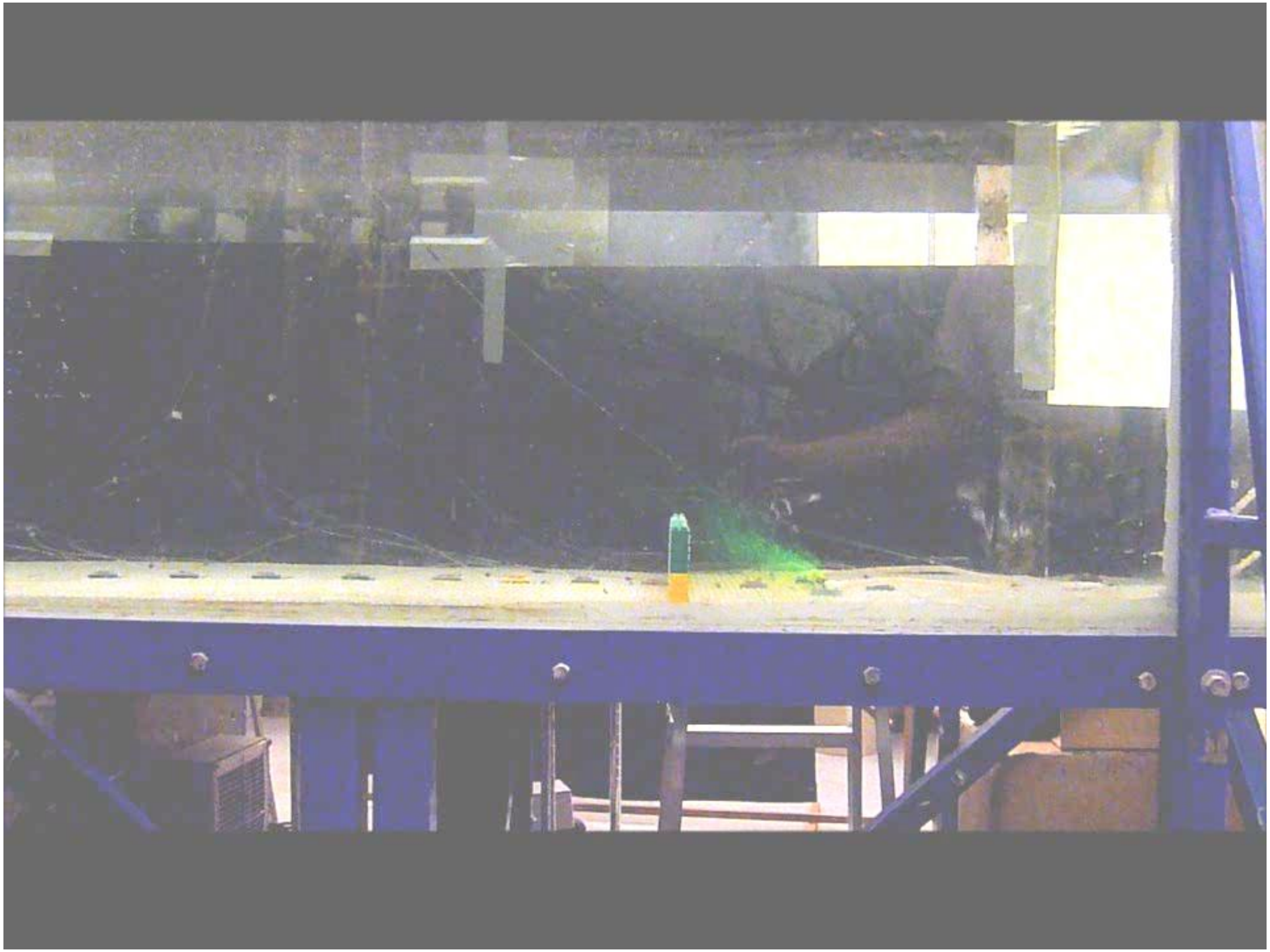
Study A Modeling/Monitoring Results continued

- Model/monitor fit depends on source treatment and meteorology
  - Poor fit for low wind speed (<1.6 ms)
  - Volume sources fit best for medium winds (1.6-3.2 m/s)
  - Point sources with downwash fit best for high winds (>3.2 m/s)

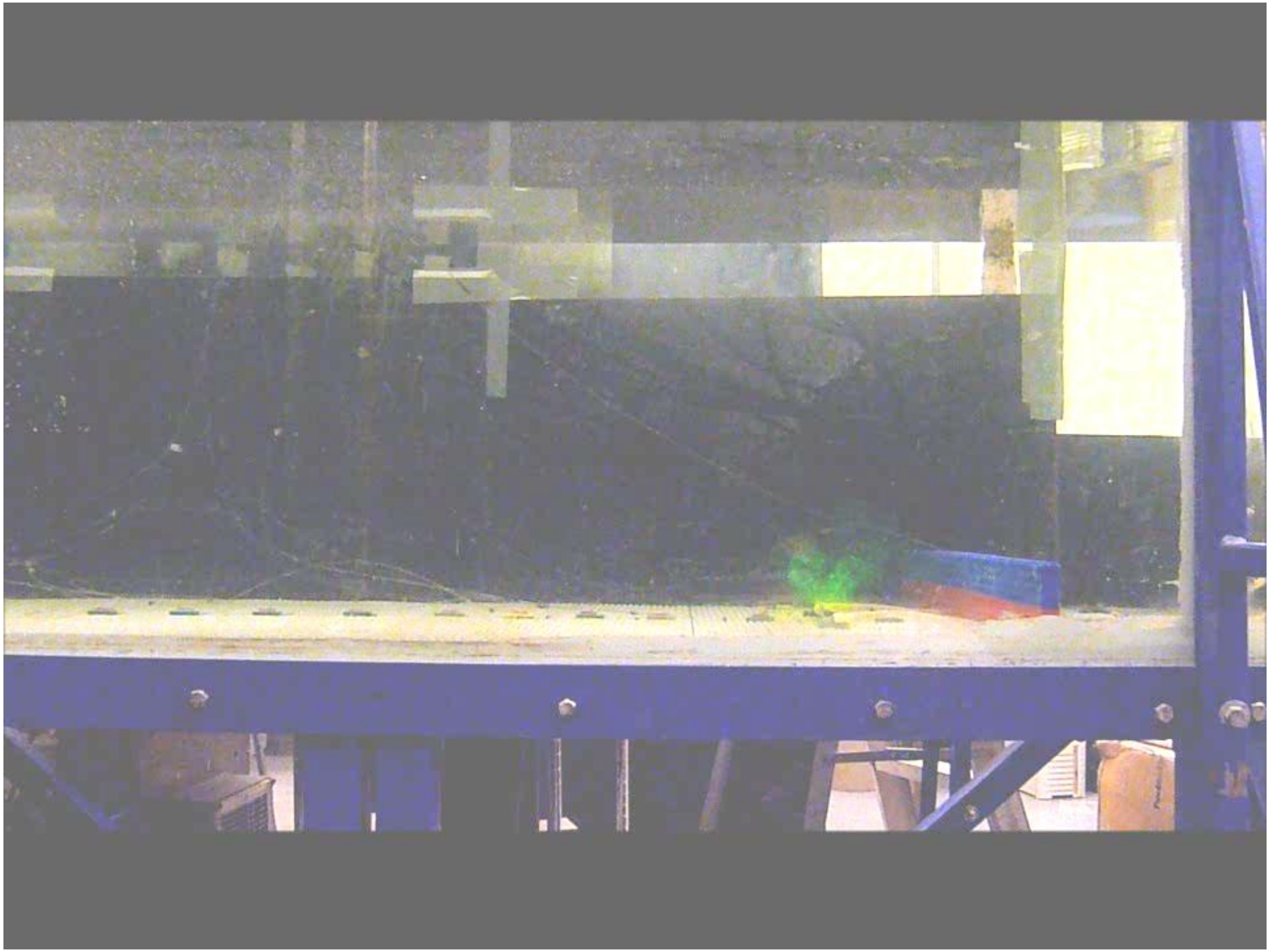




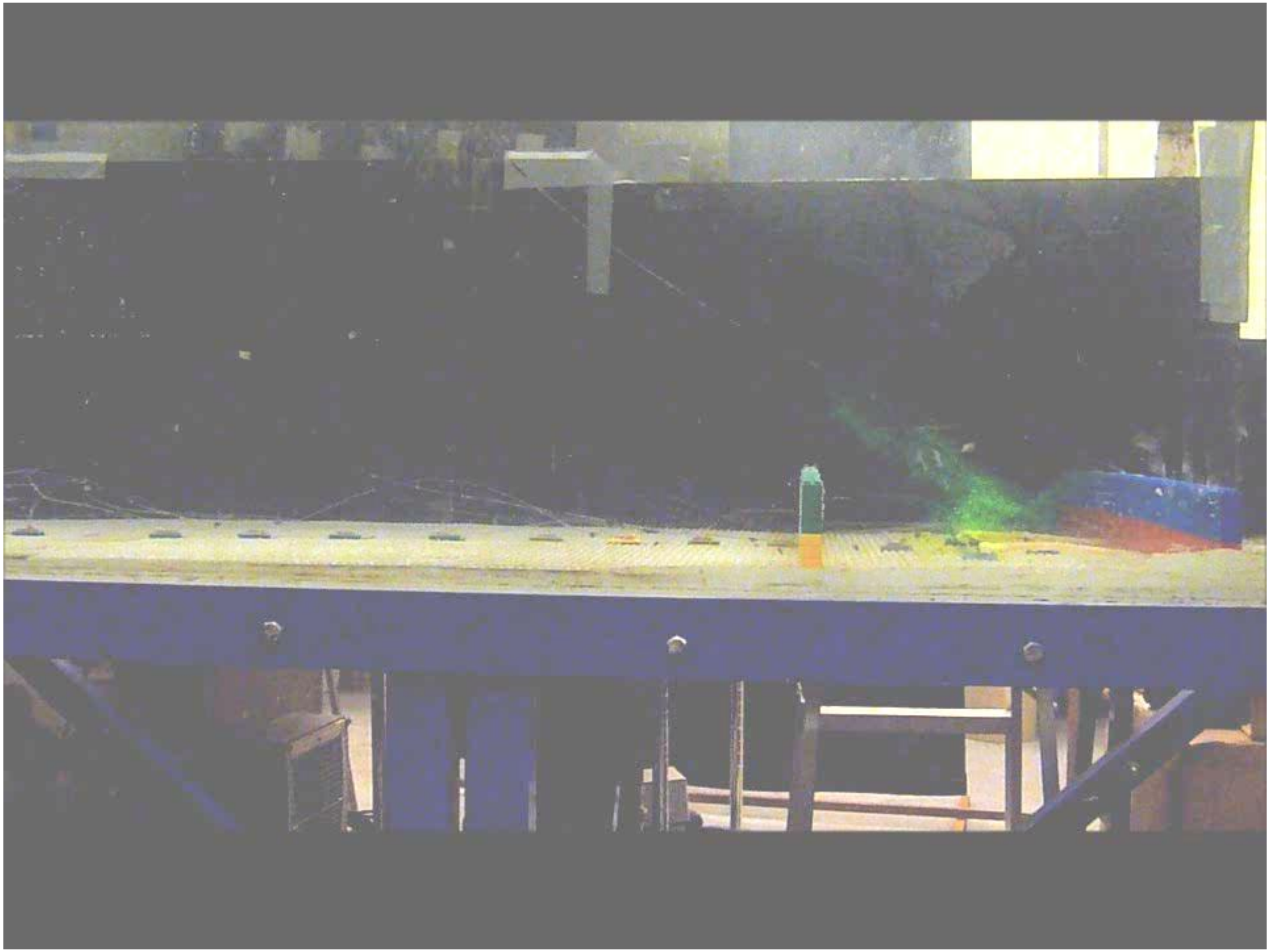
Study B – Flow Tank Experiments
Downwind Barrier Movie



Study B – Flow Tank Experiments
Upwind Barrier Movie

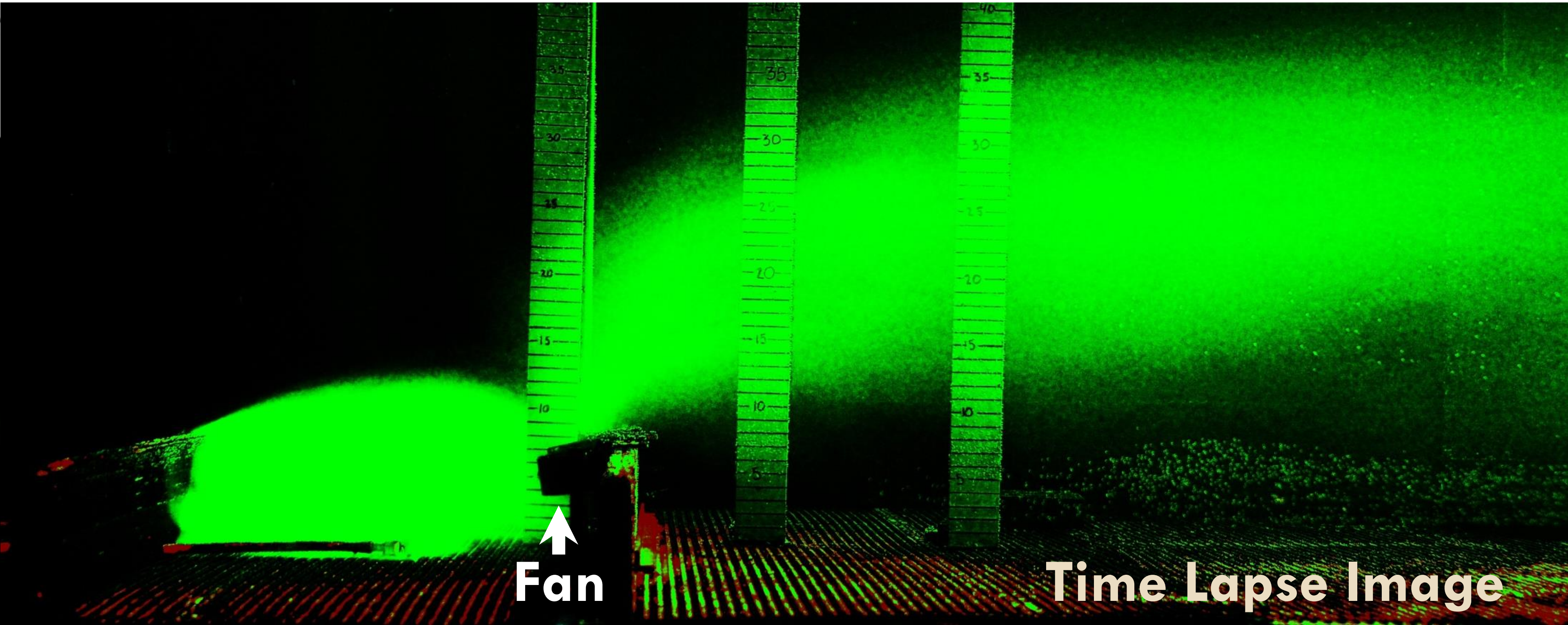


Study B – Flow Tank Experiments Double Barrier Movie



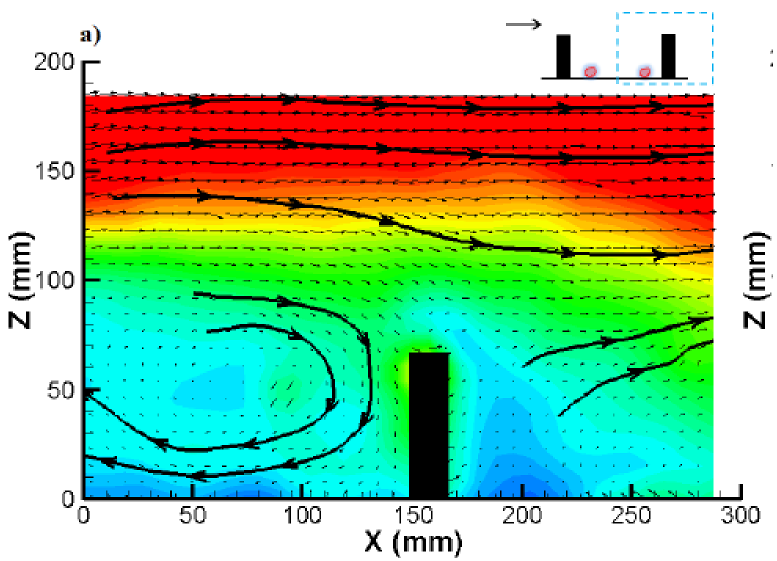
Study B – Flow Tank Experiments Testing Alternative Designs

- Laboratory setup provides ability to test new approaches
  - E.g., fans on a sound wall



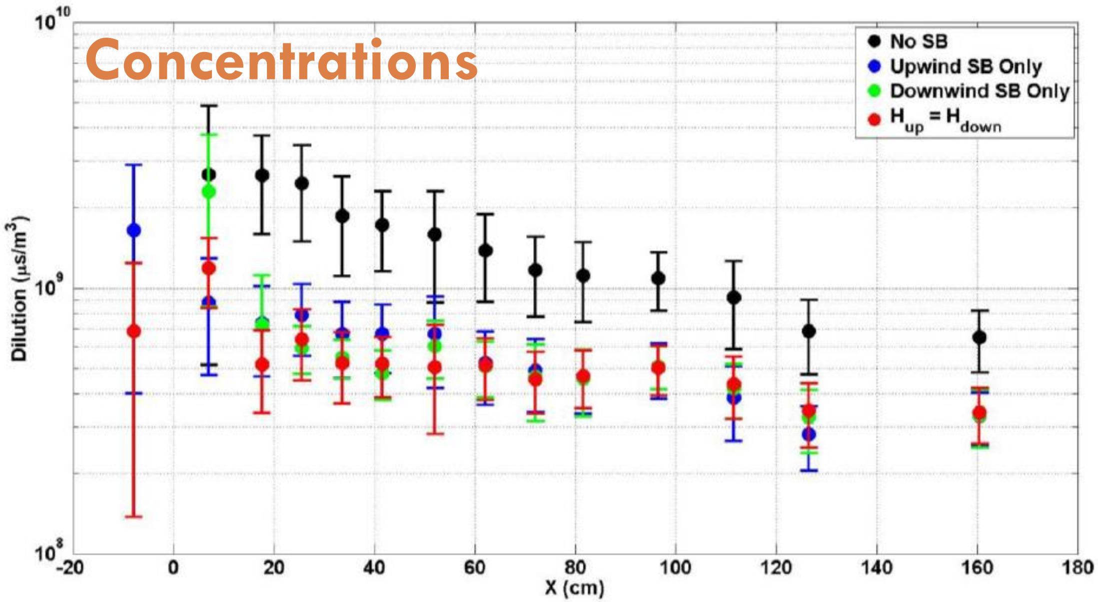
Study B – Flow Tank Experiments Quantification

- Flow velocities and contaminant concentrations are quantifiable
  - Particle Image Velocimetry
  - Laser Induced Fluorescence



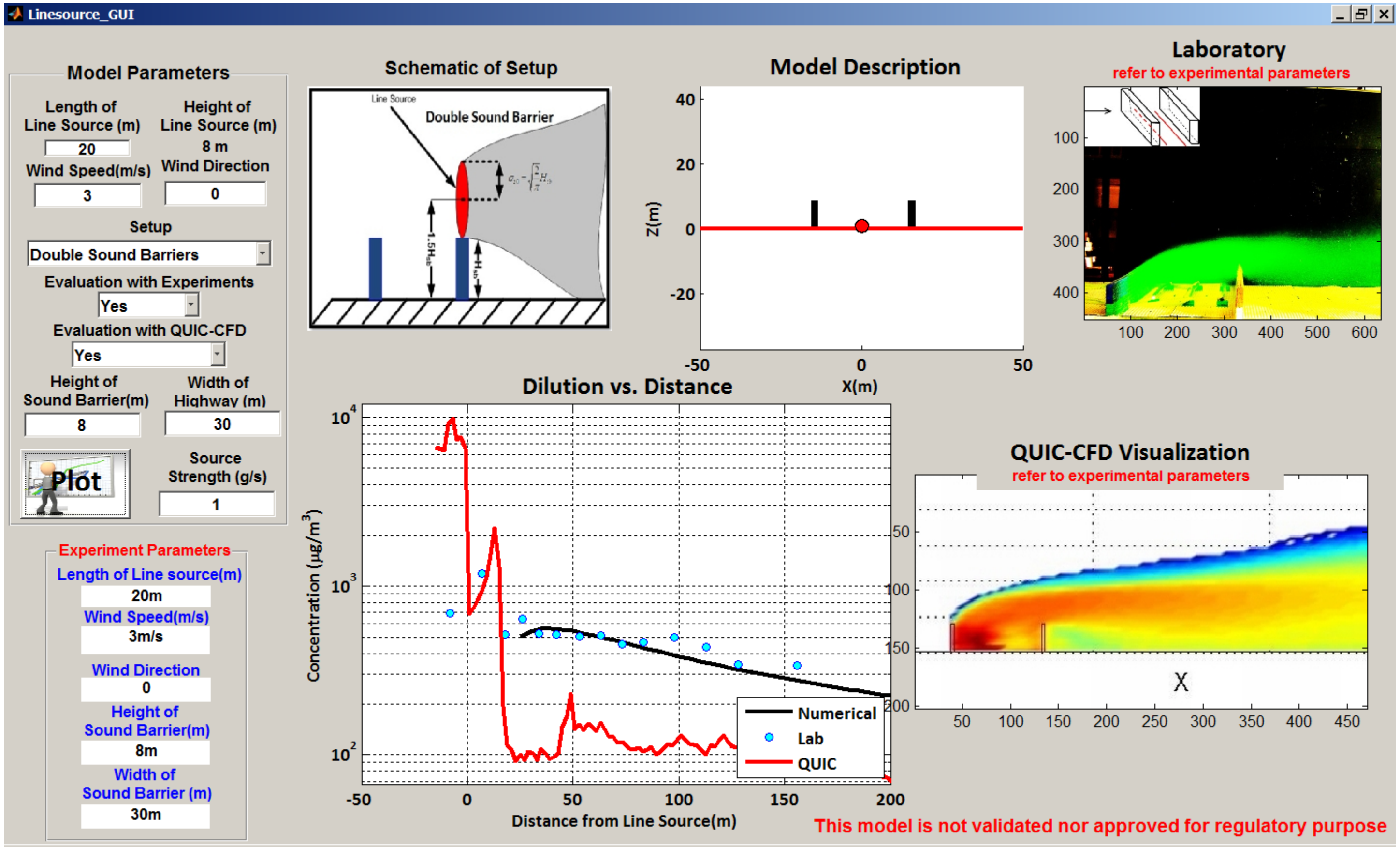
Velocity Field

Concentrations



Study B – Flow Tank Experiments Software Development

- Software package created to present results of various modeling and laboratory exercises

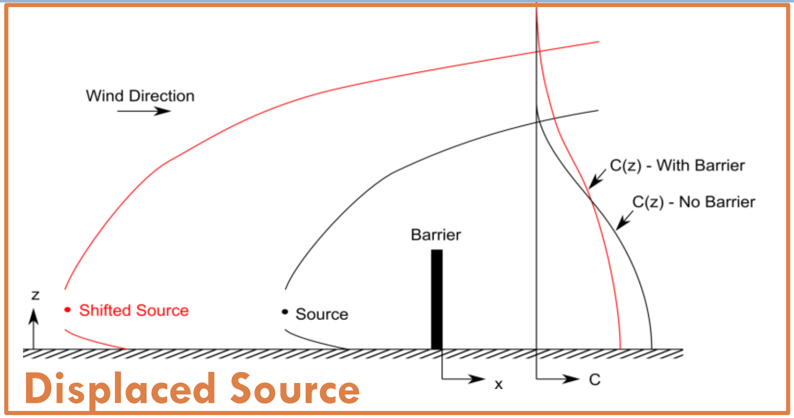


Study C – Mathematical Modeling

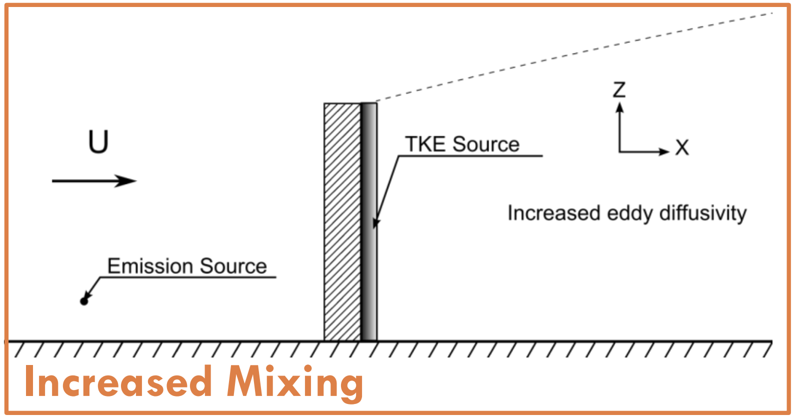
- Investigate physical parameters affecting dispersion behind a barrier
  - Increased vertical dispersion through additional turbulence generated in the wake of the barrier
  - Induced vertical mixing behind the barrier in the cavity region
  - Emissions lofted above the barrier

Study C – Mathematical Modeling
Three Formulations Investigated

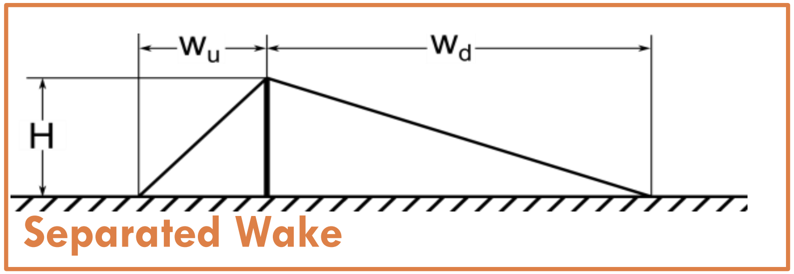
- Displaced Source



- Increased Mixing

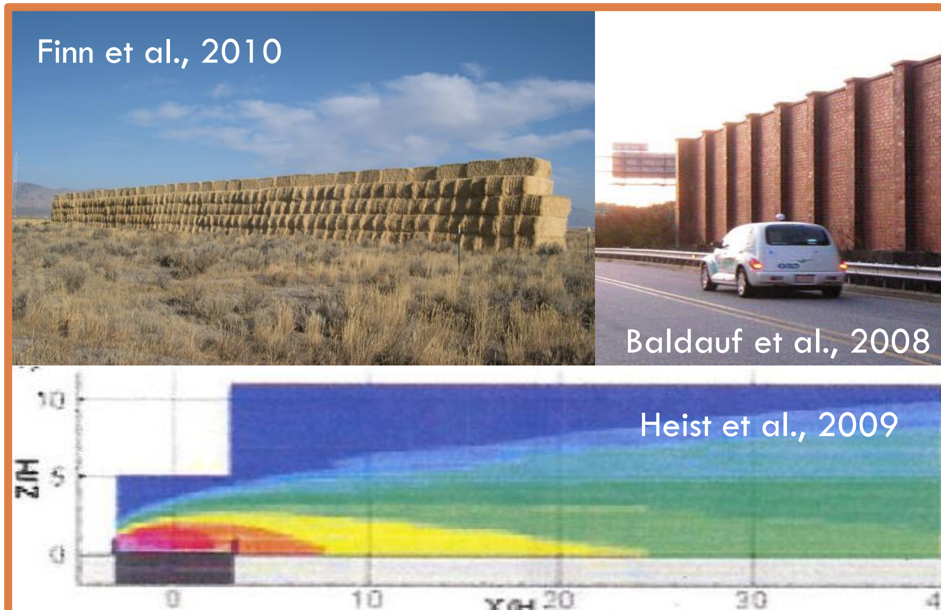


- Separated Wake (Puttock-Hunt)

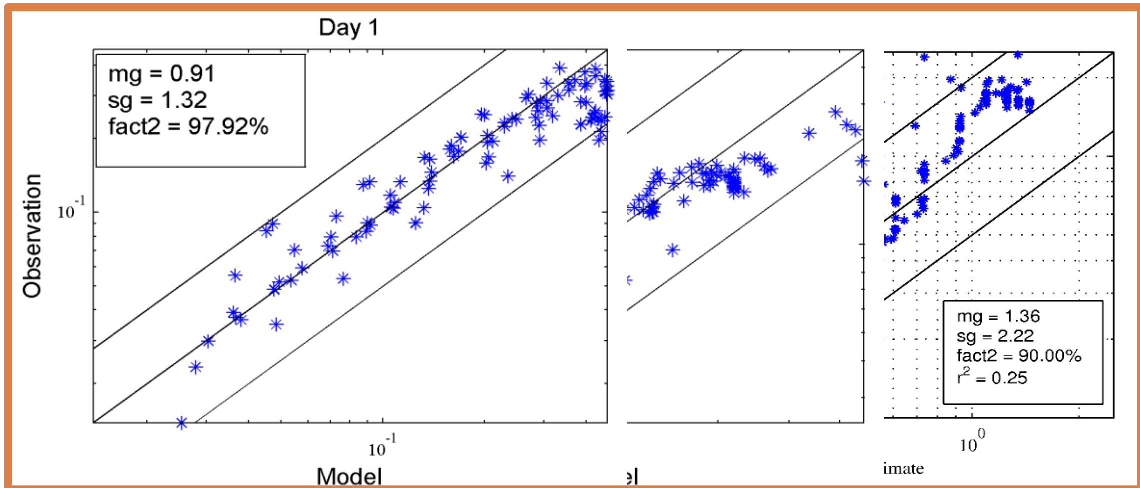


Study C – Mathematical Modeling Compare Results with Previous Studies

- Results from modeling compared against previous monitoring and CFD modeling studies

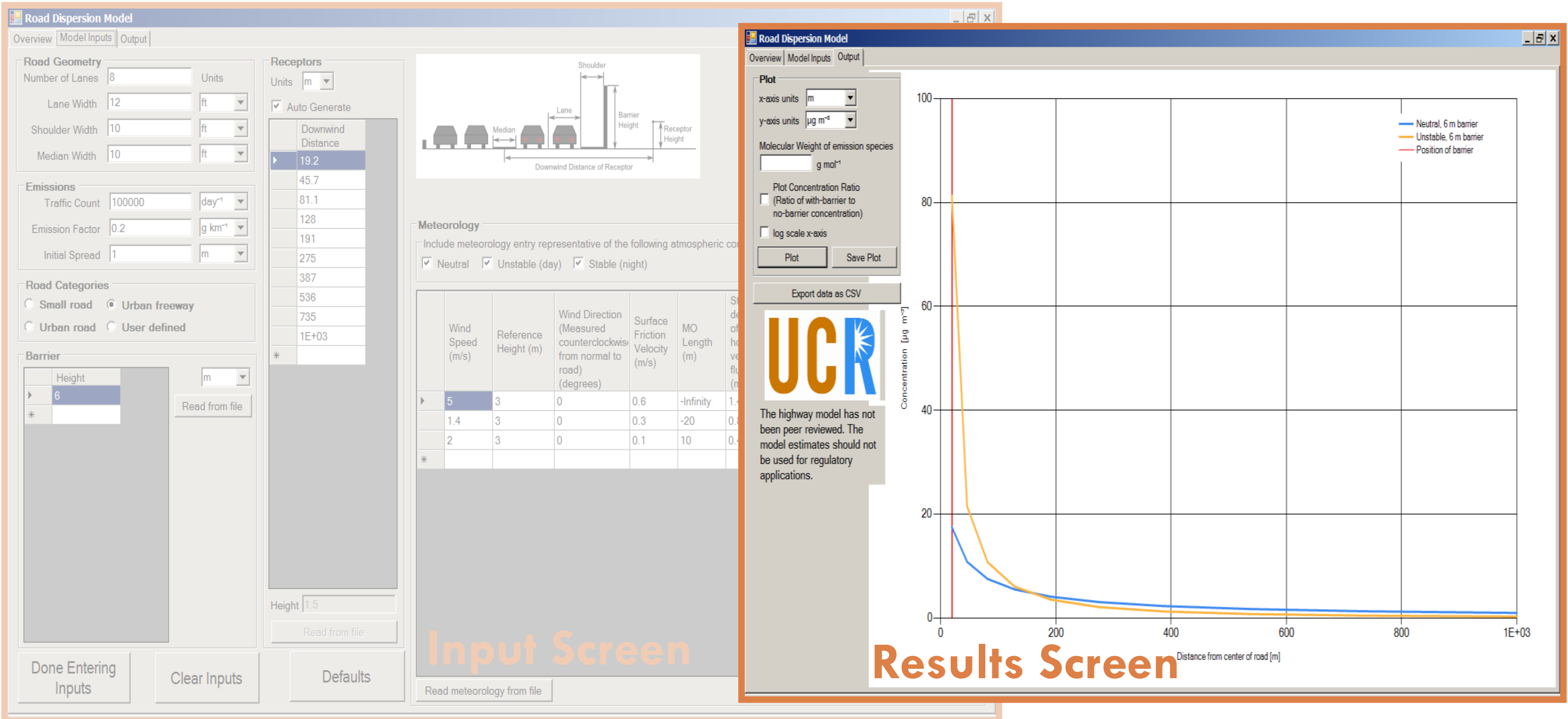


- Correlations generally good, but further research needed



Study C – Mathematical Modeling Software Development

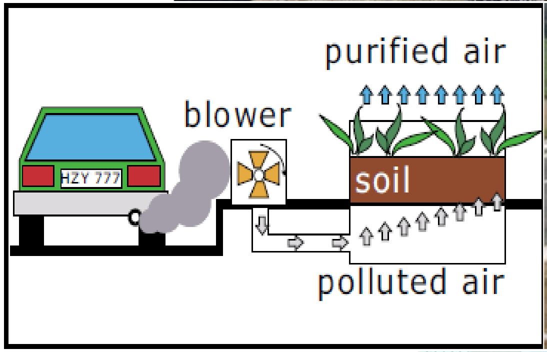
- Software calculates results using increased mixing model



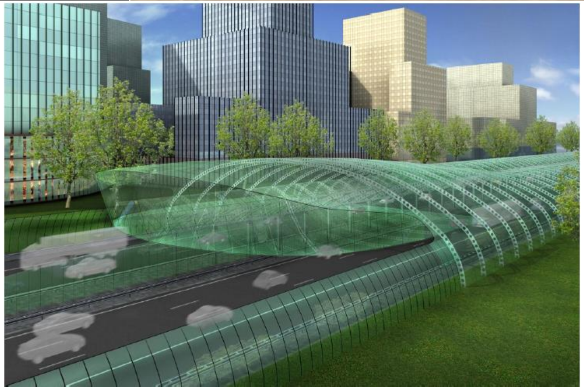
Study D – Alternative Technologies

- Photocatalytic Cement
  - Europe, Missouri

- Biofiltration
  - Japan



- Roadway Canopy
  - Concept stage



Summary

- Existing dispersion models require further development to accurately capture effects of near roadway barriers
- Research is promising, but more work needed