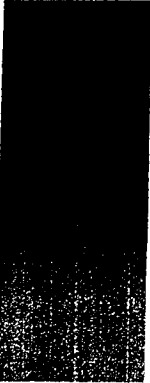


California Environmental Protection Agency,
Office of Environmental Health Hazard Assessment
(OEHHA)

OEHHA Traffic-Related Air Pollutant Studies Overview

ASTHO
Health and Environment Electronic Seminar

October 24, 2002



OEHHA's “Health Impacts of Traffic” Projects

- **Literature Review**

Respiratory Health & Exposure to Traffic
Near Busy Roads

- **Statewide Schools Assessment**

Proximity of California Public Schools to
Busy Roads: a GIS project

- **Epidemiological Study**

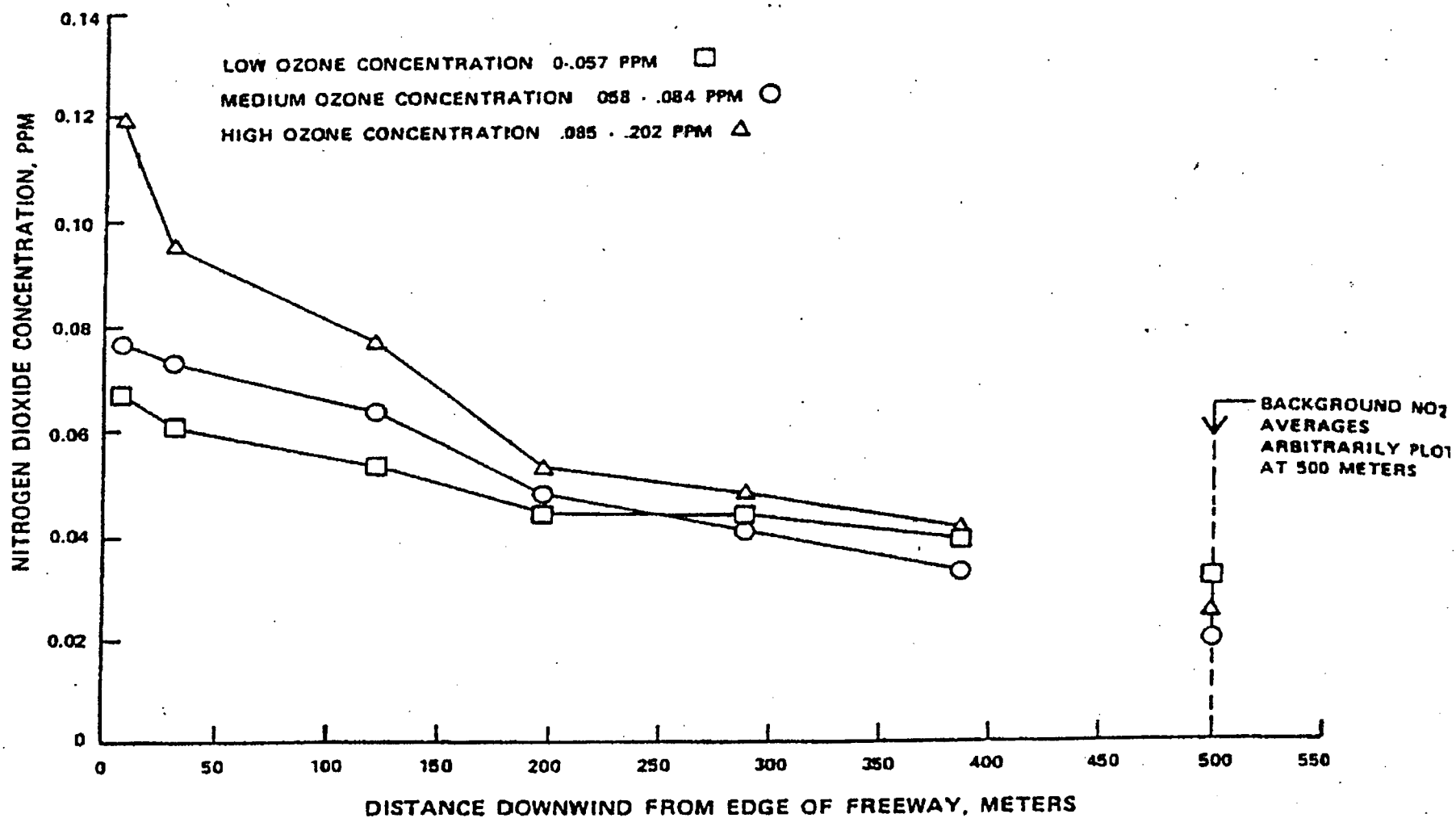
The East Bay Children's Respiratory Health
Study



Background

- Health effects with air pollution at ambient levels
- Traffic-related pollutants
 - Major source of urban air pollution
 - Association with adverse health outcomes
 - May enhance allergic response (esp. diesel)
 - Carcinogenic
- Higher traffic emissions near busy roads

Concentration of Nitrogen Dioxide Downwind of a Los Angeles Freeway



CE Rodes, DM Holland. Atmos. Environ. 1981. 15:243-250

Literature Review:

Respiratory Health & Proximity to Traffic

- **24 epidemiological studies**

Japan (3), Europe (12), UK (6), Canada (1), US (2)

- Study design (mostly cross-sectional)
- Studies primarily of school-aged children
- Outcomes
 - current wheezing, bronchitis, asthma, allergies, lung function, respiratory hospitalizations
- Exposure estimates
 - Surrogates of exposure to traffic-related pollutants
 - Few measured traffic pollutants



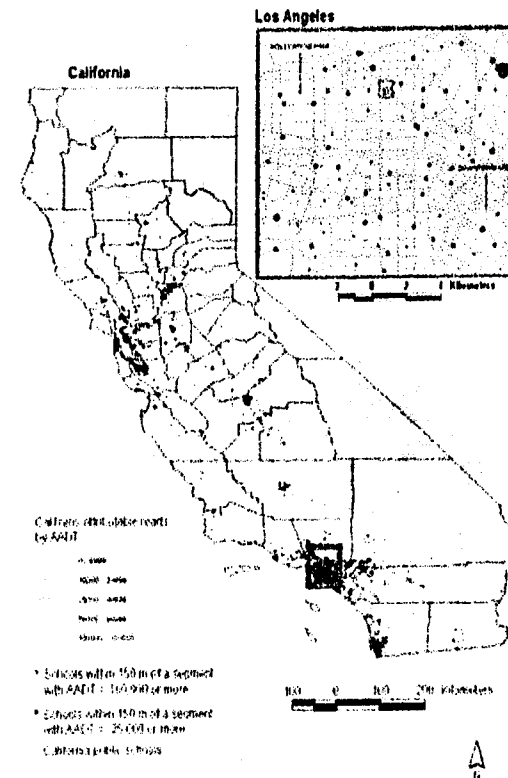
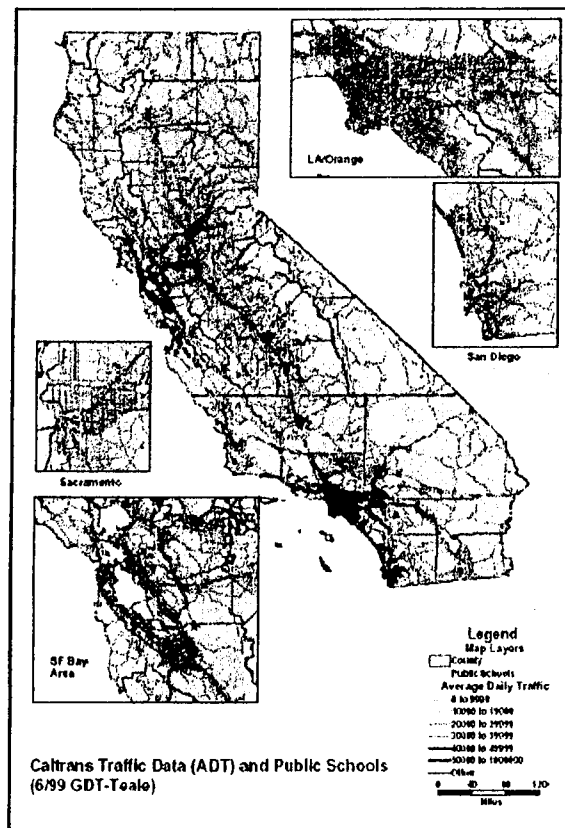
Literature Review: Respiratory Health & Proximity to Traffic

- **Findings**

- Generally, in studies with better exposure estimates
 - Traffic associated with increased wheezing,
? increased bronchitis
 - Inconsistent results with doctor's diagnosis of asthma
 - Truck traffic --possible ↑ effect
 - ?Effect more in girls?

- **Are these findings applicable in
U.S./California?**

Proximity of California public schools to busy roads: a GIS project





Proximity of California public schools to busy roads: a GIS project

Objectives

- Characterize the proximity of CA public schools (K-12) to major roads using geographic information systems (GIS)
- Describe the demographic differences in exposure

Rationale

- Respiratory health effects near busy roads
- Levels of traffic emissions - ↑ within 150-200m downwind of roads
- School location - important determinant of children's exposure to air pollutants



Methods

Data sources:

- California Dept. of Education 2000 database
 - All public schools (K-12), excluding special education and alternative schools
 - Includes school type, county, enrollment, ethnicity, SES indicators (CalWORKS, reduced fee meals), English learners
- CalTrans Highway Performance Monitoring System (HPMS) database - 1997
 - Includes highways and collector roads
 - Does not include local roads
 - Average annual daily traffic counts (AADT)

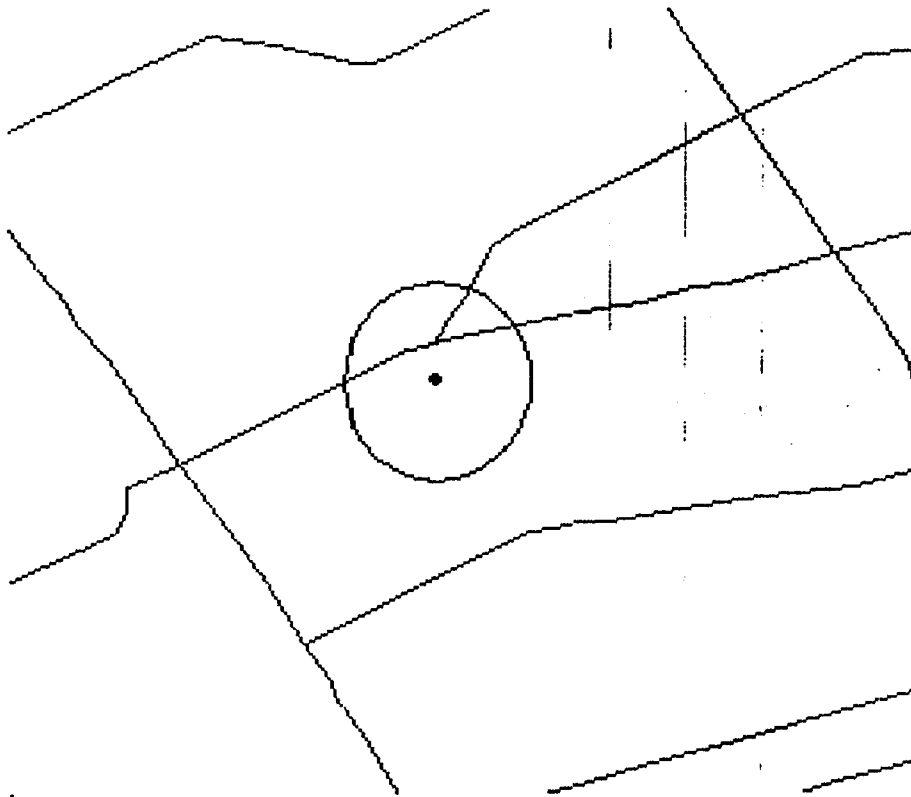


Methods

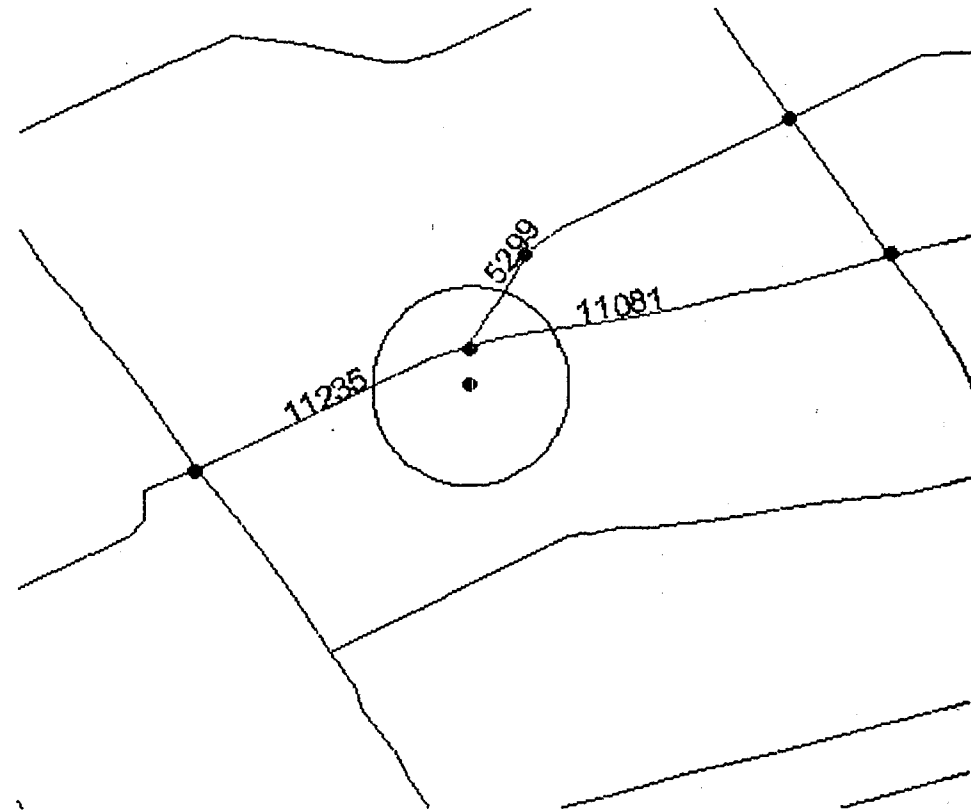
Measuring proximity of schools to traffic:

- Geocoding schools
 - Determined exact location of each school using school address and GIS software
- Determining distance to roads and traffic counts
 - Using GIS, measured distance of each school to all road segments within 150 meters
 - Selected segment with highest AADT

AADT selection process

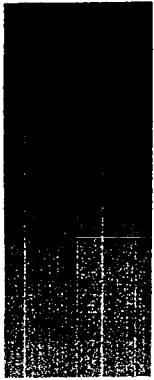


150 m buffer
around a school

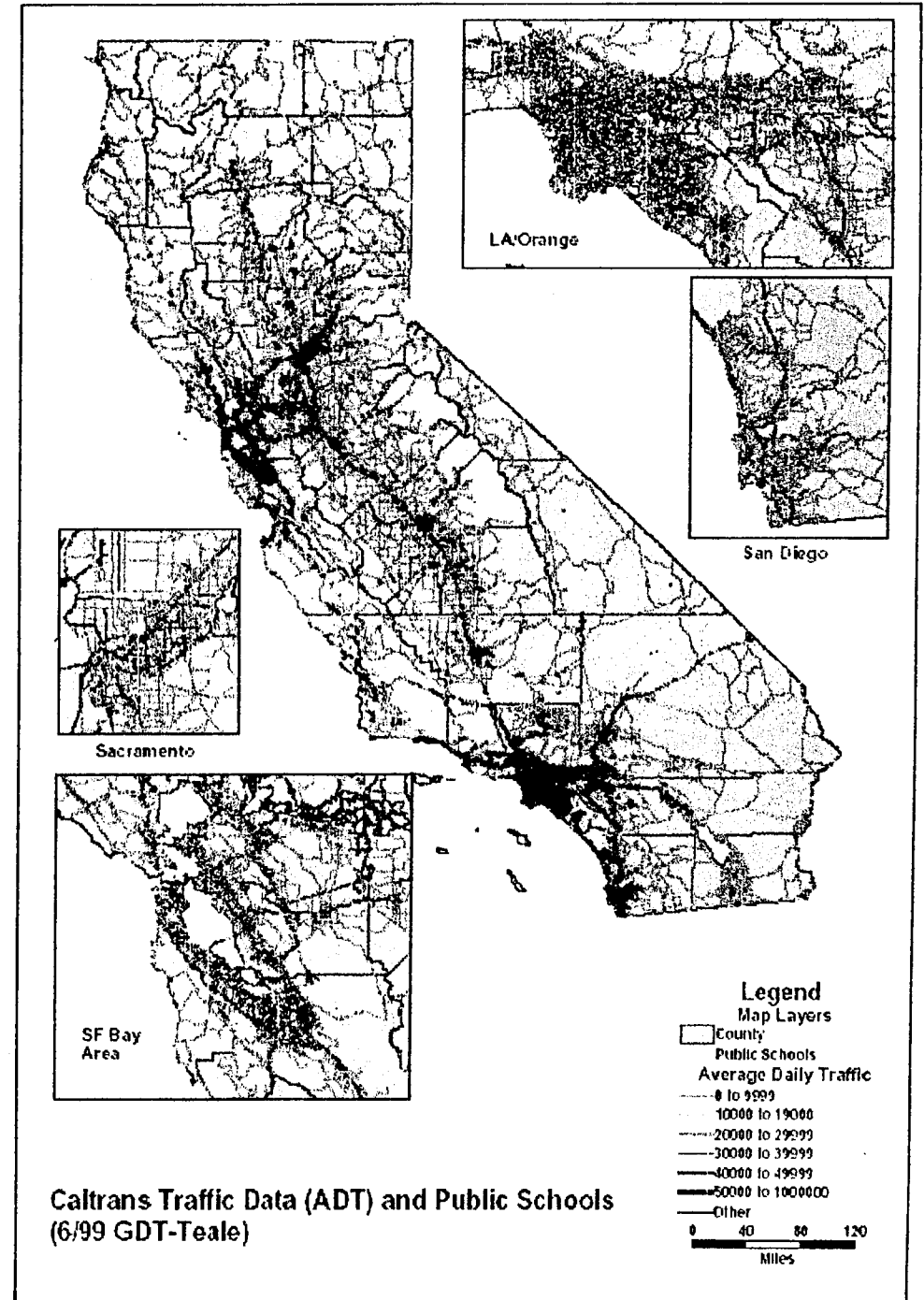


Three road segments fall
within the buffer

Highest AADT segment is
selected



- 8000+ public K-12 schools in the State
- 7515 eligible for the study
- 7460 schools (>99%) geocoded





Preliminary results

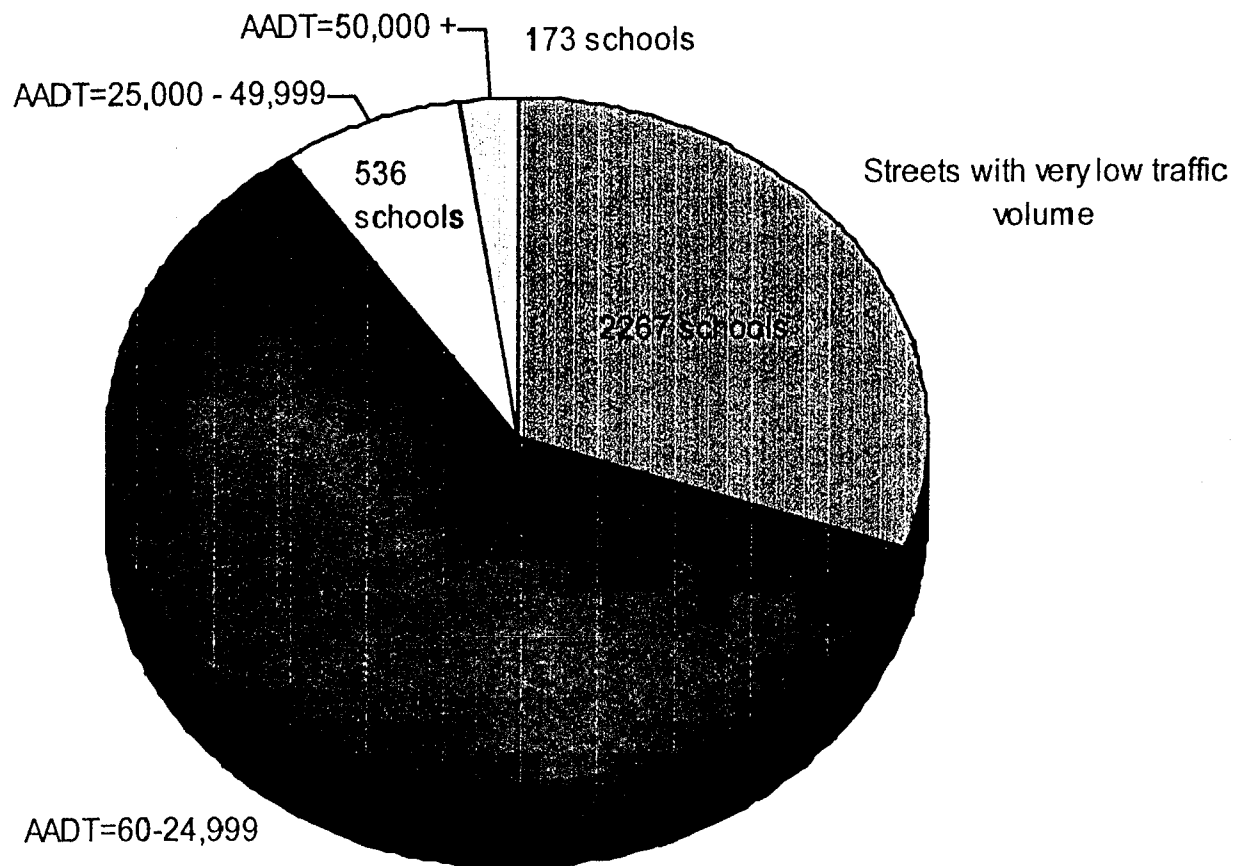
- ~ 10% of schools within 150 m of a road with high traffic volume ($\geq 25,000$ vehicles/day)
 - 721,363 students (12.4%)
- 2.3% close to very high traffic ($\geq 50,000$ vehicles/day)
 - 150,323 students (2.6%)

AADT example:

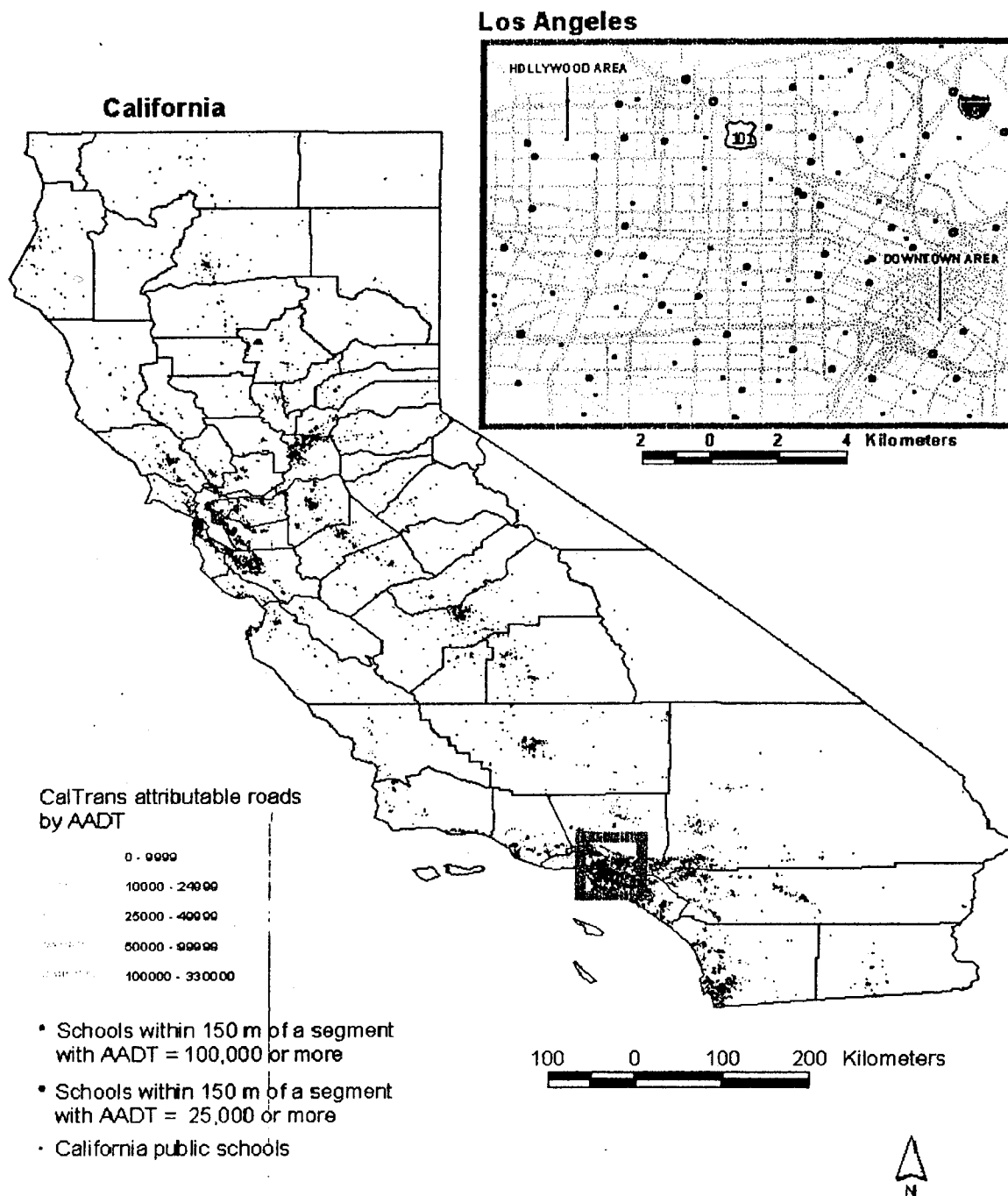
I-5 Downtown LA = 270,000 vehicles/day

Hollywood Blvd = 35,500 vehicles/day)

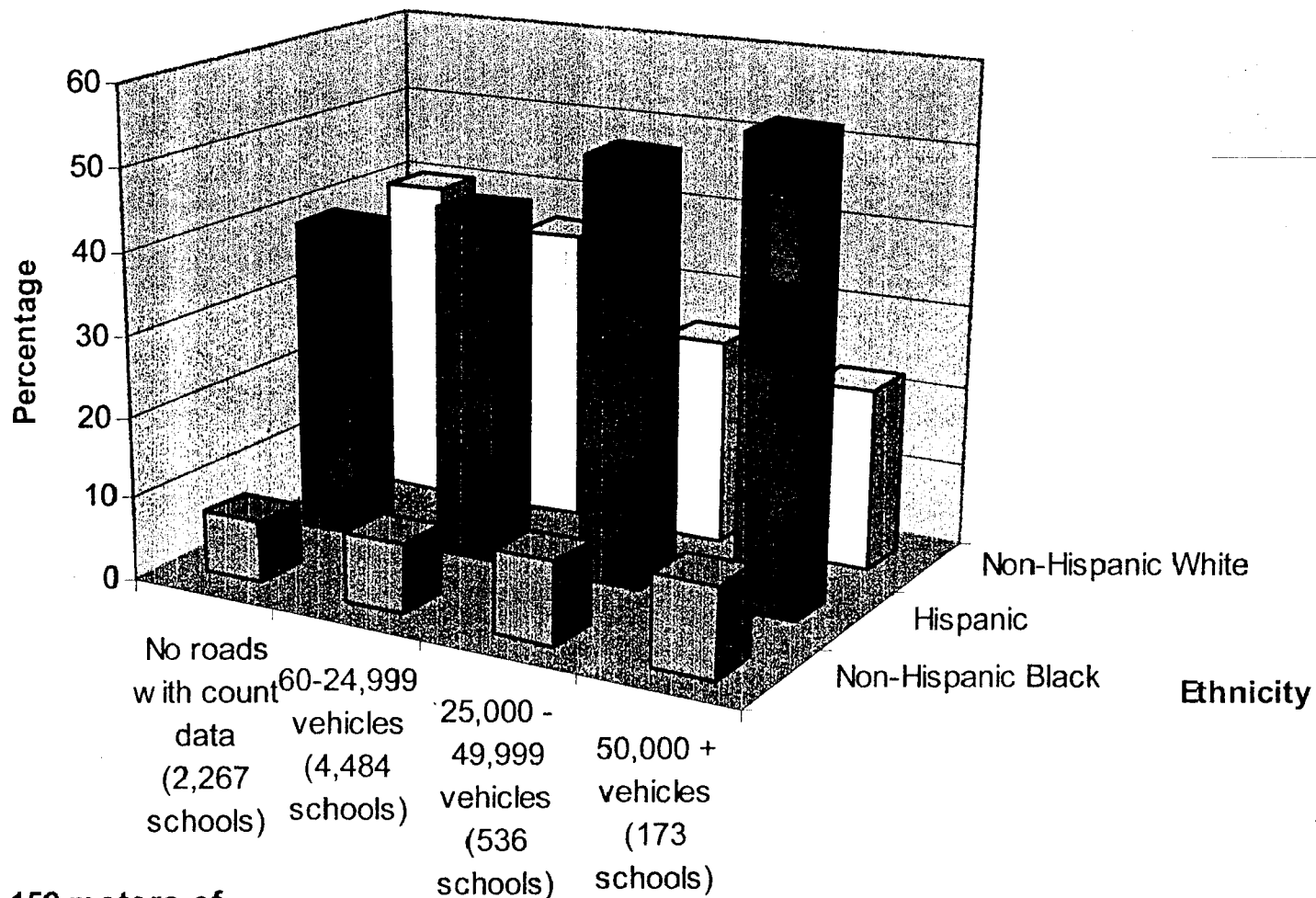
Number of California public schools by maximum traffic within 150 meters



California public schools and high traffic volume within 150 m

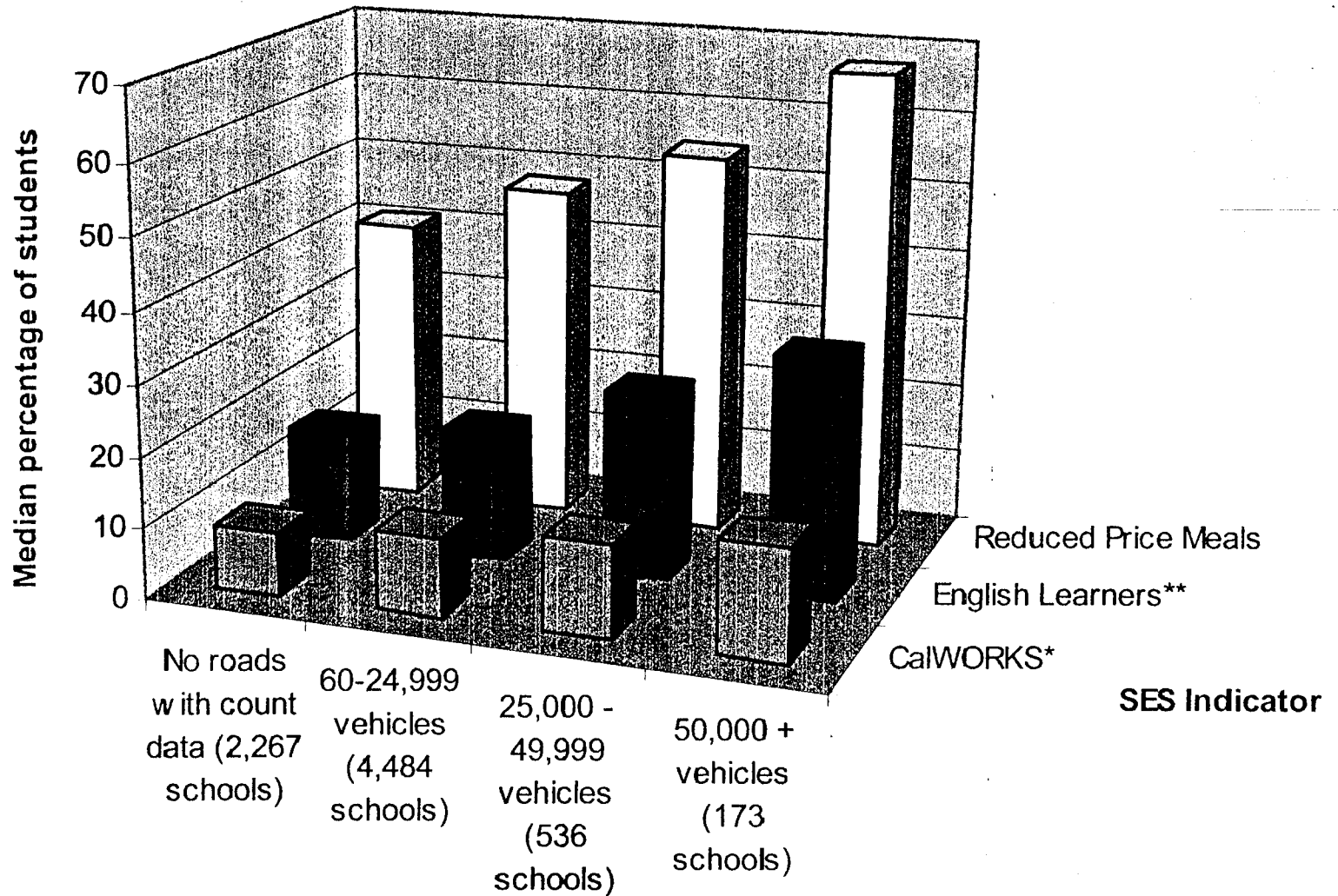


Racial/ethnic profile of students attending California public schools by category of traffic



Maximum traffic within 150 meters of school

SES profile (median %) of schools by category of traffic near the school



Maximum traffic within 150 meters of school



Conclusions

- Almost 10% of California public schools (K-12) are close to roads with high traffic volume (25,000 or more vehicles per day), and 2.3% are close to very high traffic (50,000 or more vehicles per day)
- A disproportionate number of non-White and economically disadvantaged students attend schools which are close to high or very high traffic volume
- Most schools close to high traffic volume are in large urban areas, but several schools in small urban and rural areas are also close to busy roads



Next steps

- Evaluate various traffic metrics
- Compare school populations with the US Census
- Use Census demographic variables in further analyses
- Perform analyses stratified by population density
- Perform multivariate analyses to control for some demographic variables while evaluating others

East Bay Children's Respiratory Health Study



East Bay Children's Respiratory Health Study (EBCRHS) Objectives

- Examine associations between respiratory disease and traffic-related pollutants among children in neighborhoods located at different distances from major roads.

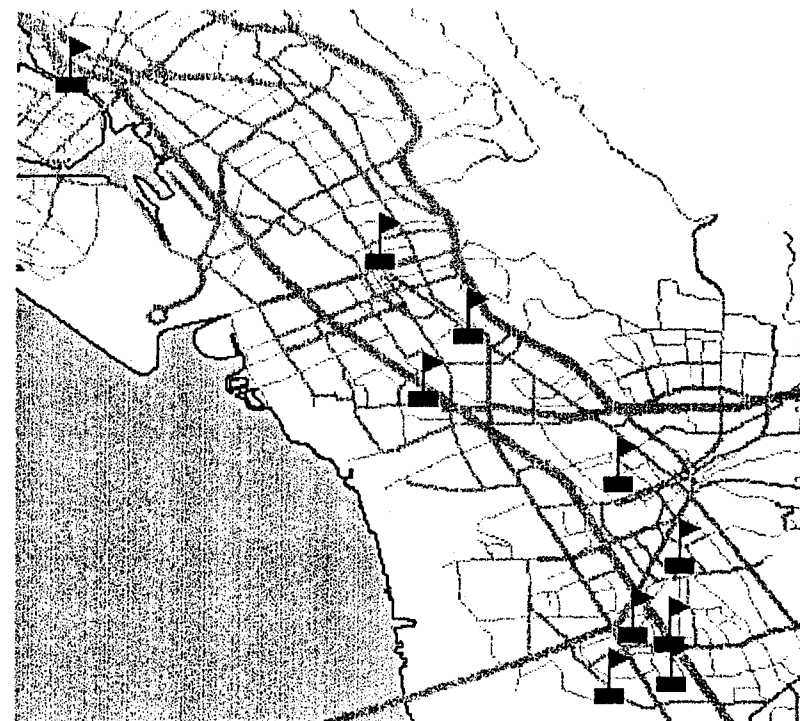
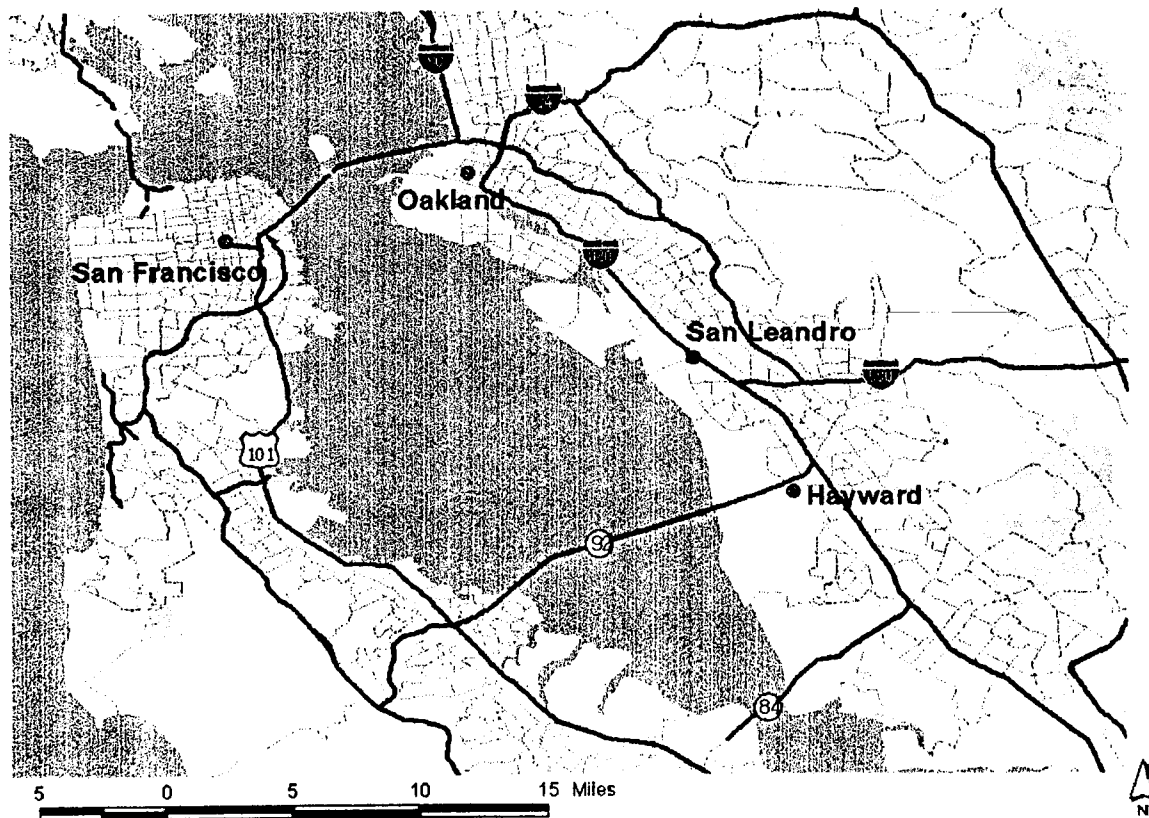


Study Overview

- **Cross-sectional study**
 - 3rd, 4th & 5th grade children recruited from 10 schools in the San Francisco Bay Area
- **School selection criteria**
 - locations reflect a range of distances from major roads
 - similar demographics across schools
- **Air pollutants measured at the schools**
 - levels of air pollutants at the neighborhood school serve as a proxy for child's overall exposure

East Bay Children's Respiratory Health Study Area

East Bay Children's Respiratory Health Study area



0 1.25 2.5 5 7.5 10 Kilometers

Regional Air Quality

PM_{2.5} 13.9 µg/m³

PM₁₀ 21.8 µg/m³

Ozone 0.081 ppm (8-hr max)

Annual Average Daily Traffic

AADT

- 118 - 9999
- 10000 - 24999
- 25000 - 49999
- 50000 - 99999
- 100000 - 320000



Study Methods

- **Health questionnaire**
 - children's respiratory health (e.g., asthma, bronchitis), family history, home environment, demographics
- **Outdoor air pollutant measurements at schools**
- **Indoor air pollutant measurements (limited)**
- **Indoor air quality survey (limited)**
- **Traffic metrics (GIS): residence, school**
- **Pilot within neighborhood (NO_x and NO₂)**



Preliminary Results

- Response rate: 70.7% (1111/1571)
- Characteristics of Study Population (self-reported)
 - 87% non-White
 - 31% household below federal poverty line
 - 49% parent \leq high school education
 - 10% child not covered by health insurance
 - 35% mold/mildew in household past 12 mo.
 - 10% mother smoked during pregnancy
 - 14% current asthma (physician-diagnosed)
 - 17% bronchitis symptoms past 12 mo.



Analysis Plans

- Evaluate association of traffic-related air pollutant levels with health outcomes
- Refine exposure estimates
 - restrict analysis
 - develop predictive model of pollutants using traffic metrics and meteorological data
 - refine pollutant model using neighborhood monitoring data
 - refine traffic metrics



Contributors

- **Literature Review**

OEHHA: Janice Kim

- **Statewide School Assessment**

OEHHA: Janice Kim, Svetlana Smorodinsky,
Shelley Green

CDHS: Bob McLaughlin

- **East Bay Children's Respiratory Health Study**

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