Oakland Pedestrian Master Plan and Space Syntax Model

Figure 1: Streetscape illustration | Oakland Pedestrian Plan, 2002

Activity
Focused Pedestrian Master Planning, Pedestrian volume modeling tool (Space Syntax Model)

Implementing Agency
City of Oakland (California)

Link to Livability
A safe and comfortable pedestrian network is a key element in any livable community. This plan focuses exclusively on pedestrian travel and safety needs, identifying ways to encourage increased walking and street activity.

Summary
The City of Oakland adopted the Pedestrian Master Plan (PMP) in November 2002. The plan designates a network of pedestrian facilities and distinguishes roadway segments and intersections in particular need of safety enhancements to better serve pedestrians. The city used an innovative data analysis tool,

the Space Syntax Model, to estimate pedestrian volumes throughout the city based on land use, population, and other network characteristics. These estimates were combined with crash data, traffic data, and community input to identify and prioritize areas with both safety problems and high pedestrian demand.

Context and Background

A safe and accessible street network for all ages and all abilities is a key component to creating a livable community. People need to feel safe, both from traffic accidents or hazards, and also from crime. Well designed streets can improve the safety of a neighborhood in both areas. An environment in which people are comfortable using the streets helps build community, prevent crime by adding "eyes on the street", and facilitates a lively atmosphere. Designing streets and intersections that are accessible to all ages and ability levels, such as the elderly, children, and people with disabilities, ensures safety, opportunities for physical activity, and a pleasant pedestrian experience for everyone. The vision of the Pedestrian Master Plan is to promote a pedestrian-friendly environment where public spaces, including streets and off-street paths, offer a level of convenience, safety and attractiveness to the pedestrian that will encourage and reward the choice to walk.

To guide development of the Pedestrian Master Plan, the City of Oakland used a pedestrian volume modeling tool, called Space Syntax, to provide a more robust and complete picture of the pedestrian experience in the city. In general, good pedestrian data is limited and most transportation demand models include little or no information on pedestrian travel behavior. Use of the Space Syntax Model in developing the Pedestrian Master Plan was an innovative approach to addressing the need for better pedestrian information on a local level. The Pedestrian Master Plan, adopted on November 12, 2002, contains strategies uniquely suited to expanding and enhancing Oakland's pedestrian network, and more accurately assesses pedestrian safety needs throughout the city.

Detailed Description

The Pedestrian Master Plan promotes pedestrian safety and access to help ensure that Oakland is a safe, convenient, and attractive place to walk. It establishes a Pedestrian Route Network emphasizing safe routes to school and connections to transit. The routes include streets, walkways, and trails that connect schools, libraries, parks, neighborhoods, and commercial districts throughout the City. It identifies priority street segments along these routes for targeted improvements over the next twenty years.

The plan also identifies new pedestrian design elements to promote pedestrian safety and access throughout the City. Policy T4.5 of Envision Oakland, the Land Use and Transportation Element of the Oakland General Plan, recommends the creation of a Pedestrian Master Plan as part of its objective to increase the use of alternative modes of transportation. While walking is a relatively inexpensive transportation mode, building and maintaining a high quality pedestrian infrastructure requires comprehensive planning and long term funding. The Pedestrian Master Plan provides a key resource for the City to prioritize use of existing funds available for transportation improvements and secure additional grant funds for projects dedicated to pedestrian safety and livable communities.

The Plan outlines infrastructure and policy improvements that address the issues of safety, sustainability, equity, vitality, and health around the city. They target specific areas with high numbers of vehicle and pedestrian collisions, poor quality infrastructure, or high estimated pedestrian volumes in an organized, efficient manner. Pedestrian volume estimates were taken from Space Syntax, which used sample pedestrian counts to model land use indicators, such as population density. To support its

conclusions and recommendations, the Plan combined public input, analysis of collision data, and Space Syntax simulations. Figure 2 shows output from the Space Syntax simulation, highlighting key areas of pedestrian activity and potential safety concerns.

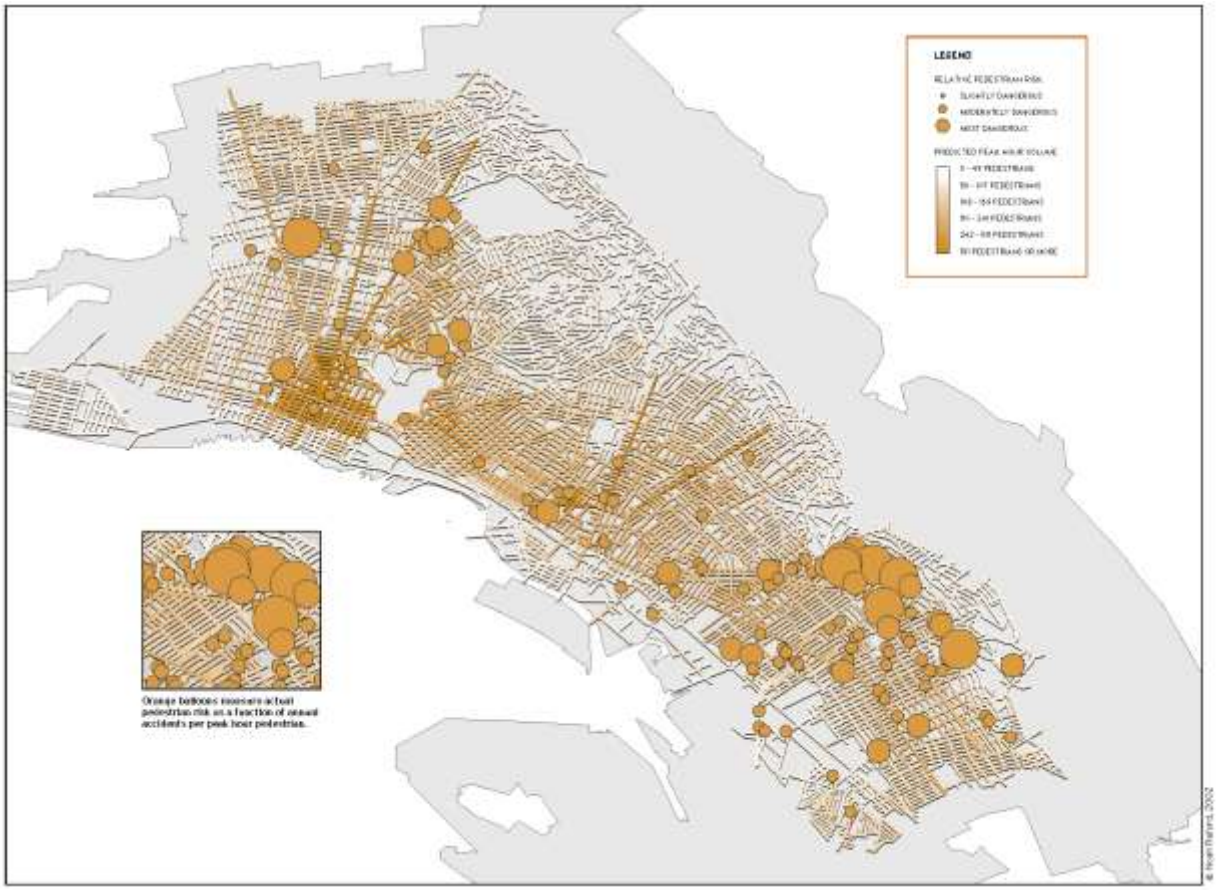

Figure 2: Space Syntax simulation showing pedestrian volumes (orange lines) and collision reports (orange circles)

Two key highlights of this Plan are the specific focus on pedestrian planning and the incorporation of an innovative data analysis tool. In most municipalities, if there is a focus on planning for pedestrians, it is usually incorporated into a broader transportation, or bicycle and pedestrian plan. Few plans focus only on the specific needs of pedestrians.

The Space Syntax tool allows planners to estimate pedestrian volumes at an individual street level by incorporating sample pedestrian counts at key intersections with Census information and street network design. Combined with collision incident data, planners can make better decisions regarding street, sidewalk and intersection improvements, based on understanding the number of people moving through these areas.

Pedestrian Infrastructure and Policies

The focal points of the Oakland pedestrian plan include a designated pedestrian network and a set of broad pedestrian policies to help identify future components of the designated pedestrian network, and improve the environmental quality of the existing network. A series of maps identifies the proposed

network, which consists of primary and secondary pedestrian routes along city streets, off-street pedestrian paths, important connections between neighborhoods, and areas in need of attention due to high safety risks, or location near schools or other activity centers. Policy areas identified by the plan include safety, land use, and education. With regard to land use, the plan encourages a mix of uses and high densities to create higher volumes of pedestrians. At the same time, it recognizes that pedestrian facilities and amenities in both existing and forecasted areas of high density should be upgraded and maintained in order to sustain a desirable level of pedestrian activity. Encouraging higher densities also supports transit, which is most effective when there is good, direct pedestrian access to reach it.

The plan identifies numerous routes as part of its designated network, and classifies the routes by location and land use. Land uses are defined as: city, district, neighborhood, neighborhood hill, or walkway. City routes, for instance, serve "places to live, work, shop, socialize and travel," providing connections between city districts as well as transit stops. District and neighborhood routes, on the other hand, serve more local functions such as schools, while walkways serve as short-cuts and do not follow streets. To support these designations, the plan includes a chapter on design elements.

Data Analysis

To develop the plan, planners collected crash, demographic, and geographic data. A database of crash records from the Statewide Integrated Traffic Records System (SWITRS) provided information about the number of crashes, their locations, and demographic information about the individuals involved. Other data included geographic information system (GIS) maps of the Oakland area showing all city streets, and the locations of activity centers such as schools, recreation centers, libraries, senior centers, and major transit stops.

While analysis of raw collision data produced lists of the most dangerous intersections and corridors, mapping the data allowed for a more comprehensive spatial analysis of collision locations and their relation to major streets, schools, and other activity centers. Planners prioritized areas near schools because of the significant number of transportation trips by foot that school children in Oakland represent , and the recognized importance of promoting walking to school for health, social, and environmental reasons.

Although collision data and maps are valuable, they are limited in that they do not provide information on pedestrian flow volumes, and therefore cannot account for the relative risk to pedestrians at specific locations. To supplement collision data, the city applied software developed by Space Syntax, a British research and consulting entity, to develop estimates of pedestrian volumes across the network. The software uses counts of pedestrian volumes at specific locations and extrapolates them throughout the network. Other factors, such as population density and land use characteristics are used to simulate flow - the "through movements" - of pedestrians over the network.

Beginning with a geocoded street grid of Oakland, representing the pedestrian network, planners inserted population density data from the U.S. Census by tract. The software then predicted pedestrian flows for each link on the pedestrian network based on characteristics of the network such as node (intersection) interconnectivity, distances to other nodes, and population density. In order to calibrate initial results, Oakland added employment density to the model, using data from the US Department of Labor's Economic Census, which improved the accuracy of the estimates. The software provided estimates of pedestrian peak hour flows for each link. The estimation process is distinct from the traditional four-step modeling process in that, rather than emphasizing "to movements" governed by

gravitational concepts of origins and destinations, Space Syntax estimates "through movements" to characterize patterns of pedestrian flow on the network based on the characteristics of the network.

Combining estimated flows with collision information, planners created a measure of pedestrian safety risk for segments of streets and intersections throughout Oakland and again mapped the results. Risk is defined as the number of annual collisions per peak hour pedestrian. The maps show that high risk intersections often are different than those with high raw collision rates, since many locations with high numbers of collisions also have high pedestrian volumes and therefore a lower risk per pedestrian.

Having completed the data analysis, planners designated a pedestrian route network for Oakland based on the criteria that routes do the following:

- Serve schools, transit stops and routes, libraries, senior centers, recreation centers, commercial districts, and other areas of high pedestrian activity;
- Serve and improve conditions in areas with high pedestrian collision volumes or rates;
- Connect previously unconnected neighborhoods;
- Overcome barriers such as freeways, railroads, and topographies; and
- Take advantage of natural features such as shorelines, ridges, and creeks.

In addition to data analysis and route designation, project staff conducted more than 70 neighborhood meetings to gather community input. Information included lists of particularly unsafe intersections and locations of concern along major roadways. Interestingly, by "literally mapping people's complaints," analysts found that many of the locations identified by residents at community meetings matched the locations identified through collision data analysis.

Application Examples

Based on the community input, data analyses, and selection criteria, planners produced policy recommendations, a list of priority projects, and a finalized proposed route network. The policy recommendations consisted of a list of goals for improving safety, access, streetscaping, land use, and education. Priority projects were divided into two categories based on an expected implementation timeline (those within 1-5 years and those within 6-20 years). All listed projects were part of the designated pedestrian route network and, at the time of the Plan's approval, many of the early tier projects had been approved by the city council and were awaiting funds from sponsoring agencies.

Priority Projects and Partnerships

Since its release, the Plan has been instrumental in determining where and how to focus pedestrian improvement resources. Based on the collision analysis and community input, two neighborhoods stood out as the highest priorities for additional planning and capital improvements. Chinatown, located in downtown Oakland, had the highest concentration of pedestrian-motor vehicle collisions in the city. The PMP's analysis helped catalyze a partnership between the Oakland Pedestrian Safety Project (OPSP), the Oakland Chinatown Chamber of Commerce, and Asian Health Services (a community-based health clinic). This partnership successfully completed multiple pedestrian safety educational programs and an environmental justice planning process funded by the California Department of Transportation. The resulting Revive Chinatown Community-Based Transportation Plan provided the basis for a $2.2 million grant from the Metropolitan Transportation Commission's Transportation for Livable Communities Program. The improvements will include bulbouts, scramble signals, countdown signal heads, high-

visibility crosswalks, pedestrian-scale lighting, and bilingual wayfinding signage throughout the Chinatown core.

Similarly, the predominantly Latino Fruitvale District stood out for its high concentration of pedestrian-motor vehicle collisions. Based on the analysis in the PMP, OPSP obtained a second environmental justice planning grant for more detailed work along Fruitvale Avenue in both the Fruitvale and Dimond Districts. That plan includes numerous improvements to pedestrian safety and access around the Fruitvale Transit Village and the Dimond commercial district that is currently undergoing revitalization. It also includes improvements to two freeway underpasses: one currently separating the Fruitvale District from the waterfront and the other currently creating an artificial barrier between the Fruitvale and Dimond districts.

The PMP also has been used effectively to inform both the Safe Routes to School and Safe Routes to Transit programs. Staff prioritized school improvements based on the plan's analysis and have given particular attention to schools on arterial streets and schools with large immigrant populations (where the walking rates tend to be the highest). The Safe Routes to Transit policies brought needed visibility to the importance of the pedestrian to bus connections. For example, the City of Oakland completed a planning process in the Foothill-Seminary neighborhood commercial district that explicitly linked streetscape and pedestrian improvements to trunk line bus service. Oakland's General Plan designates Foothill Boulevard as a regional transit street, and this planning process will serve as a model for how to link streetscape improvements, bus service, and commercial revitalization.

Additionally, the plan includes a list of priority projects described by their locations, estimated costs, and sponsoring agencies. One such project is the San Pablo Avenue median from 53rd to 67th Streets. The median now serves as a "refuge" for pedestrians crossing the roadway, thereby enhancing their safety. Oakland's Community and Economic Development Agency sponsored the $100,000 project, which also improves accessibility for disabled users. Many similar projects, though initiated and/or funded by other agencies either prior to or concurrent with the development of the PMP, are included on the list because they represent improvements consistent with the designated network and with more general policy goals of safety and access for pedestrians.

Lessons Learned

It is necessary to plan for safety as well as access.

The PMP does not focus only on pedestrian safety, but also strongly links safety with access. Planning safe streets only makes sense if there are places (retail and commercial centers or other neighborhoods) for people to walk to. Creating linkages between areas will encourage more people to walk along those routes, increasing the volume of pedestrians. A higher volume of pedestrians can make the streets safer from a crime perspective (more eyes on the street) and a safety perspective (vehicles become more aware of pedestrians in areas of high pedestrian volume).

Pedestrian concerns and improvements are universal.

Most community groups welcome pedestrian improvements. Rather than holding planning meetings about pedestrian improvements, planners can partner with community associations to begin the dialogue about pedestrian issues. Oakland planners' attendance at 70 community meetings to seek input and convey information was made simpler by taking advantage of the existing network of neighborhood associations rather than planning their own meetings. By attending community meetings,

planners are demonstrating a commitment to the community by making the process accessible and taking community concerns seriously.

It is valuable to focus exclusively on pedestrians.

Many plans combine pedestrian and bicycle planning. While the nonmotorized modes have some common characteristics and needs, they are not the same and require distinct analysis methods and different types of infrastructure.

Plan for pedestrian movement on arterials.

Transit stops are often located on busy roadways, creating a conflict between the need for movement of auto traffic and the provision of safe and accessible amenities for transit passengers who, upon disembarking, become pedestrians. It is critical to address arterial roads, particularly the controversial question of whether and how marked crosswalks belong on busy arterial roadways. This will require thoughtful consideration of how to balance the needs of pedestrians with the goal to maintain appropriate vehicle traffic flow.

Emphasize linkages.

In many situations, expending resources on planning and developing extensive pedestrian corridors can be costly and less productive than identifying and focusing investments on essential pedestrian facilities. For example, providing neighborhood connections and developing a plan for the linkages between transit stops and pedestrian facilities can result in more significant progress for pedestrians than larger-scale corridor studies and projects.

Include pedestrian exposure information when prioritizing projects.

Current lack of "exposure" data is a real concern for many interested in planning, safety, and public health. For example, one intersection may see 100 pedestrians an hour and has 10 collisions a year. By contrast, another intersection may see 10 pedestrians per hour and have 5 collisions per year. Without the information on the pedestrian usage of the intersection, the first case may appear to be significantly more dangerous than the second. Understanding the relative safety of an intersection can help planners prioritize improvements for the most dangerous intersections.

Incorporate pedestrian simulation with other analysis.

Space Syntax is an effective tool for predicting pedestrian volumes and its accessibility measures correlate well with pedestrian movement, allowing quality results from a simplified approach. However it has limitations which must be mitigated by additional data analysis. The program did not include transit stops or recreational areas as variables in the model. When using a pedestrian modeling tool, planners will need to look for anomalies in the street system that may account for a greater or lesser volume than predicted by the program.

In general, based on its experience, the Oakland team encourages a focused approach in order to increase the likelihood of success in pedestrian planning. Focus on:

- involving the communities,
- addressing the needs of existing users of the pedestrian network, especially those who cannot or choose not to drive,
- promoting only a few policy areas, and
- identifying promising technologies such as Space Syntax that will enhance future planning efforts.

For Further Information

Contacts

Jason Patton
Bicycle/Pedestrian Program Manager
City of Oakland
510-238-7049
jpatton@oaklandnet.com

Websites and Publications

Oakland Pedestrian Master Plan www.oaklandnet.com/government/Pedestrian/index.html

Space Syntax /www.spacesyntax.com/