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Traffic-Related Pollutant Levels: Near-Road Compared to Allen Park

An Analysis of Sites Proximate to Southfield Freeway

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Outline

1. Near-Road
2. DEARS Near-Road
3. Methods
4. Results
5. Future Work

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Near-Road

The environment or area

Mobile Sources

The sources: vehicles

Traffic-Related Pollutants

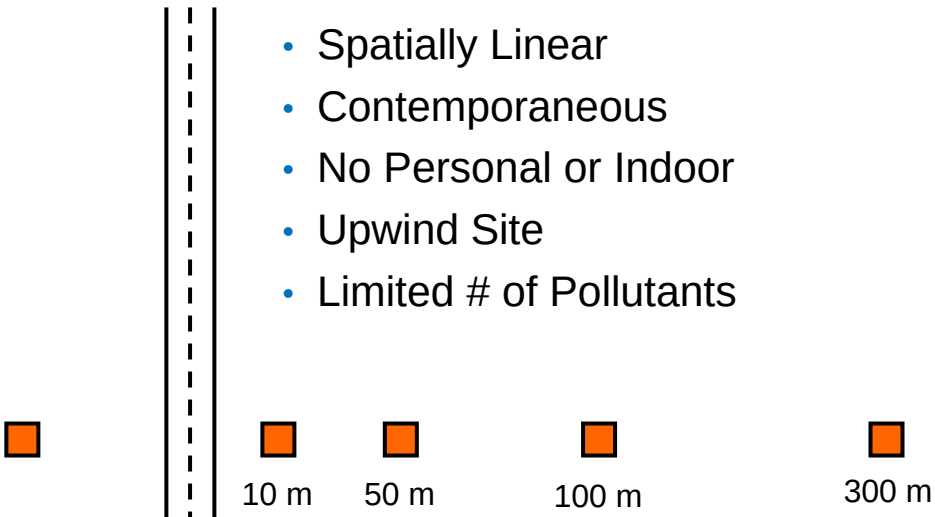
(& Mobile Source Air Toxics)

The chemicals or constituents

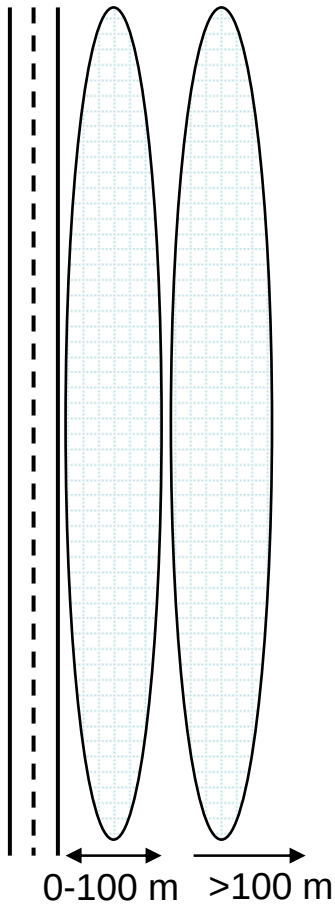
Mobile sources contribute to both the regional airshed & near-road microenvironment

Traditional Near-Road Approaches

- Spatially Linear
- Contemporaneous
- No Personal or Indoor
- Upwind Site
- Limited # of Pollutants



- Buffers
- Near vs. Far
- Epidemiology



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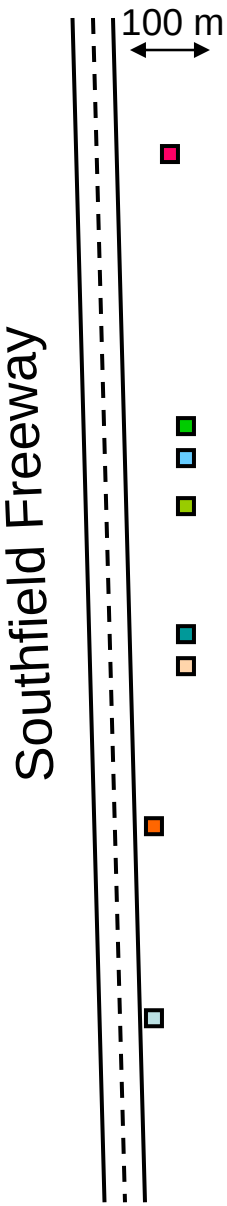
DEARS Near-Road

- Proximate Residential
- Spatially & Temporally Distributed
- Personal, Indoor & Outdoor
- Comparison to Central Site Monitor
- Suite of Pollutants



Methods
Statistical

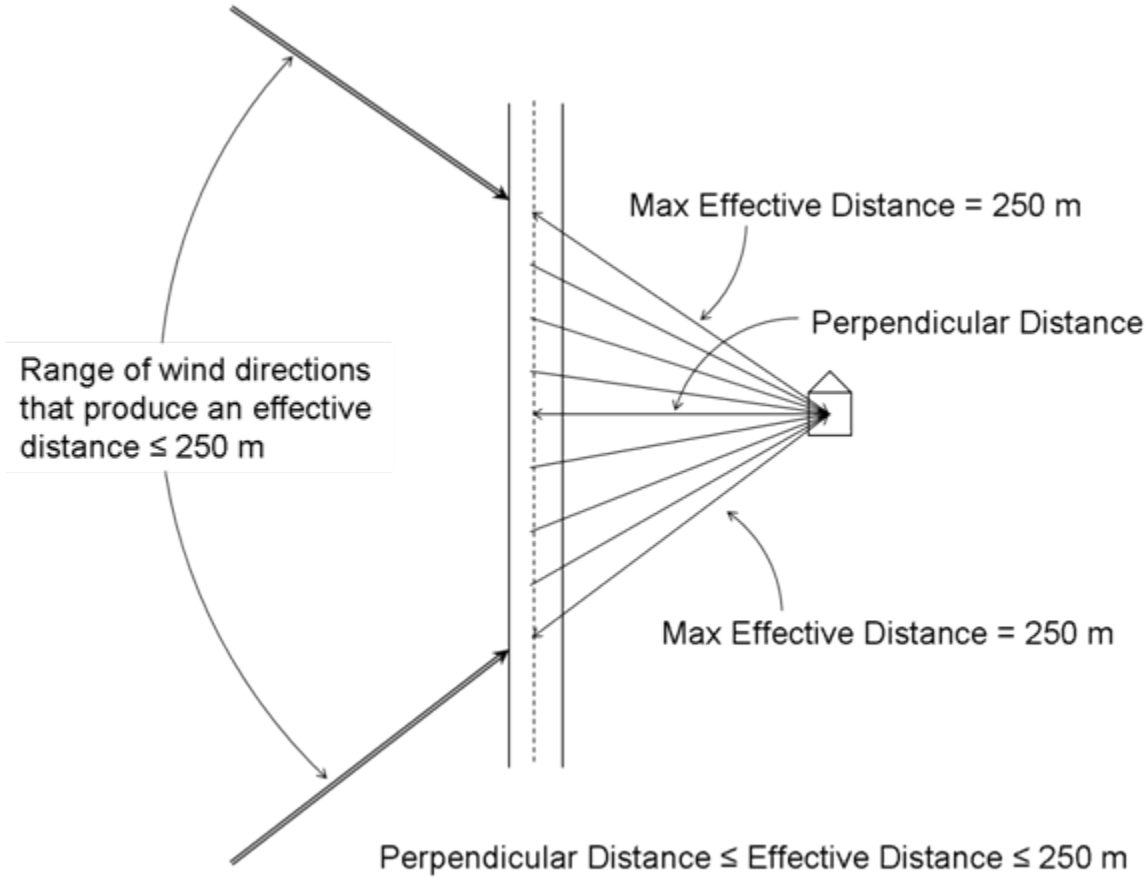
- Univariate Repeated Measures Model
  - Concentrations = f(Distance)
  - Accounts for Autocorrelation

- Outdoor normalized with Ambient (O/A)
  - Regional Temporal Variability
  - Measurement Error

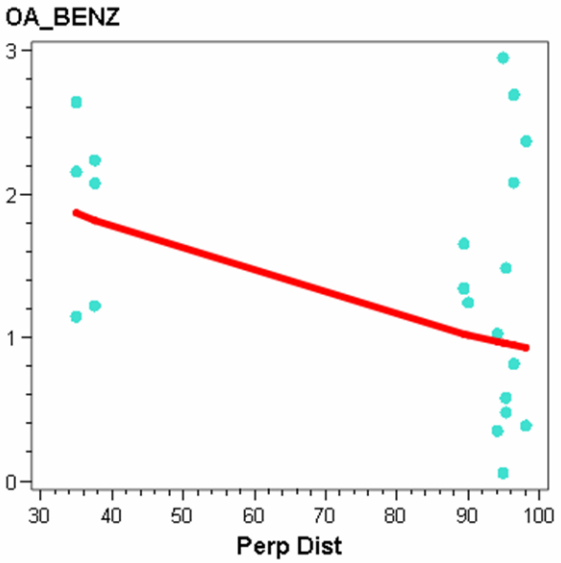
$$\text{Log(O)} = \text{Log(A)} + \beta\, \text{D}$$
$$\text{Log(O)} - \text{Log(A)} = \beta\, \text{D}$$
$$\textit{Log(O/A)} = \beta D$$
$$e^{\text{Log(O/A)}} = e^{\beta\, \text{D}}$$
$$\text{O/A} = e^{\beta\, \text{D}}$$

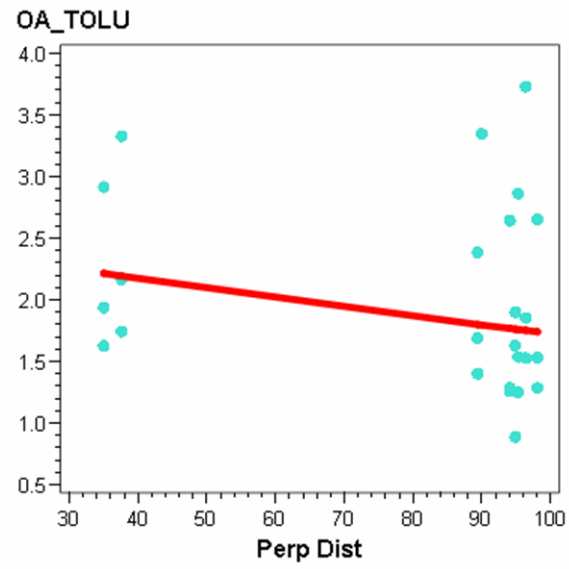
$e^{\beta D}$ describes the *shape* of the near-road gradient

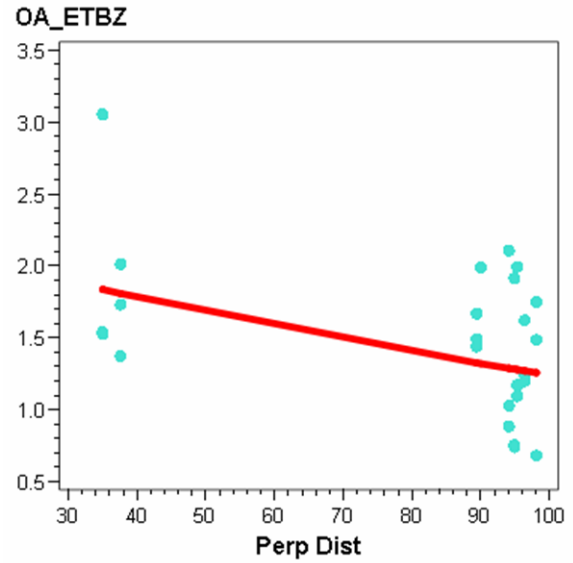
Methods
Analytical

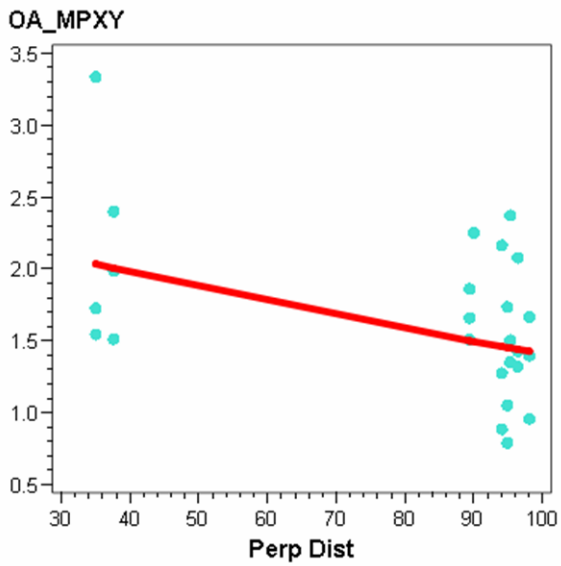


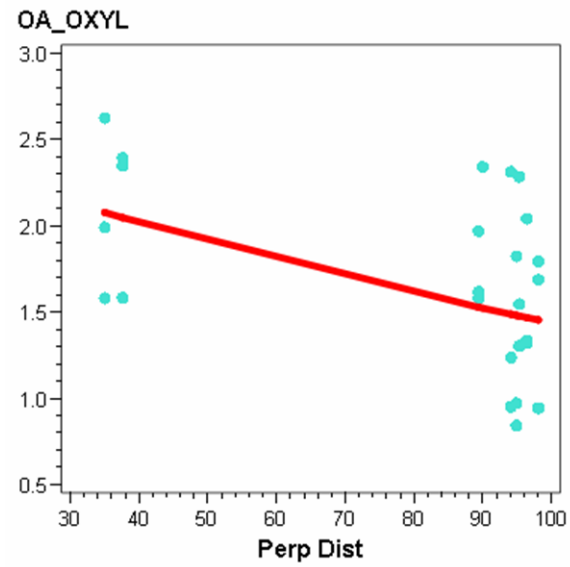
Results
Perpendicular Distance





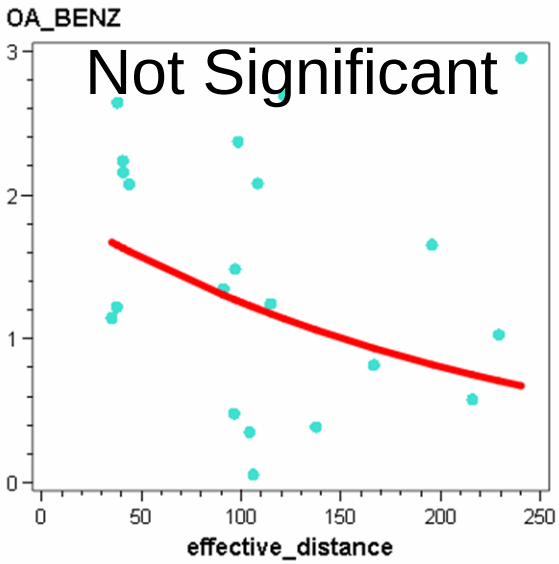


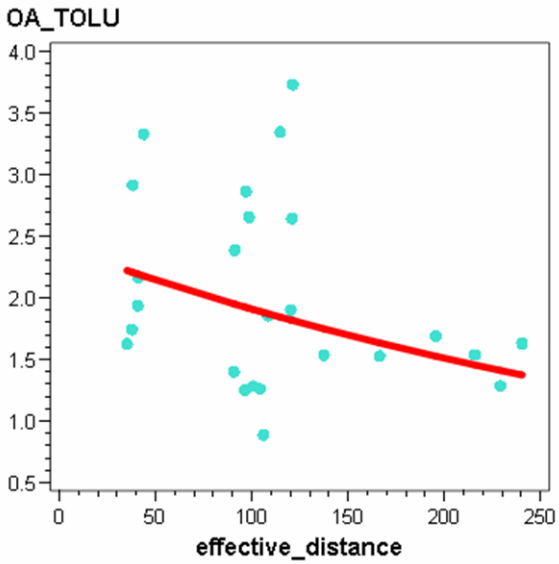


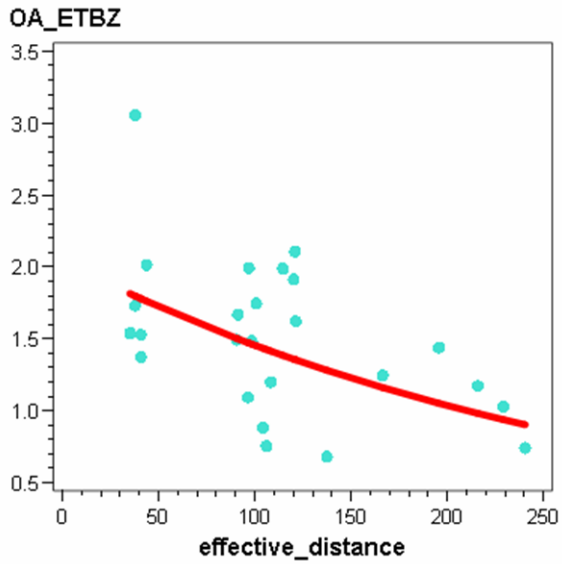


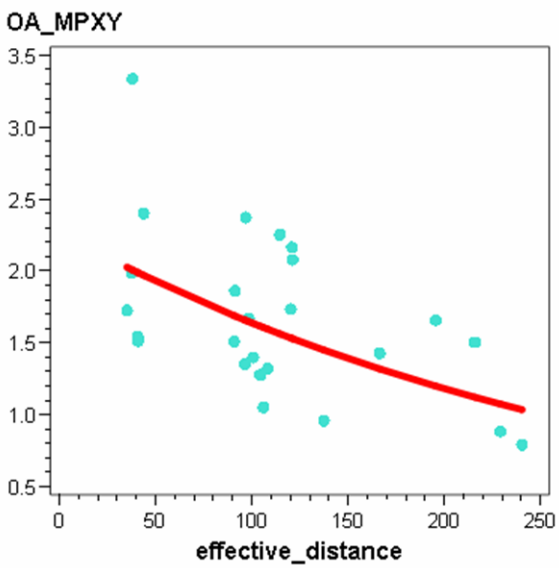
Limited to site distances
Doesn't explain ratio variability
Linear slopes questionable

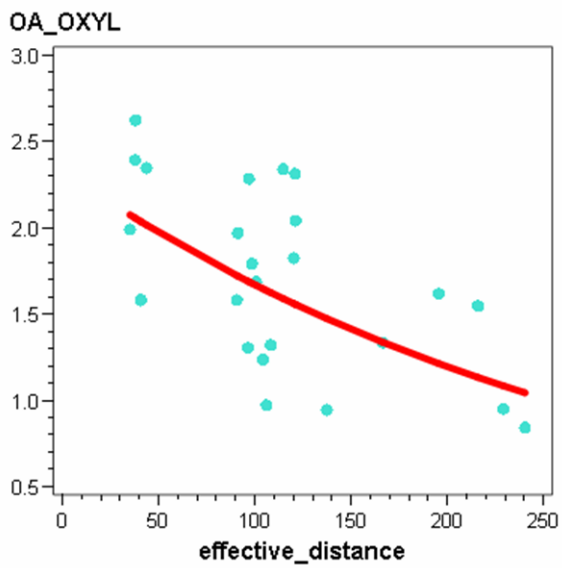
Results
Effective Distance











Range of distances to 250 m
Better explains ratio variability
Curvilinear slopes
More significant & Better fit

Summary

Season 3

Pollutant	Median (μg/m³) Effective Distance	Median (μg/m³) All DEARS
Benzene	2.54	2.19
Toluene	5.59	4.84
Ethylbenzene	1.13	1.03
m,p-Xylene	3.20	2.84
o-Xylene	1.18	1.01

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Which Pollutants Tell Us About Roadways?

Pollutant Group	Specific Pollutant	Representative?
Gases (VOCs)	Benzene Toluene Ethylbenzene m,p-Xylene o-Xylene 1,3 Butadiene 1,3,5 Trimethylbenzene 4 Ethyltoluene	Yes
Carbon Particles (2.5 µm)	Elemental Carbon	Probably for Trucks
Small Particles (2.5 µm)	Arsenic Chromium Lead Manganese Nickel	A Few Are

DEARS General Findings

(Confirms the science)

Wind

- Wind direction matters
- Nearby, downwind houses
- Air travels farther at different angles - and it matters!

  (That's new)
- Upwind houses don't show fingerprint

Distance

- Right next to the road, levels are about 2½ times background
- Pollutant levels drop quickly
- Decrease to background levels by about 750'

The DEARS Advantage

Expand the Fingerprint

…and the science

- What other pollutants?
- What else?
  - Traffic
  - Infiltration into Houses
  - Seasons? Weather?
- If we understand the contributing factors, then can a single community site help us predict what happens near roads?

Comprehensive Near-Road Exposure Study

- Are people who spend a lot of time near roads exposed to more pollution? How much more?
- Which factors contribute to high and low levels of exposure?
- What can be done to decrease exposure?

We've only scratched the surface…

Disclaimer

Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.

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