



March 3, 2006

Colland Jang
Chair, Oakland Planning Commission
Community Economic Development Agency
City of Oakland
250 Frank Ogawa Plaza, Suite 3315
Oakland CA 84612

**Re: Analysis of Pedestrian Injuries Resulting from the Oak to Ninth Avenue Project;
Oakland FEIR; Case ER 04-0009**

Dear Chairperson Jang:

At the public hearing on the DEIR of the Oak to Ninth Development Proposal, you raised the important issue of pedestrian safety and requested the City to conduct in the EIR an adequate analysis of project related impacts on pedestrian safety impacts. As a member of the public health community, I appreciate your concern about this issue.

Adverse environmental impacts on humans and public health must be addressed under CEQA, including but are not limited to impacts on pedestrian safety, noise, air quality, and hazardous materials.¹ Several stakeholders identified deficiencies in the DEIR analysis of project effects on pedestrian injuries in the neighborhoods surrounding the proposed Oak to Ninth development. Unfortunately, the FEIR analysis of pedestrian safety remains inadequate; furthermore, I believe, many City of Oakland FEIR responses to comments on the DEIR are not based on evidence.

This letter provides additional evidence and original analysis demonstrating that pedestrian injuries will increase significantly directly due to project-related increases in traffic volume in several neighborhoods of Oakland surrounding the project. The evidence and analysis includes the following key points:

- **The definition and use of the term *pedestrian injury rate* in the DEIR and FEIR is neither accurate nor consistent with definitions used by the Federal Government or those used in epidemiologic investigations.**
- **Oakland has a rate of pedestrian injuries several times higher than Federal public health standards. The neighborhoods surrounding the project have a disproportionate share of pedestrian injuries relative to other neighborhoods in Oakland.**
- **Project-related impacts on pedestrian injuries are significant. Quantitative forecasting of changes to Oakland's pedestrian injury rate based on project related changes in traffic flows and a baseline injury rate of 100 injuries/year in the area of influence estimates that the project's traffic alone will contribute about 5.4 additional injuries per year or 268 pedestrian injuries in the years 2025-2075. The cumulative impact of increased traffic in the area by 2025 forecasts 20 additional injuries per year with a total of 1000 growth related additional injuries in the years 2025-2075.**
- **The DEIR and FEIR have not proposed or evaluated the feasibility of sufficient pedestrian safety improvements including circulation changes and street and intersection facility improvements, available to prevent increases in traffic related injuries.**

¹ Section 15065 of the regulations for the California Environmental Quality Act (CEQA) mandates an environmental impact report (EIR) to analyze any "...environmental effects of a project [that] will cause substantial adverse effects on human beings, either directly or indirectly. CEQA guidelines section 15126.2, subdivision (a) requires an EIR to discuss "health and safety problems caused by the physical changes" that the proposed project will precipitate. Bakersfield Citizens for Local Control vs. the City of Bakersfield reaffirmed the necessity of health analysis in an EIR prepared under CEQA. Environmental Justice also demands a full analysis of the health impacts on low-income and minority populations.

Significance of Pedestrian Injuries, National Injury Standards, and Inadequacies in the Oak to Ninth FEIR

A significant error in the FEIR is the inaccurate definition of the term, *rate of injury*. The FEIR inaccurately defines "rate of injury" as "accidents per number of vehicles." Using this definition, the City of Oakland argues that *the project will not affect the rate at which motor vehicle accidents occur because it will not affect the roadways*. This statement is misleading. The number of accidents per vehicle and the number of accidents per mile might reflect the relative safety of vehicle and roadways, respectively, but these measures do not reflect the impacts to human health. With regard to human health impacts, an appropriate measure of adverse impact is the increase in the number of injuries or the increase in the rate of injuries **defined as the number of injuries per unit time**. This definition is the one used by the Federal Department of Health and Human Services in pedestrian injury objectives for the Nation. Holding the number of accidents per vehicle trips constant, the rate of injuries will increase simply because the number of vehicle trips will increase.

The US Department of Health and Human Services (USDHHS) has established National objectives for the **rate of pedestrian injuries**.² Much like National Air Quality Standards, these objectives or standards can serve as thresholds for significance for pedestrian injuries within CEQA analysis. These objectives include:

- A rate of non-fatal vehicle injuries to pedestrians no greater than 19 injuries per year per 100,000 people.
- A rate of fatal vehicle injuries to pedestrians no greater than 1 injury per year per 100,000 people.

According to Oakland's Pedestrian Master Plan, Oakland residents suffer approximately 85.5 vehicle injuries to pedestrians per 100,000 every year including 3 pedestrian fatalities per 100,000 per year.³ **This rate of injuries is about 4 times the USDHHS standards. The published rate of fatal injuries in Oakland is 3 times the USDHHS standard.** Based on current rates and national standards, any increase in pedestrian injuries should be considered a significant adverse effect.

A significant number of Oakland pedestrian injuries occur in the neighborhoods and streets (e.g., Downtown, Jack London Square, Chinatown, Lakeshore, East Lake, Lower San Antonio, International Blvd) surrounding the proposed project. Based on population and the intensity of pedestrian injuries, this impact analysis estimates a baseline injury rate of at least 100 pedestrian injuries per year in the area affected by the Oak to Ninth Project.⁴ Furthermore, the neighborhoods surrounding this project contain sensitive populations more vulnerable to impacts on pedestrian safety, including children, the elderly, walking-dependent, and the low-income transit-dependent.

Vehicle injuries to pedestrians have significant economic costs beyond their physical toll on victims. A recent analysis of California data concludes that in 1999 economic costs resulting from 5634 fatal and non-fatal vehicle injuries to pedestrians resulted in over \$3.9 billion in direct and indirect costs (\$692,000 per injury). California Highway Patrol estimates of economic costs of vehicle injuries to pedestrians disaggregated by injury severity are provided in the table below.

Pedestrian Injury Severity	Economic Cost per Injury
Fatal Injury	\$2,709,000
Severe Injury	\$180,000
Visible Injury	\$38,000
Complaint of Pain	\$20,000

Environmental Factors Affecting Pedestrian Injuries

² U.S. Department of Health and Human Services. Healthy People 2010 Objectives.

³ Oakland Pedestrian Master Plan. Page 30.

⁴ The author of this analysis has requested a map of counts of pedestrian injuries from the City of Oakland. A more precise estimate of pedestrian injuries in the area of influence of the Oak to Ninth project is pending this data.

The rate of pedestrian injuries in an area is dependent on several **environmental factors** such as vehicle volume, vehicle type (truck vs. car), vehicle speed, pedestrian volume, roadway width, vehicle speed, pedestrian facilities (sidewalk width, driveway conflicts, buffers), intersection design (crossing distance, signal phasing and timing, corner radii, cross walk treatments, median islands, curb extensions), lighting, and weather.^{5 6 7 8 9}

Vehicle speeds are the most important predictor of the **severity** of pedestrian injuries. Below 20mph the probability of serious injury or fatal injury is generally less than 20%; this proportion rapidly increases with increasing speed and above 35mph, most injuries are fatal or incapacitating.¹⁰ With regards to sensitive populations, the elderly and the very young populations are more vulnerable to vehicle injuries while walking because of slower walking speeds or slower reaction times.

Public health and transportation safety research consistently demonstrates that **vehicle volumes** are an **independent environmental predictor of pedestrian injuries**.^{11 12 13 14} In other words, all things being equal, when the number of vehicle trips increases, the number of vehicle injuries to pedestrians will also increase. A national study of pedestrian injuries and crosswalks that included data from Oakland also found that higher average daily traffic and multi-lane roads were significant and independent environmental risk factors for vehicle-pedestrian crashes in multi-variate analysis.¹⁵ One recent study found that traffic volume, traffic speed and lateral separation between pedestrians and traffic explained 85% of the variation in perceived safety and comfort for pedestrians.¹⁶ The City of Oakland Pedestrian Master Plan also highlights the negative effect of high volumes on safety.¹⁷ The magnitude of effect of vehicle volume on injuries is significant. For example, a study of nine intersections in Boston's Chinatown, researchers calculated an increase in 3-5 injuries per year for each increase in 1000 vehicles.¹⁸

5 La Scala EA, Johnson FW, Gruenewald PJ. Neighborhood Characteristics of Alcohol-related Pedestrian Injuries. *Prevention Science*. 2001; 2:123-134.

6 Taylor M, Lynam D, Barua A. The effects of drivers speed on the frequency of road accidents. Transport Research Laboratory. TRL Report 421 Crowthorne, UK, 2000.

7 Morrison DS, Petticrew M, Thomson H. What are the most effective ways of improving population health through transport interventions? Evidence from systematic reviews. *Journal of Epidemiology and Community Health* 2003;57:327-333.

8 Evidence shows that pedestrian and bicycle injuries vary with the 0.4 power of the proportion of trips made by walking or bicycle. Jacobsen PL. Safety in numbers: more walkers and bicyclists, safer walking and bicycling. *Injury Prevention*. 2003; 9: 205-209.

9 Leden L. Pedestrian risk decrease with pedestrian flow. A case study based on data from signalized intersections in Hamilton, Ontario. *Accident Analysis and Prevention*. 2002; 34:457-464.

10 National Highway Traffic Safety Administration. Literature Review on Vehicle Travel Speeds and Pedestrian Injuries. Washington DC: USDOT, 1999.

11 LaScala EA, Gerber D, Gruenewald PJ. Demographic and environmental correlates of pedestrian injury collisions: a spatial analysis. *Accident analysis and Prevention*. 2000; 32:651-658.

12 Roberts I, Marshall R, Lee-Joe T. The urban traffic environment and the risk of child pedestrian injury: a case-cross over approach. *Epidemiology* 1995; 6: 169-71.

13 Stevenson MR, Jamrozik KD, Spittle J. A case-control study of traffic risk factors and child pedestrian injury. *International Journal of Epidemiology* 1995; 24: 957-64.

14 Agran PF, Winn DG, Anderson CL, Tran C, Del Valle CP. The role of the physical and traffic environment in child pedestrian injuries. *Pediatrics*. 1996; 98: 1096-1103.

15 Zegeer CV, Steward RJ, Huang HH, Lagerwey PA. Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines. Federal Highway Administration, 2002.

16 Landis BW, Vattikuti VR, Ottenberg RM, McLeod DS, Guttentplan M. Modeling the Roadside Walking Environment: A Pedestrian Level of Service. TRB Paper -1-0511 Tallahassee. 2000.

17 City of Oakland. Pedestrian Master Plan. Page 18.

18 Brugge D, Lai Z Hill C, Rand W. Traffic injury data, policy, and public health: lessons from Boston Chinatown. *Journal of Urban Health* 2002; 79: 87-103.

Impact Analysis

Empirical research on traffic safety and vehicle volumes shows that the rate of pedestrian injuries increase consistently as vehicle volume increases but the relative increase in this rate is attenuated as vehicle volumes rise. The attenuation may be caused to reduced pedestrian activity in areas with high traffic. A common parametric form of the injury-vehicle volume relationship is described as follows:

$$\text{Injuries} = \alpha X (\text{Average Annual Daily Trips})^\beta ; \text{ typically where } \beta < 1 \quad 19$$

Several empirically tested pedestrian injury estimation models provide evidence that pedestrian crashes are proportional to the square root of vehicle volume (e.g., $\beta = 0.5$ in the equation above).²⁰ This means the number of pedestrian injuries after the project can be estimated simply as:

$$\text{Total Annual Injuries} = \text{Current Annual Injuries} X (\text{Future AADT / Baseline AADT})^{1/2}$$

The Draft EIR acknowledges that development of the Oak-to-Ninth Avenue Project, which includes 3100 residential units and 3500 parking spaces, will result in an additional 27,110 daily vehicle trips external to the project. (Table IV.B-4) As described in the detailed intersection level traffic analysis in the DEIR, these trips will increase traffic volume on local streets in the downtown, Chinatown, and Jack London Square, and other neighborhoods.

According to traffic analysis in the DEIR, the increase in vehicle volumes at intersections in the neighborhoods around the project will vary considerably, ranging from about 2% to 127%. The average project-related increase in vehicle volume in the surrounding neighborhoods at the studied intersections is about 11% after project completion. The average cumulative increase in vehicle volume by 2025 at these intersections is 45%.

Assuming the current annual rate of pedestrian injuries in affected neighborhoods is 100 per year, the model described above estimates an increase in 5.4 injuries per year or 268 injuries between 2025 and 2075.²¹ Based on the cumulative increase in average daily trips of 45% in 2025, the impact is 20 injuries per year or 1000 injuries between 2025 and 2075.

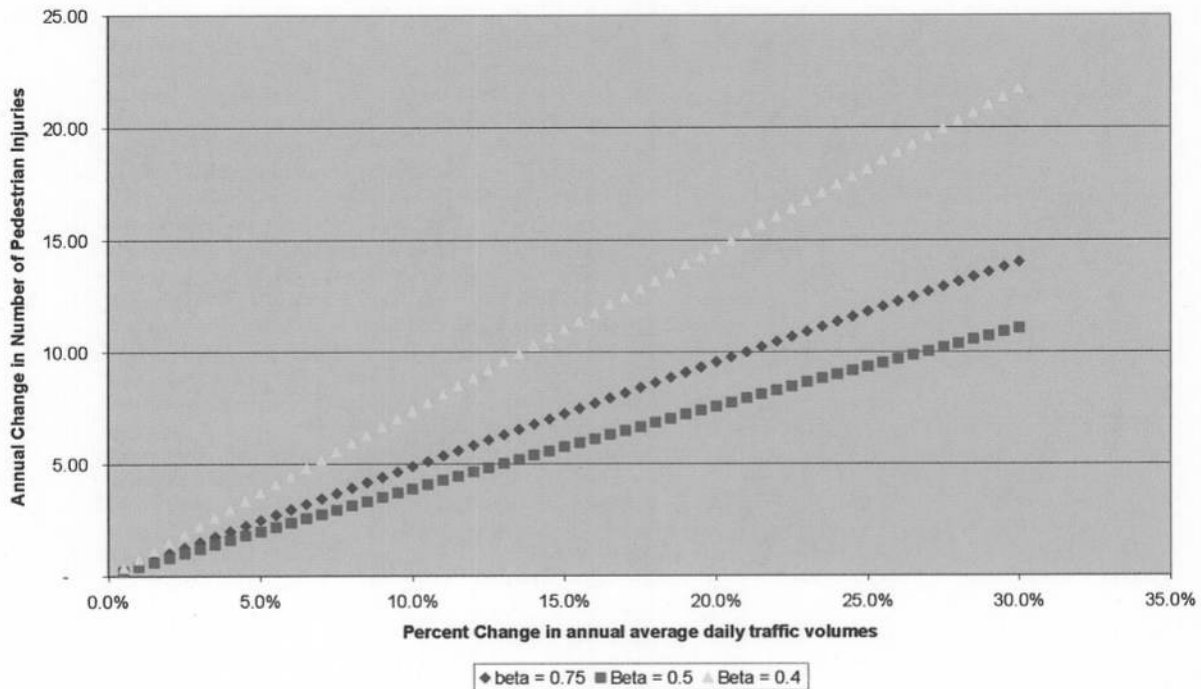
The figure below graphically illustrates the relationship between change in vehicle volume and the change in the number of injuries. The middle line represents a model with Beta set to equal 0.5 in the equation above. The upper and lower lines provide a reasonable upper and lower bound on this volume—injury relationship. A more refined analysis might estimate changes in pedestrian injuries based on vehicle flow on all segments on all roadways; nevertheless, this estimate shows that the Oak to Ninth Project will result in a significant environmental impact on pedestrian injuries in an area where the rate of pedestrian injuries already exceeds the national standard.

19 Lord D, Manar A, Vizioli A. Modeling crash-flow density and crash-flow-V/C ratio relationships for rural and urban freeway segments. *Accident Analysis and Prevention* 2005; 37: 185-199.

20 Lee C, Abdel-Aty M. Comprehensive analysis of vehicle-pedestrian crashes at intersections in Florida. *Accident Analysis and Prevention* 2005; 37: 775-786.

21 Estimates of pedestrian injuries in the project's area of influence are based on review of available injury data. This estimate will be updated based on the most recent pedestrian injury data when available.

**Change in Injury Counts In Relation to Changes in Traffic Flow
For Downtown, Jack London Square, West Lake, Chinatown, Oakland, California
Estimated Baseline Injury Rate = 100 per year**



Available Pedestrian Safety Mitigations are not Utilized

The DEIR indicates that as mitigations to intersection LOS impacts, the project will only include new signals with pedestrian signal heads at a few intersections (Embarcadero and Oak, Embarcadero and 5th Ave; Embarcadero and I-880 Northbound off-ramp; Embarcadero and Broadway.) A Master Response in the FEIR also includes further analysis of safety impacts around train crossings. However, no mitigations are proposed in other neighborhoods where traffic will increase significantly. The DEIR summarily concludes (without evidence) that these traffic control devices at these few intersections will “safely accommodate the added vehicle and pedestrian traffic and the project would have a less than significant impact.” The following evidence argues against the City of Oakland’s conclusions in the DEIR and FEIR:

- The DEIR does not fully analyze impacts on pedestrian injuries resulting from project-related vehicle trips in the neighborhoods surrounding the project. It is not possible to judge the effectiveness of mitigations if the impact is not fully characterized.
- Pedestrian Safety measures proposed by the project focus on intersections. Many vehicle injuries do not occur at intersections.²²
- The mitigations proposed are for a limited number of intersections. The FEIR does not propose or evaluate environmental mitigations at other intersections in and around the project area that are impacted by significant changes in traffic volume.
- For the mitigations proposed, the FEIR does not provide any evidence to support the efficacy of these traffic signal devices as a means to reduce pedestrian injuries.
- The FEIR does not consider other environmental mitigations impacts on pedestrian safety including curb extinctions, median islands, cross walk treatments, presence of sidewalks, roadway buffers, street lighting, and reduced crossing speeds.
- The FEIR does not consider traffic calming as mitigation. Reviews of international studies demonstrate that on average traffic calming interventions reduce accidents by 15%.²³

²² According to the National Highway Traffic Safety Administration 78% of pedestrian injuries occur at non-injury locations. NHTSA. Traffic Safety Facts. 2002.

- The FEIR inaccurately states that pedestrian safety measures in the Revive Chinatown Plan include only the fully funded short term measures. The FEIR also mischaracterizes sidewalk widening as a pedestrian amenity but *not a safety measure*. Sidewalk widening and one-way to two-way conversions are two of the longer term recommendations proposed in the Revive Chinatown Plan that are also pedestrian safety measures. The study by Landis cited above demonstrates that sidewalk widths are a determinant of pedestrian safety. Sidewalk widening also may require lane reductions which may alter vehicle flows.
- The FEIR suggests that the Pedestrian Master Plan provides a framework for mitigating the adverse impacts of vehicles on pedestrians but the project does not contribute to improvements suggested by the Plan.

Further analysis of pedestrian safety impacts and mitigations should focus on all Oakland streets and intersections with significant increases in traffic volume resulting from the Oak to Ninth Project. The mitigations should consider all appropriate and effective practices in pedestrian safety including but not limited to:

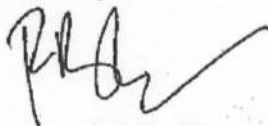
- Traffic Calming including vehicle lane narrowing, raised crosswalks, raised intersections and traffic circles;
- Bulb outs and center median refuge islands;
- Diversion of through traffic around mixed use neighborhoods;
- One-way to two way conversions and lane reductions in mixed use residential areas;
- Speed limit reductions in mixed-use residential areas;
- Grade separated crossings where significant pedestrian pathways cross high volume multi-lane streets;
- Pedestrian warning signs or lights at crossings or cross walks without traffic signal lights
- Sidewalk widening or buffers between sidewalks and vehicle lane buffers.

Summary

Overall, the analysis of pedestrian safety in the DEIR and FEIR includes little substantive evidence or original analysis, just unsupported conclusions. An evidence based analysis shows that project-related impacts on pedestrian safety are significant. The project has provides for no mitigations specific to the needs of pedestrians in the mixed use neighborhoods surrounding the project area. I strongly urge the Developer, the City of Oakland, the Planning Commission, and the Oakland City Council to provide additional pedestrian safety mitigations as described above to prevent the pedestrian injuries expected to result from this project.

Thank you for your consideration of this analysis and the proposed mitigations. I look forward to learning of Oakland Planning Commission actions to prevent pedestrian injuries. Please do not hesitate to call me with questions.

Sincerely,



Rajiv Bhatia, MD, MPH.

CC: Claudia Cappio, Douglas Boxer, Nicole Franklin, Suzie Lee, Michael Lighty, Mark McClure, Anne Mudge, Zac Wald, Jane Brunner, Nancy Nadel, Pat Kernanhan,

23 Morrison DS, Petticrew M, Thomson H. What are the most effective ways of improving population health through transport interventions? Evidence from systematic reviews. *Journal of Epidemiology and Community Health* 2003;57:327-333.