Oakland Pedestrian Master Plan and Space Syntax Model

Name of Tool: Pedestrian Master Planning and Space Syntax Model

Implementing Agency: City of Oakland (California)

Scale of Application: State/regional planning, corridor/subarea planning

Description: The City of Oakland adopted its Pedestrian Master Plan in November 2002. The plan designates a network of pedestrian facilities and distinguishes segments and intersections in need of particular attention for safety enhancements. The city used the Space Syntax model to estimate pedestrian volumes throughout the city based on land use, population, and other network characteristics, and used these estimates in conjunction with crash data, traffic data, and community input to identify and prioritize areas with both safety problems and high pedestrian demand.

Purpose and Need

Oakland residents travel by foot farther and more frequently than most of their counterparts in other Bay Area cities, yet the city recognizes that many pedestrian routes face safety and aesthetic limitations. These limitations include incomplete or nonexistent sidewalks and crosswalks, missing traffic signals, lack of street furniture and landscaping, busy and dangerous vehicular arterial streets, and freeways as physical barriers.

To address these concerns, Oakland's 1998 General Plan recommended development of, among other plans, a Pedestrian Master Plan. The plan outlines pedestrian improvements that address the issues of safety, sustainability, equity, vitality, and health by targeting specific areas of poor safety, poor quality infrastructure, or high volume potential in an organized, efficient manner. In addition, the plan addresses broader issues facing pedestrians such as neighborhood connectivity, conformity with land use and transportation needs and goals, and promoting the "right to walk" in a safe and comfortable environment. To support its conclusions and recommendations, the plan combined public input, analysis of collision data, and advanced pedestrian simulation software known as Space Syntax.

Description

In August 2002, after undertaking three years of work at a cost of $250,000, the Oakland Pedestrian Safety Project submitted its final draft of the Pedestrian Master Plan to the Oakland City Council, which approved the plan three months later. The notion of a pedestrian plan itself pushes the envelope of municipal planning, while several component methods and techniques used in Oakland reflect even greater levels of innovation. This section discusses the plan contents, general development process, and technical methods undertaken in Oakland.

The focal points of the Oakland pedestrian plan include a designated pedestrian network and a set of broad pedestrian policies. A series of maps identifies the 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 forecast 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 one of the largest, most direct sources of pedestrian traffic.

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

Next, armed with this array of information, planners mapped collisions using a GIS platform in order to pinpoint hazardous locations, particularly those near schools. 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. According to project manager Zachary Wald, school children in Oakland are responsible for a good number of transportation trips by foot. As a result, planners focused much of their analysis on areas near schools.

Although collision data and maps provide value to planners, they suffer the limitation of not accounting for pedestrian flow volumes, and therefore not accounting for the actual hazard or 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. The software uses counts of pedestrian volumes at particular locations and extrapolates them throughout the network. Population densities, land use characteristics, and several other factors 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.

The application of Space Syntax in Oakland had several limitations. First, it did not include the location of transit or recreation activities as "features" of the network in the flow estimation process. Secondly, consumer behavior attributes such as streetscape aesthetics or safety preferences were not factored into the estimation. Nevertheless, according to Noah Raford, Space Syntax specialist for the Oakland plan, simplified approaches typically "[work] well because research has shown that accessibility measures correlate well with pedestrian movement (between 0.5 and 0.8 r-squared, depending on the environment)." Another limitation is that the interface is somewhat sophisticated, requiring advanced GIS and database skills. Nevertheless, the software produces highly detailed and, in Oakland's case, quite accurate predictions of pedestrian flows (73 percent correlation with pedestrian counts). While the 2002 pedestrian plan made only limited use of Space Syntax, Wald regards the software as an essential aspect of future pedestrian planning efforts, especially in light of improvements to address the shortcomings identified.

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.

Concurrently with the data analysis and route designation, project staff gathered community opinions from attendance at over 70 neighborhood association meetings. 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 route network. The policy recommendations consisted of a list of goals for improving safety, access, streetscaping, land use, and education. An example of a land use goal is, "Use building and zoning codes to encourage a mix of uses, connect entrances and exits to sidewalks, and eliminate ‘blank walls' to promote street level activity." 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.

The plan identifies numerous routes as part of its designated network. Routes are then classified in two ways. First, they are classified by their geographic location or the facilities they serve – specifically, as "downtown pedestrian routes," "safe routes to school," or "safe routes to transit." Second, they are classified as one of the following based on the type of land uses served: 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.

The pedestrian plan also contains 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 will serve as a "refuge" for pedestrians crossing the roadway, thereby enhancing their safety. Oakland's Community and Economic Development Agency will sponsor 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 pedestrian plan, 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.

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 pedestrian plan'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 Pedestrian Master Plan, OPSP obtained a second environmental justice planning grant for more detailed work along Fruitvale Ave 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 separating the Fruitvale District from the waterfront and the other creating an artificial barrier between the Fruitvale and Dimond districts.

The plan 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 emphasis in the policies and the route network prioritized the pedestrian-transit connection and brought needed visibility to the pedestrian-bus connection. For example, the City of Oakland recently completed a planning process in the Foothill-Seminary neighborhood commercial district that explicitly linked streetscape 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.

Successes and Lessons Learned

Wald emphasizes that the basic premise of the plan is that "we're not just promoting pedestrian *safety*." Instead, they are promote safety and access together. Luckily, most community groups welcome pedestrian improvements, which highlights the first lesson of the process: "Don't hold your own meetings! Pedestrian safety is always on the agenda of neighborhood groups. Go to existing neighborhood groups' meetings; you will be welcome." Indeed, 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.

The plan does not mention bicycles; this was intentional and, according to Wald, one of the plan's notable features. Many plans fall into the common and convenient trap of "lumping bikes and pedestrians together." In reality, however, the two modes require quite distinct analysis methods and vastly different types of infrastructure. If modes are going to be lumped together, Wald opines that bikes have more in common with autos and that pedestrians should be linked with buses since transit generates high levels of pedestrian travel.

Transit stops commonly dot 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. Wald notes that "confronting the arterial roads issue" is inevitable, particularly the controversial question of whether and to what degree marked crosswalks belong on busy arterial roadways. For pedestrian planners, markings are both intuitive and essential; for traffic engineers, markings can be counterintuitive and disruptive. Wald cautions that this issue could be the most delicate one in pedestrian planning, requiring more compromise than in other areas.

While long corridors have value for other modes and occasionally for the pedestrian mode, Wald feels that expending resources on planning and developing pedestrian corridors can be costly and less productive than other approaches. Instead, making neighborhood connections and developing a plan for the linkages between transit stops and pedestrian facilities represent more worthwhile efforts within the planning process than larger-scale corridor studies.

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 (such as children and transit users), promoting only a few policy areas, and identifying promising technologies such as Space Syntax that will enhance future planning efforts.

For Further Information

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Web Sites and Publications:

- Oakland Pedestrian Master Plan