Supplemental Material

Methods:

GIS-based Traffic Metrics:

Geocoding:

We geocoded residential addresses of participants and school addresses using ArcGIS 8.3 (Environmental Systems Research Institute (ESRI), Redlands, CA) and a Geographic Data Technology (GDT) road network (GDT version 13, Tele Atlas, Inc., Menlo Park, CA, http://www.teleatlas.com/). We used a side offset of 25 feet (~7.6 m) from street centerline to determine the location.

Traffic data and road network:

We obtained a base road layer with average annual daily traffic (AADT) counts from the California Department of Public Health (Craig Wolff, Environmental Health Investigation Branch, California Department of Public Health). This road layer had traffic count data from the California Department of Transportation (CalTrans, 2001 Highway Performance Monitoring System (HPMS) database) conflated (transferred) onto the base road layer (GDT street geography), with discrepancies resolved interactively. The GDT road network had excellent alignment when overlaid onto a layer containing digital orthophotographs of the study area.

The HPMS traffic database has been previously described in several recent epidemiological studies of traffic and adverse health outcomes (English et al. 1999, Wilhelm and Ritz 2003). Only freeways, highways (HPMS functional class 11 or 12), other principal arterials (HPMS functional class 14), and minor collector roads (functional class 16 or 17) are contained in this base road layer. There are no traffic flow data for local residential streets. Of note, for some of the larger roads, each direction of travel was represented as a separate roadway in the traffic database. The "distance to the nearest freeway" was the shortest distance from the residence to the middle of the nearest set of lanes of the freeway. For these dualized roads, the "AADT" reported here represents the daily traffic counts in both directions. Data on range of traffic in the study area are summarized in Table 1.

Development of Traffic Metrics

Traffic metrics were calculated using methods described previously.

Briefly, for each residential location a circular buffer of specific radius (usually 150 or 300 m) was created in ArcGIS. Road segments, length of road segment within the buffer, and annual average traffic count (AADT) on the road were identified (see Figure 1) and distance to a given road segment was calculated. Traffic attributes for each location (e.g., distance to a road segment, AADT for that road segment, segment length) were exported into SAS (version 8.2 Windows; SAS Institute Inc., Cary, NC). Using SAS software, we constructed the traffic metrics listed in Table 1 of the manuscript.

Our study area has strong prevailing winds from west to east due to bay breezes, and freeways/highways near participants' homes generally run from north to south. During the neighborhood-monitoring period, prevailing winds were from the westerly direction (hourly

measurements ranged from 220°-310°) over 80% of the time. Annually, hourly measurements ranged from 220°-310° over 60% of the time. The main freeway that was within 300 m of residences was running in a north-south direction. There were no east-west freeways within 300 m of residences in this study. Several residences were within 300 m and east (upwind) of the north-south freeway but also within 300 m west (downwind) of another freeway running in a 30-45 degree (NE) direction east of their residences. These residences were classified as downwind.

Health Outcomes:

We defined all health outcomes and their important covariates based on the questionnaire completed by the parents. *Ever-asthma* was defined as a "yes" response to the question, "Has a doctor or other health professional ever told you or your family that your child has or had asthma?" *Current asthma* was defined as having ever-asthma AND an "episode of asthma" or "wheezing within the last 12 months." *Current Bronchitis* was defined as a "yes" response to the question, "During the past 12 months, did your child have bronchitis?" OR a report of cough and chest congestion or phlegm lasting at least three consecutive months of the past 12. In sensitivity analyses, we used a slightly different definition of current asthma that was used in our earlier report (Kim et al. 2004) (i.e., selecting "asthma" from a list of respiratory conditions provided after the question, "During the past 12 months**,** did a doctor say that your child had any of the following chest illnesses?"). Results were similar (see Table 4).

We also asked about factors potentially associated with asthma or bronchitis, such as race/ethnicity, measures of socioeconomic status, maternal and paternal history of asthma, current smoker in the home, mold, and commute patterns to and from school (see Kim et al. 2004).

References

English P, Neutra R, Scalf R, Sullivan M, Waller L, Zhu L. 1999. Examining associations between childhood asthma and traffic flow using a geographic information system. Environ Health Perspect 107(9): 761-767.

Kim JJ, Smorodinsky S, Lipsett M, Singer BC, Hodgson AT, Ostro B. 2004. Traffic-related air pollution near busy roads: the East Bay Children's Respiratory Health Study. Am J Respir Crit Care Med 170(5): 520-526.

Wilhelm M, Ritz B. 2003. Residential proximity to traffic and adverse birth outcomes in Los Angeles County, California, 1994-1996. Environ Health Perspect 111(2): 207-216.

Table 1: Range and mean annual average daily traffic counts (AADT) for roads within 1000m of children's residences, by functional class

Functional class	*Road description*	Mean AADT	Min AADT	Max AADT
11	Principal Arterial Interstate	184,321	52,000	245,000
12	Principal Arterial Other Freeways And Expressways	92,070	92,000	93,000
14	Other Principal Arterial	32,716	1,880	67,000
16	Minor Arterial	17,071	347	41,889
17	Collector	7,104	500	25,500
19	Local[b]	n.a.		

[a]"Non-local roads" are roads classified as functional class 11-17. (Highway Performance Monitoring System (HPMS) Instruction Manual, http://www.dot.ca.gov/hq/tsip/hpms/index.php)

[b]n.a. (not applicable). In general, the CalTrans (state-maintained) traffic database does not record estimated traffic on local roads (functional class 19). Therefore, for practical purposes, only non-local roads are considered in creating the traffic metrics. (There was only one local road segment in the CalTrans database that was within 1 km of the study area. This road segment had an AADT value of 4500.)

Table 2. Range of exposures for different traffic metrics for study participants (n = 1080)

	Maximum AADT (vehicles per day)	Closest AADT (vehicles per day)	Distance weighted traffic density (vehicles per day)	Traffic density (vehicles - kilometers per day)
1st Quintile	none[2]	none[2]	none[2]	none[2]
2nd Quintile	up to 7,120	up to 5700	up to 4187	up to 1,919
3rd Quintile	7,121 to 18,900	5701 to 10,534	4187-8979	1,920 - 4,402
4th Quintile	18,901 to 28,657	10,535 to 23,800	8980 to 21418	4403 to 9413
5th Quintile	28,658 to 245,000	23,801 to 245,000	21,418 -265,245	9,414 to 74,041
≥ 90 percentile	67,000 to 245,000	35,100 to 245,000	34,330-265,245	16,823 to 74,041

Distance to freeway (# of participants)	≤ 75 m	>75 m to ≤150 m	> 150 m to ≤300 m	Over 300 m
	36	64	113	867

Distance to major arterial or higher (# of participants)	≤ 75 m	>75 m to ≤150 m	> 150 m to ≤300 m	Over 300 m
	121	193	317	449
Excluding those also near freeway/highway	81	128	n = 237	n = 491

[1]See Table 4 of the main manuscript

[2] Local traffic only- assigned a value of zero

[3]Numbers exclude those participants who are also living within 150 m of a freeway/arterial (n total = 937)

Table 3: Associations between distance-weighted traffic density (DWTD) and current asthma and bronchitis in the last 12 months[a]

	Current Asthma n = 88/724		Bronchitis n = 87/745	
	Odds Ratio	95% CI	Odds Ratio	95% CI
DWTD within 150m				
1st Quintile	1.00		1.00	
2nd Quintile	1.79	(0.80, 4.0)	0.73	(0.35, 1.53)
3rd Quintile	1.11	(0.47, 2.65)	1.34	(0.67, 2.66)
4th Quintile	1.65	(0.7, 3.84)	0.68	(0.31, 1.50)
5th Quintile	2.37	(1.04, 5.45)	1.12	(0.54, 2.33)
≥ 90th Percentile	2.18	(1.04, 4.55)	2.29	(1.20, 4.37)

[a]DWTD = sum of Gaussian-weighted AADT values for all streets within a 150 m buffer. Formula assumes 96% of traffic pollutant dispersion from a road with a given AADT at 500 ft (152.4 m).

[b]Odds ratios adjusted for chest illness before age of 2; pests, indicator of mold presence, crowding. For asthma, models were also adjusted for maternal history of asthma.

Table 4: Comparison of associations between residential proximity to traffic for different definitions of current asthma[a]

	Current Asthma (main manuscript)		Current Asthma (alternative definition)	
	Odds Ratio	95% CI	Odds Ratio	95% CI
Maximum AADT within 150m (vehicles/day)				
1st Quintile (local traffic only)	1.00		1.00	
2nd Quintile (up to 7,120)	1.50	(0.67,3.36)	1.48	(0.67, 3.28)
3rd Quintile (7,121 to 18,900)	2.33	(1.03,5.28)	2.44	(1.11, 5.39)
4th Quintile (18,901 to 28,657)	0.60	(0.21,1.69)	0.51	(0.18, 1.14)
5th Quintile (28,658 to 245,000)	2.50	(1.13,5.53)	2.61	(1.19, 5.72)
≥ 90th Percentile (67,000 to 245,000)	2.40	(1.13,5.07)	2.51	(1.19, 5.29)
Closest AADT within 150m (vehicles/day)				
1st Quintile (local traffic only)	1.00		1.00	
2nd Quintile (up to 5700)	1.39	(0.62,3.11)	1.43	(0.65, 3.14)

3rd Quintile (5701 to 10,534)	2.83	(1.23,6.54)	2.65	(1.18, 5.93)
4th Quintile (10,535 to 23,800)	1.40	(0.6,3.29)	1.34	(0.58, 3.09)
5th Quintile (23,801 to 245,000)	1.58	(0.69,3.65)	1.50	(0.66, 3.44)
≥ 90th Percentile (35,100 to 245,000)	1.16	(0.53,2.54)	1.31	(0.61, 2.84)
Traffic Density within150m [b]				
1st Quintile	1.00		1.00	
2nd Quintile	1.23	(0.53, 2.83)	1.21	(0.53, 2.75)
3rd Quintile	1.96	(0.85, 4.52)	2.08	(0.93, 4.64)
4th Quintile	1.40	(0.60, 3.3)	1.29	(0.56, 2.97)
5th Quintile	2.37	(1.05, 5.36)	2.26	(1.01, 5.05)
≥ 90th Percentile	2.14	(1.02, 4.52)	2.31	(1.09, 4.92)

[a] Alternative definition of "current asthma". Participant was classified as current asthma if parents selected "asthma" from a list of respiratory conditions in response to the question [During the previus 12 months, did a doctor say that your child had any of the following chest illnesses? (Mark all that apply).] Odds ratios adjusted for chest illness before age of 2; pests, indicator of mold presence, crowding, and maternal history of asthma. For alternative definition, asthma models also included maternal smoke during pregnancy.

[b]See Table 2 for quintile ranges.

Table 5 Concentrations of Nitrogen Oxides during Week 1 of the Neighborhood Monitoring Study[1]

Site	Downwind of Freeway	Distance to Freeway (m)	NO2 (ppb)	NOx (ppb)
1	No	75	10.1	18.5
2	No	134	9.7	17.1
3	No	211	12.6	22.5
4	No	295	11.8	19.4
5	No	322	9.3	15.8
6	No	337	13.3	18.8
7	No	355	10.6	17.3
8	No	372	10.6	17.2
9	No	470	13.6	23
10	No	555	10.2	16.8
11	No	609	10.3	17.4
12	No	717	9.8	17.4
13	No	788	10	16.6
14	No	847	9.6	16.2
15	No	983	11	25.3
16	No	1452	13.6	16.8
17	No	1652	13.2	18.9
18	Yes	55	32.6	70.3

19	Yes	94	23.4	43.8
20	Yes	99	29.7	53.1
21	Yes	115	22.2	36.8
22	Yes	156	23.1	36.2
23	Yes	166	20	31
24	Yes	180	17.5	27
25	Yes	191	22.1	33.9
26	Yes	233	16.3	26.9
27	Yes	242	18.1	26
28	Yes	424	18.6	33.6
29	Yes	494	13.7	19.4
30	Yes	616	14.1	21.3
31	Yes	678	13	17.6
32	Yes	718	12.3	17.8
33	Yes	797	13.5	19.5
34	Yes	1042	11.9	16.9
35	Yes	1111	11.4	17.4
36	Yes	1195	13.7	19.1
37	Yes	1408	13.6	19.7

[1]Data for Figure 1 of the manuscript.

Figure 1. Schematic diagram of a study residence, surrounding roads with corresponding AADT, 150 m and 300 m buffers. Road segment A with AADT of 26,100 is included in analysis using 150 m buffer. Highway segment B with AADT of 198,000, road segments C (AADT = 4,200) and D (AADT = 11,400), and segment A are all included in analysis using 300 m buffer.