Roads, Pollution and Housing: Setting Some Boundaries

Presented to

11th Annual New Partners for Smart Growth Conference
Session: "Housing and Freeways: How Close Is Too Close?"
San Diego, California

Presented by

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Outline

Near-Road Pollution

1. News (from Los Angeles)
2. Near-road pollution, why we care (health)
3. Problem sources (cars and trucks)
4. Problem scale (distance from road)
5. The future (fleet turnover)

Smart Growth

6. Enter smart growth (Los Angeles)
7. Benefits vs. risks (health)
8. Solutions (mitigation)

Los Angeles Times

Freeway air pollution linked to brain damage in mice

"Our data… suggest that freeway pollution could have a profound effect on… health in children and young kids, especially those who attend schools built alongside freeways."

Todd Morgan, USC research professor

Source: **April 7, 2011**, *Los Angeles Times*

Near-Road Pollution: Why We Care

"...near major roads [people] have an increased incidence and severity of health problems…"

Source: U.S. EPA Highway Clean Air Research Program
http://www.epa.gov/ord/ca/quick-finder/roadway.htm

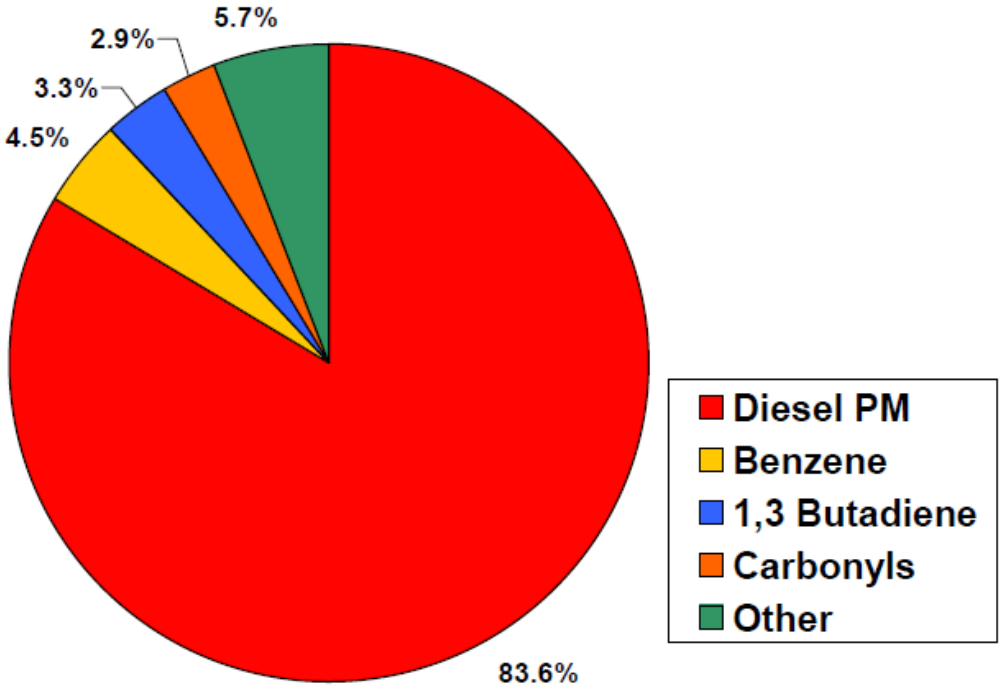
Problem Sources: Cars and Trucks

- Light-duty
  - CO, NO_x, PM
  - Toxics
    - Benzene
    - 1,3-butadiene

- Trucks
  - NO_x, PM
  - Toxics
    - Diesel PM

Problem Sources: Truck Focus

Diesel particulate matter (DPM) emissions are most important “air toxic”



Basinwide Risk: 1194 Per Million

Los Angeles “MATES” study: DPM produced **over 80%** of air pollution-related cancers.

(SCAQMD, 2008)

Problem Sources: Congestion

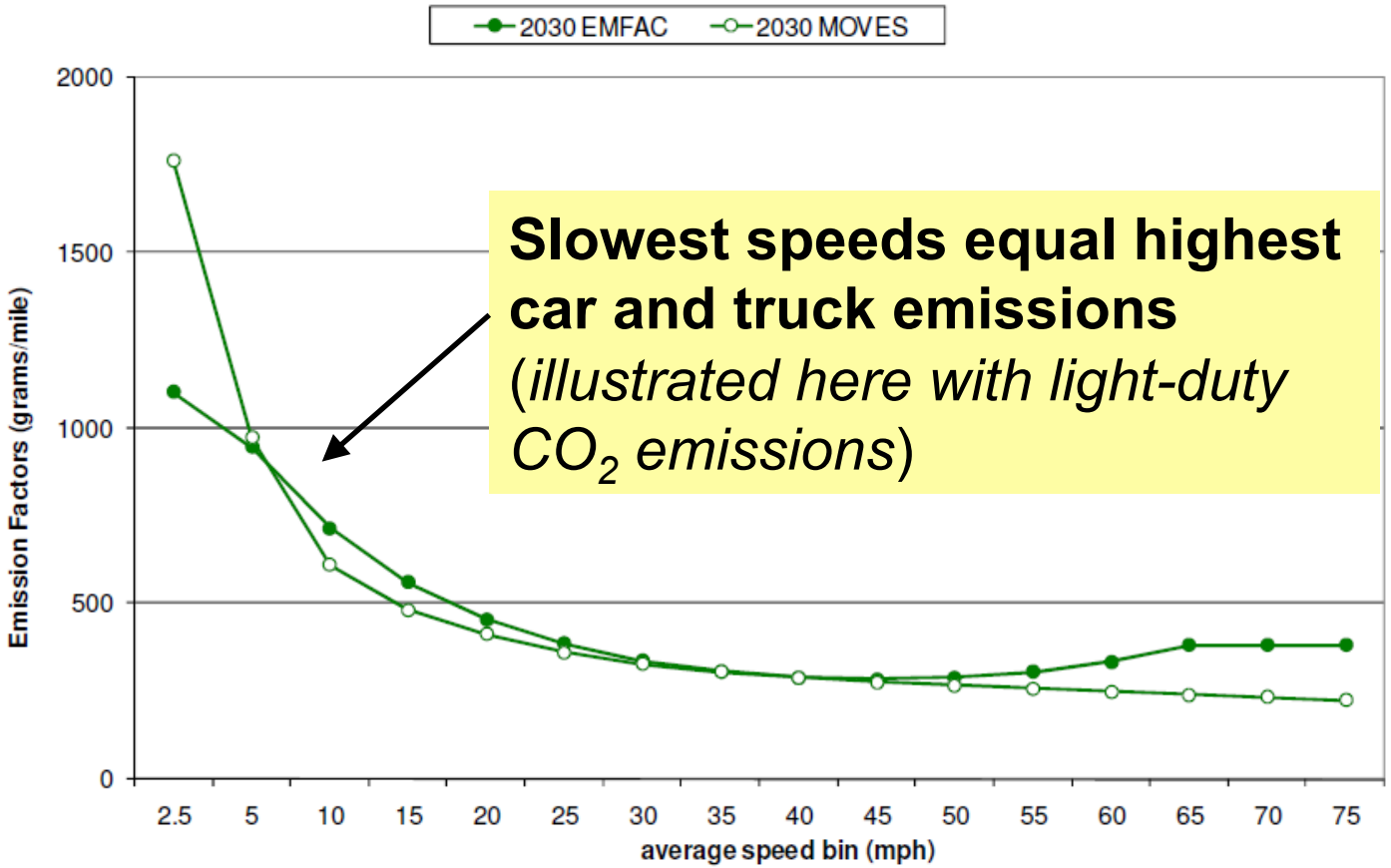
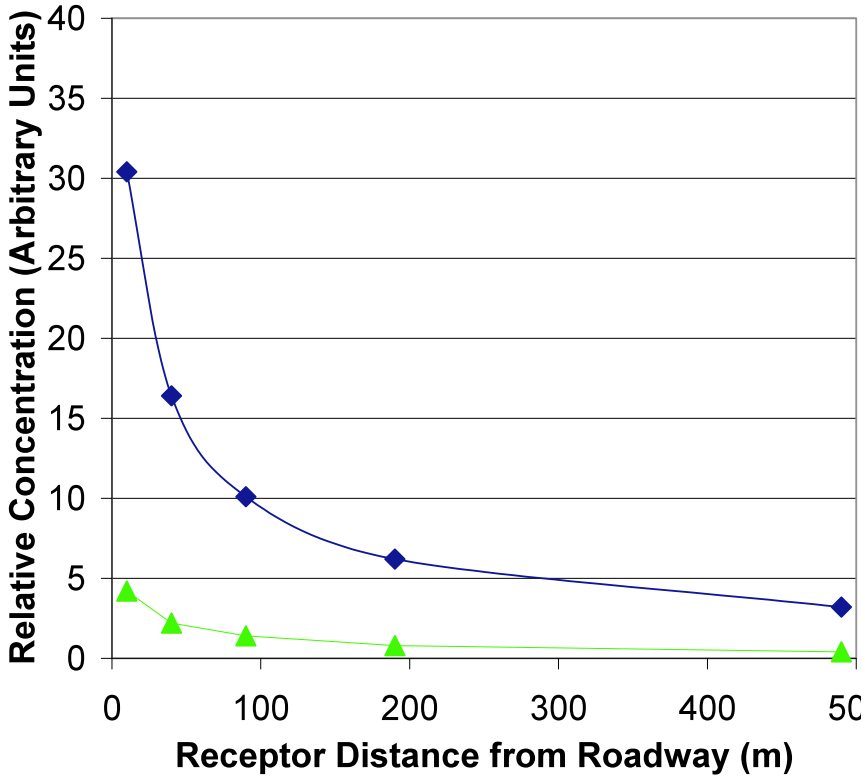


Image source: Bai, Eisinger, and Niemeier (2009)
TRB Paper, *MOVES vs. EMFAC*

Problem Scale: Key Concepts



Wind Speed

Slow: 1 m/sec

Faster: 10 m/sec

Modeled concentrations vary with **winds** and **distance**

Source: Tamura and Eisinger, 2003 (US 95 Case Study)

http://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/

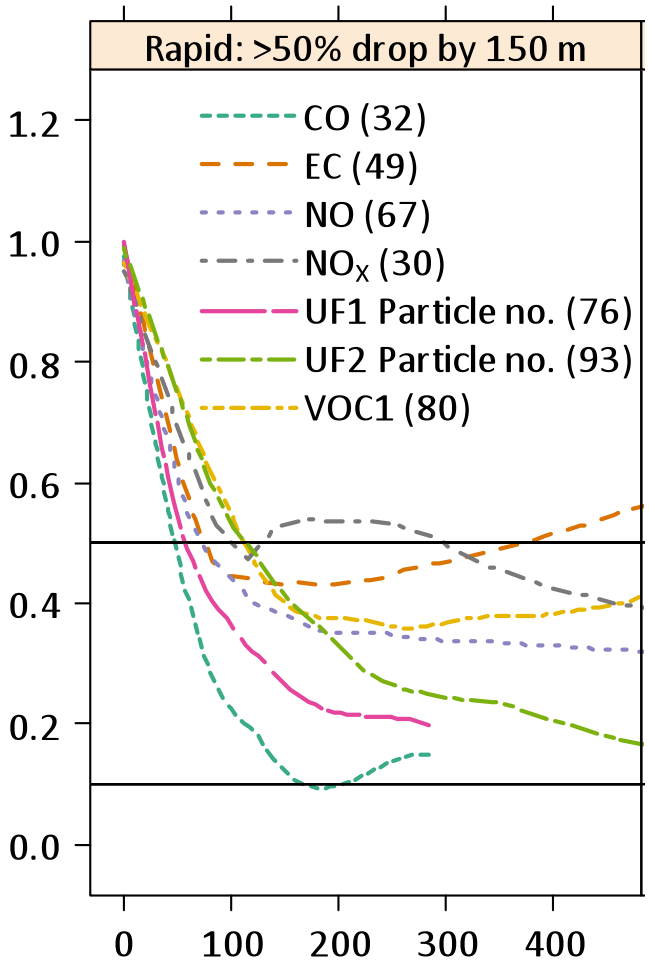
Problem Scale: Worldwide Data

Measured concentrations
41 studies, 13 countries, 30 years

Key findings, by distance from road:

- 150 m – rapid (50%) decline
- 400 m – most at background
- 600 m – nearly all at background

(nighttime exceptions)



Source: Karner, Eisinger, Niemeier; *ES&T* **2010,** vol. *44, 5334-5344*

Future, Part 1: Standards

From 1980 to 2010, new-car HC emissions were cut >90%. *New-truck emissions were also reduced*.

Model Year	HC	CO	NO_x
1966	6.30	51.0	
1971			4.0
1980	0.39		1.0
1981		7.0	0.7
1993	0.25	3.4	
2010	0.035	~1.7	~0.05

Sample California standards for new light-duty vehicles (units are g/mi)

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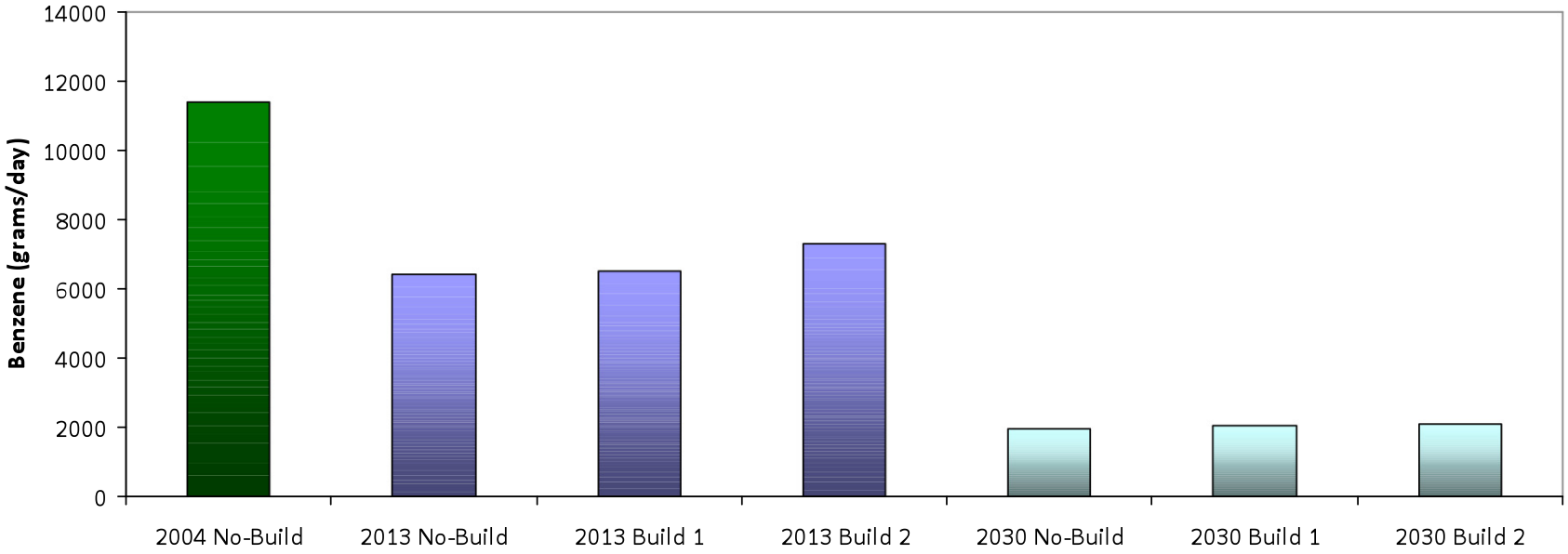
Future, Part 2: Implications



Hypothetical freeway project (chart above): benzene **emissions drop ~80% (2004–2030)**

Source: STI analyses

Sacramento MPO modeled near-road $PM_{2.5}$: $PM_{2.5}$ **emissions drop ~80% (2008–2035)**

Source: 2035 SACOG draft plan

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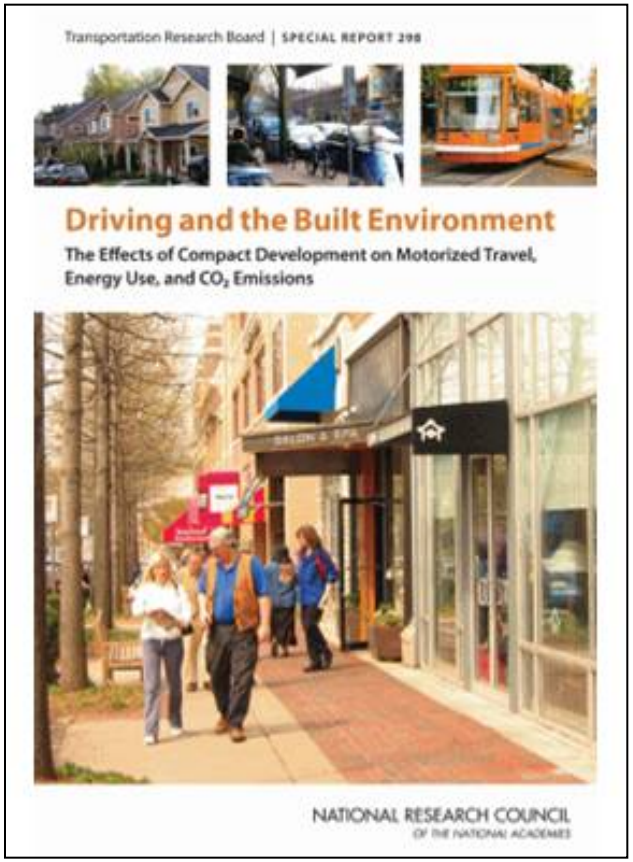
Enter Smart Growth: Reduced Travel and Emissions

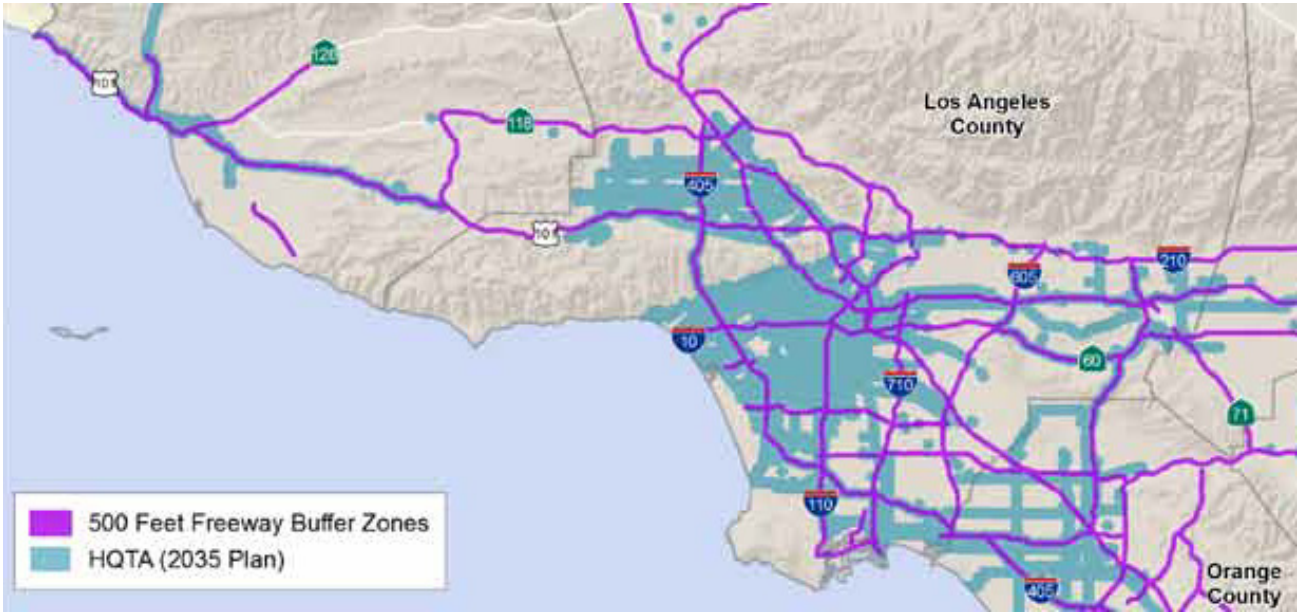
Regionally, can reduce VMT, energy use, and CO_2 emissions **about 1 to 11% by 2050**



Source: U.S. National Research Council, 2009

Los Angeles Plan: >50% of New Growth in "High-Quality Transit Areas" (**HQTAs**)

2035 Plan



Blue: HQTAs

Purple: 8–11% of new growth <500 ft from freeways

Source: SCAG December 2011 Draft RTP/SCS Environmental Justice Supplement

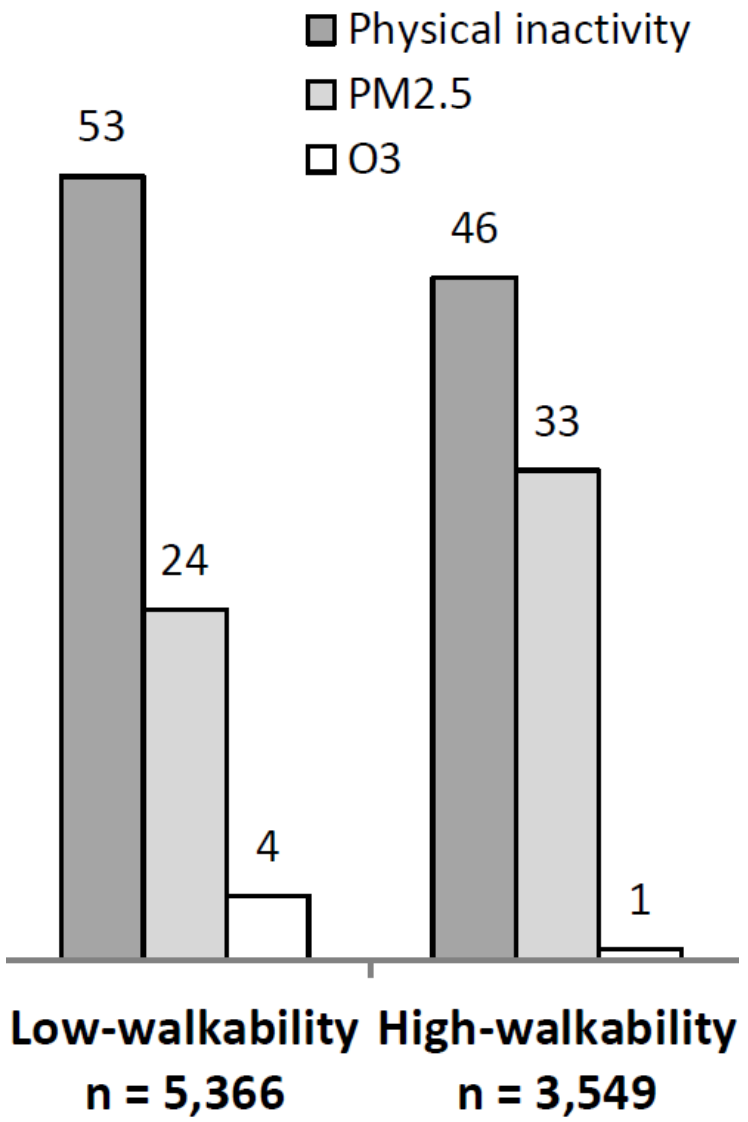
Benefits vs. Risks

"…**initial review** of the literature suggests that **beneficial aspects** of active transportation [*walking or biking*] **outweigh any negative impacts** related to increased air pollution exposure…"

Benefits vs. Risks: Ongoing Work

- More people are physically active (25% vs. 13%)
- However, **increased air pollution exposure can offset activity benefits**

From: Hankey et al. (2011) *Health Impacts of the Built Environment*



Deaths per 100,000 people/year from ischemic heart disease (**using 2001 pollution data**)

Solutions: Sample Challenge

Bay Area Upper Muni Yard Affordable Housing Site (near I-280)
Design Considerations: Population Groups and HVAC Filters

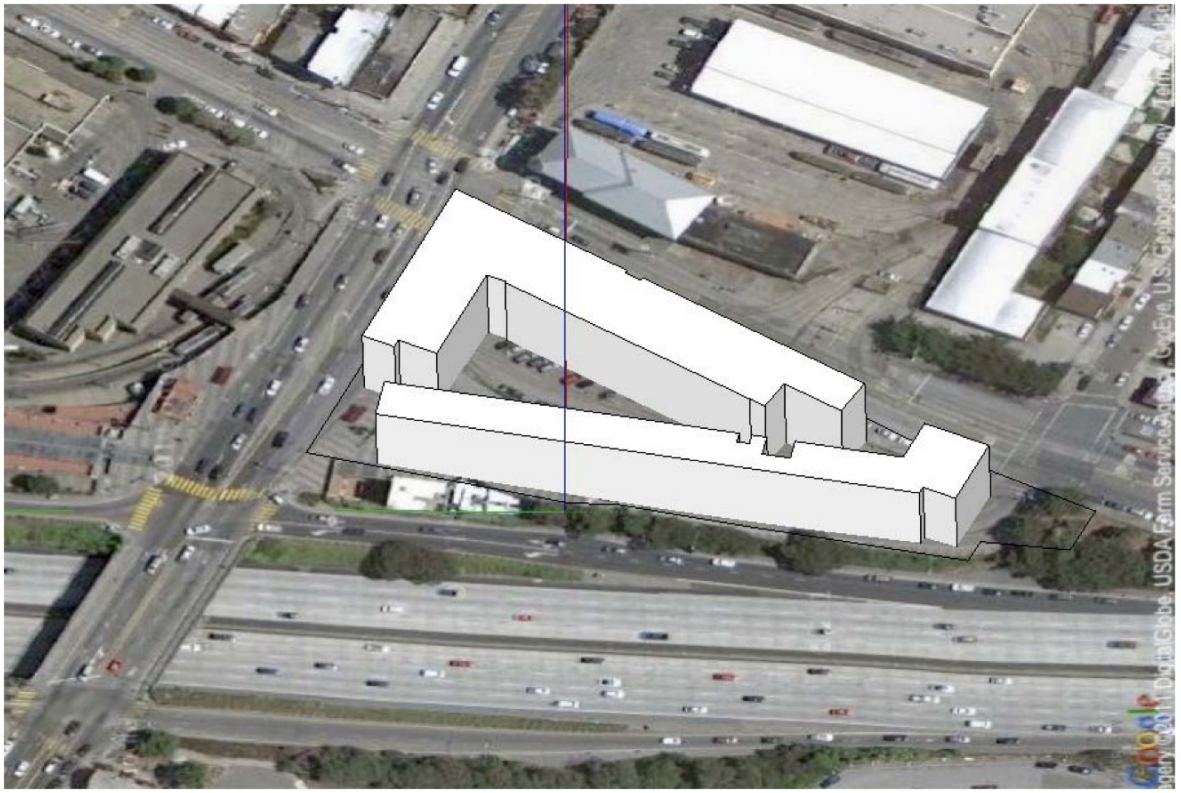


Image courtesy of Tom Rivard, SF Dept. of Public Health

Solutions: Closing Thoughts

Reduce Emissions

- Congestion
- Fleet turnover

Intercept Pollutants Outdoors

- Sound walls
- Vegetation

Increase Distance to Roads

- 150–600 m zone

Control Land Use by Sensitive Groups

- Children, seniors
- The health-impaired
- Pregnant women

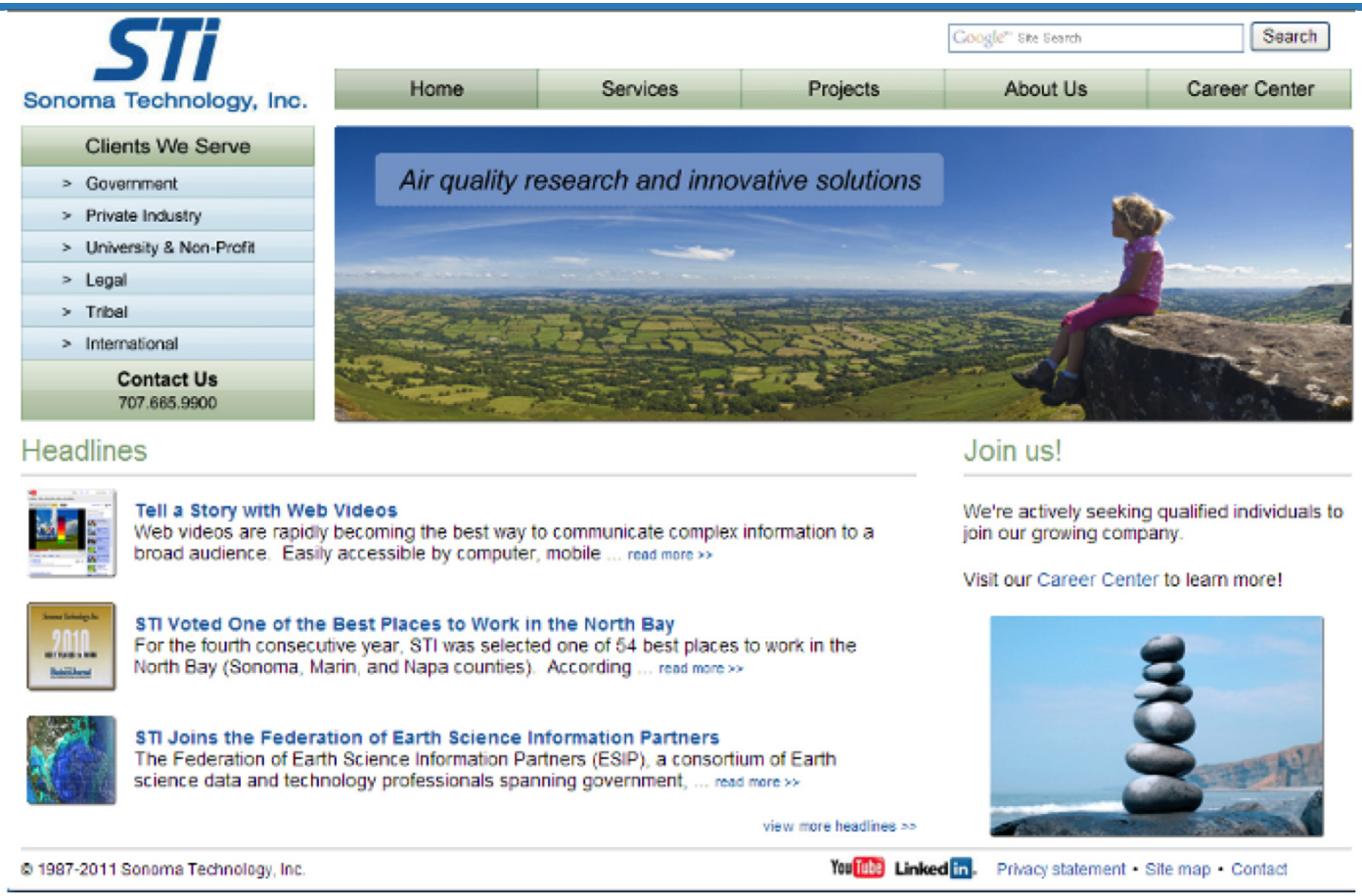
Control Vehicle Types

- Truck rerouting

Intercept Pollutants Indoors

- HVAC air intake locations
- HVAC filters

Contact



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Additional Material

For question and answer period

BBC Mobile News | Sport | Weather | Travel | TV

NEWS LONDON

Pupils' health 'at risk' from London road pollution

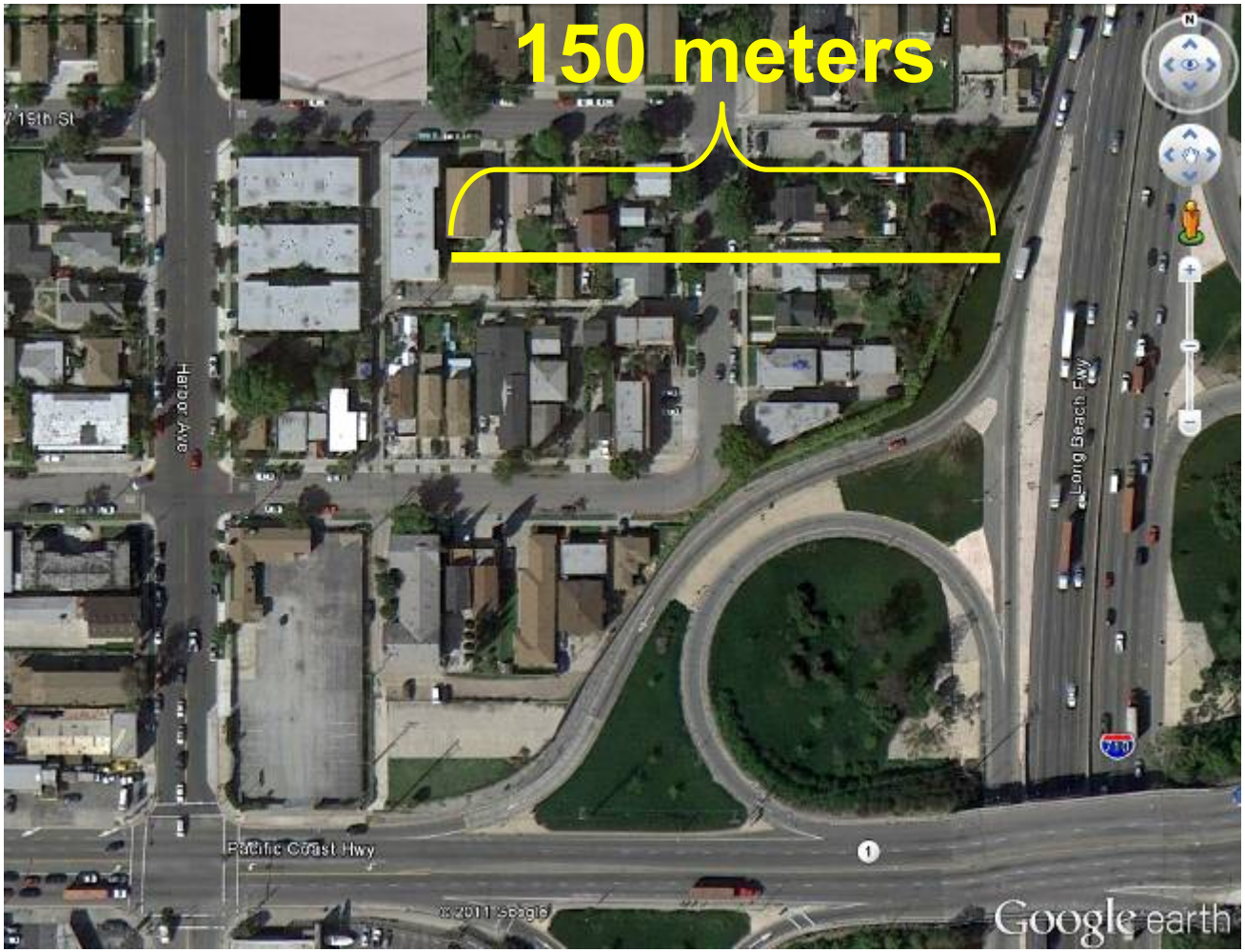
Up to 2,270 schools in London are within 400 m of busy roads

Source: **June 7, 2011**, *BBC News*

(based on research by Clean Air London and Aphekom)

Problem Scale: Illustration

Streets near 710 Freeway and Port of Long Beach



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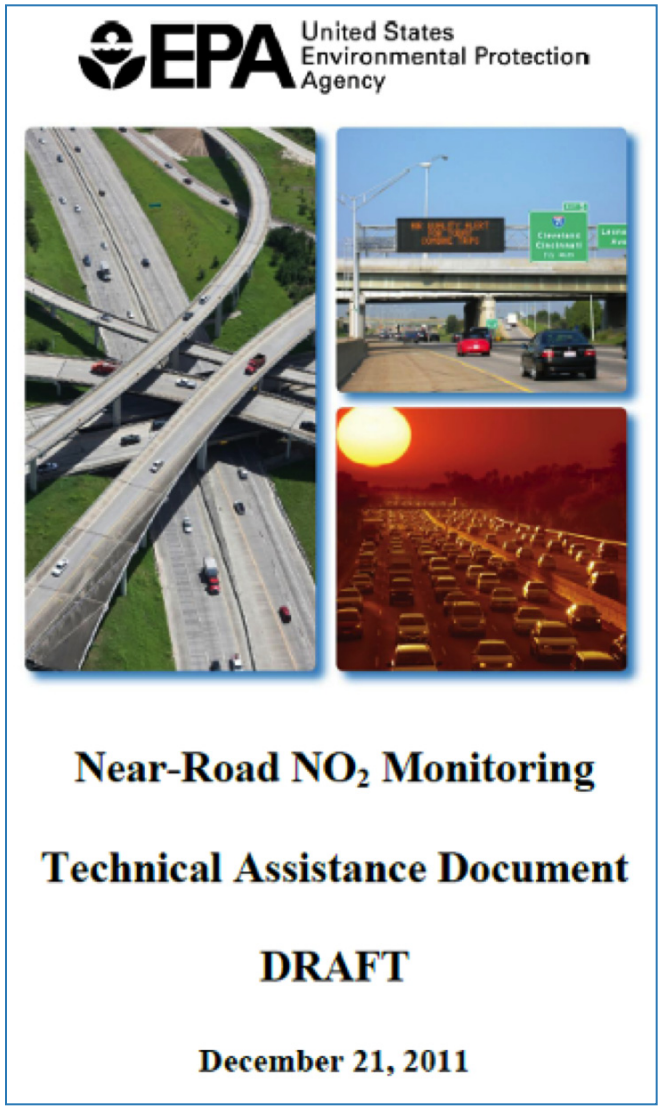
Near-Road Pollution: EPA Requirement



In recognition of the near-road issue…

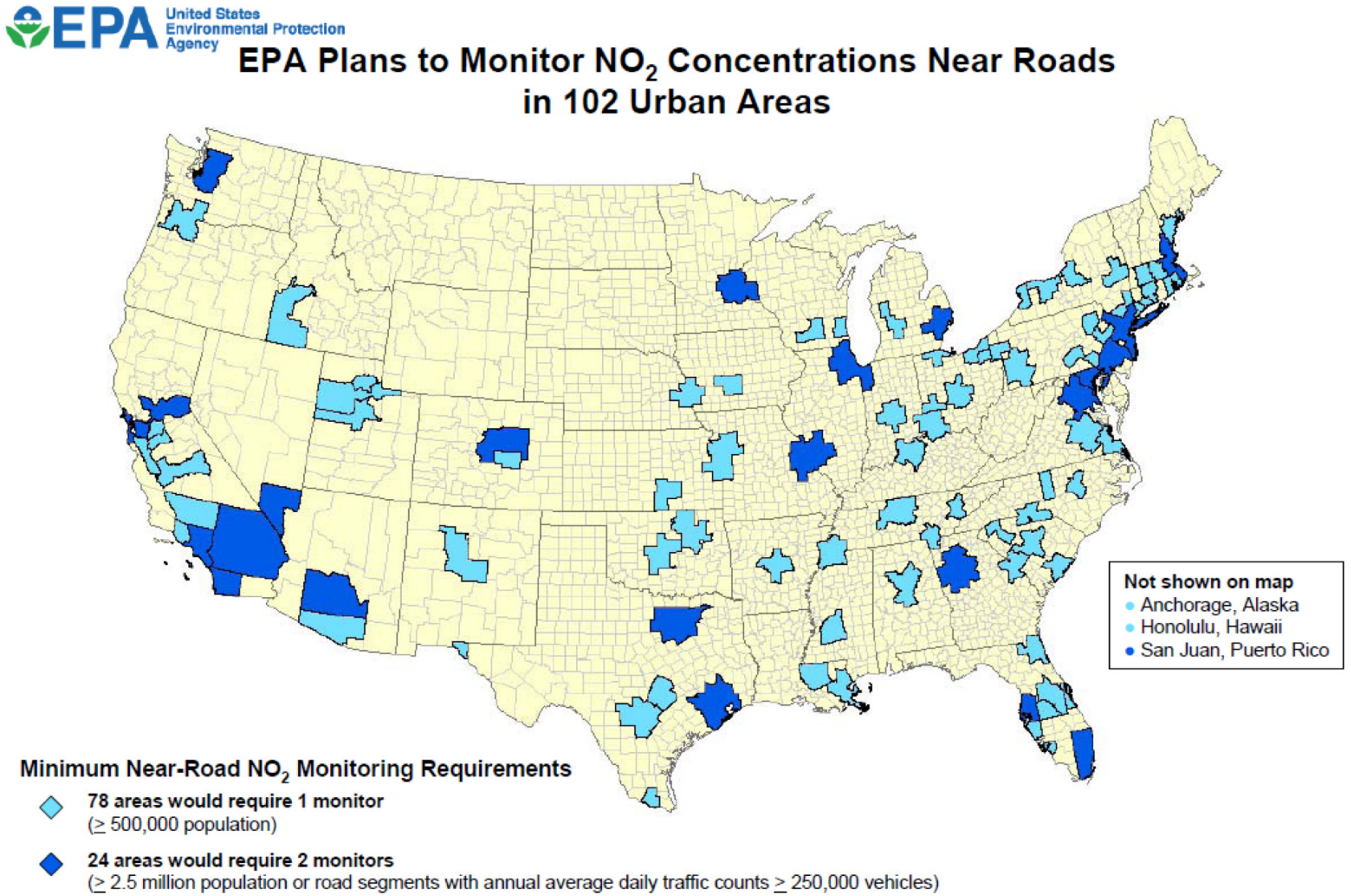
EPA requires near-road pollution measurements starting January 1, 2013

Required Near-Road NO_2 Monitoring

- 1 site: areas ≥ 500,000 population
- 2 sites: areas ≥ 2.5 million population
- 2 sites: areas with roads ≥ 250,000 AADT

- Rank roads by AADT (weight trucks more)
- Identify possible maximum NO_2 sites
- Locate monitor "as near as practicable to the outside nearest edge of the traffic lanes…" **but not further than 50 meters**

Required Near-Road NO_2 Monitoring



The Future: Truck Standards Over Time

Car and truck emissions standards have become more stringent over time

(truck standards shown here)

During 2007–2010, standards tightened further:

- NO_x 0.20 g/(hp-hr)
- PM 0.01 g/(hp-hr)

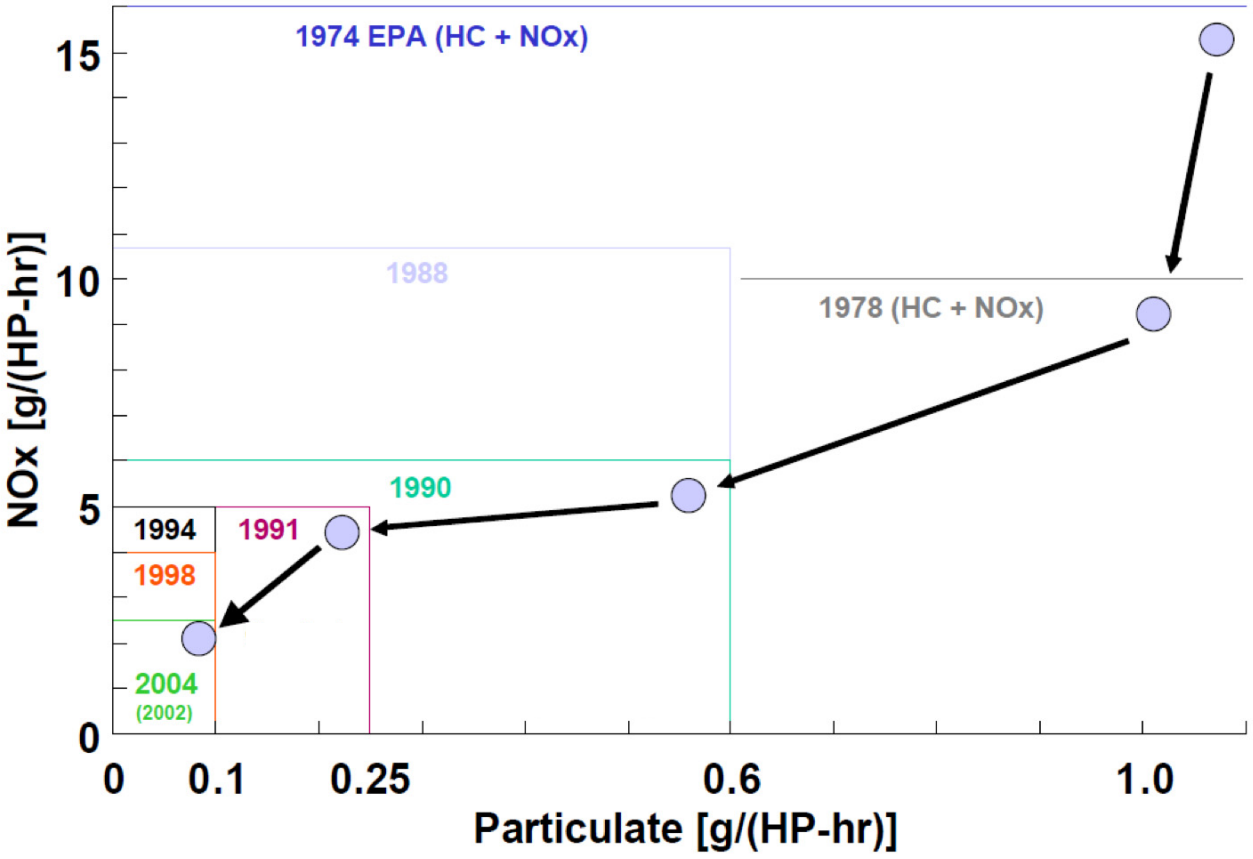
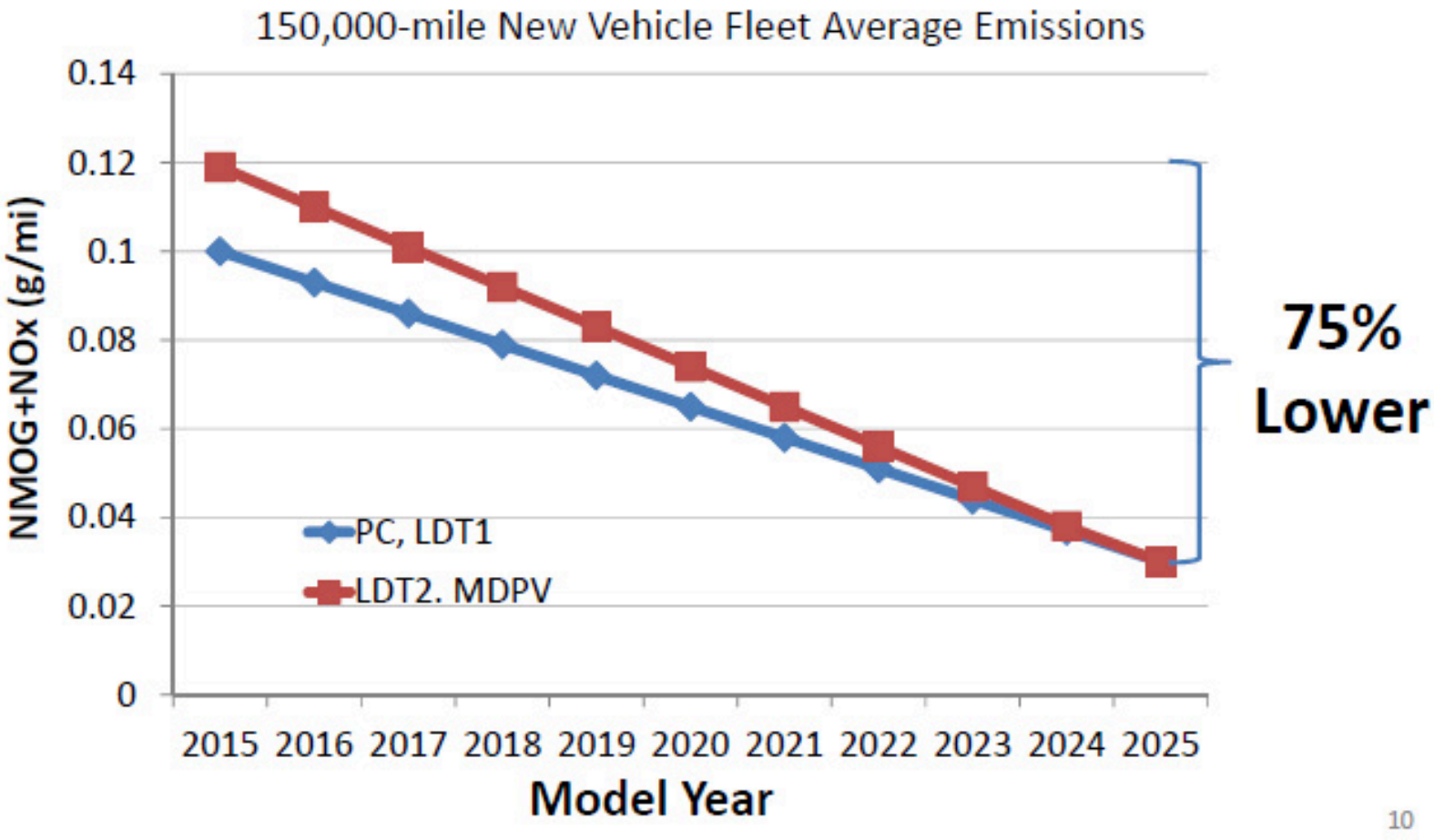


Figure source: Patrick Flynn, Cummins Engine Co.

The Future: New ARB Clean Car Rules



Approved by California Air Resources Board, January 27, 2012

Solutions: Caveats

Caveats for impacts and mitigation

- Near-road findings are largely from studies of areas where there were no barriers between roads and receptors
- Barriers channel air and make problems more complex
- Tall buildings next to narrow streets are like “canyons” with their own meteorological and air quality conditions
- Site-specific conditions govern air quality (wind speed, wind direction, topography, traffic, and so on)
- The vehicle fleet is getting cleaner over time
- Treat these findings as “directional,” meaning they should help you grasp key concepts

Closing Thoughts: Bullet Points

- Pollution declines quickly within 150 to 600 m. So…
  - **Increase distance between roads and people**
  - **Consider buffers (sound walls, vegetation)**
- Vehicles pollute more when operated at slow speeds. So…
  - **Avoid congested traffic near smart growth communities**
- Diesel PM dominates air-related cancer risk (in California). So…
  - **Avoid routing truck traffic near sensitive locations**
- Some people are more susceptible, like children and elderly. So…
  - **Avoid sensitive land uses near major roads (e.g., schools)**
- People spend 90% or more of their time indoors. So…
  - **Optimize building air intake and filtering systems**
- Finally, vehicles (cars and trucks) keep getting cleaner. So…
  - **Understand that, for a given set of traffic conditions, pollution near roads will decline over time**