Department of Civil and Environmental Engineering
CE454 Urban Transportation Systems

Project Findings

Establishing a Measure of Pedestrian Activity

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November 22, 2006

Background

In recent years, the Portland Metropolitan area has experienced phenomenal growth and development. Unfortunately, many of our existing transportation systems have not been able to keep up with the accompanied increase in population, use, and need for improvements. Despite its climate, Portland is a very active town, with high levels of pedestrian and cyclist activity, and a large widely-used public transportation system. It is this very population that contributes to Portland's clean air, safe public streets, and local businesses.

In many areas, the combination of increased traffic and pedestrian activity has resulted in unsafe or inconvenient situations for both drivers as well as pedestrians. Partly due to inadequate parking in these thriving neighborhoods, vehicles are forced to park parallel, or often times, to illegally "double park". Due to the nature of these areas and their original design, visibility is greatly impaired. As one can imagine this creates quite a hazard for pedestrians stepping off the foot path to cross the street, as well as to handicapped users utilizing unmarked crosswalks.

Currently, Oregon law requires vehicle drivers to yield to pedestrians in crosswalks whether they are marked or not. An unmarked crosswalk is generally considered any intersection of streets, where a crosswalk is not identified by lines on the roadway or a sign. Some of the problems with this law are that drivers often are unfamiliar with it and are unaware of their responsibility to yield, or drivers are unable to see pedestrians and likewise are unable to yield safely.

In order to address the pedestrian crossing issues that face these rapidly developing neighborhoods, several factors have to be examined. Among these are the relevance of marked crosswalks, and whether vehicles are more likely to yield the right of way if a crosswalk designation is provided, as well as the need for marked crosswalks, and whether a neighborhood has enough crossing demand and pedestrian flow to justify the installation of a marked crosswalk. The location of crosswalks will also be a key factor, in that many neighborhoods and busy city streets have longer blocks than others, and perhaps this necessitates crosswalk installations mid-block, which in turn would have to be marked in order for drivers to identify them as such.

Introduction

In a preliminary investigation, XYZ consultants determined that the demand and criteria for marked crosswalk installation would require a more extensive investigation to gather a broader sample of data for analysis. However, in examining previous data provided regarding pedestrian flow on major city streets, a sample of 5 major city streets were examined under closer detail. These were selected based on the nature of the neighborhood i.e. primarily residential, business, school, etc., residential density, pedestrian flow data, and locality.

The first area examined was Northwest 23rd avenue from NW Irving to NW Johnson streets. This neighborhood is a mix of high density residential, and commercial/employment. The limited space and parking facilities in this neighborhood result in high traffic flows, as well as high pedestrian flows. The main street being NW 23rd avenue is lined with small stores, and restaurants. This lends itself to high amounts

of foot traffic with the highest activity occurring mid-day. Due to the vehicle congestion in this area, traffic tends to move relatively slow, and pedestrians have a tendency to cross at random locations mid-block.

The second area was NW 21st avenue from NW Hoyt street to NW Glisan Street. The characteristics of this area were very similar to those of NW 23rd avenue, however the locality of a school (Metropolitan Learning Center), and bus stops located on this section of street seemed to present less random foot traffic and more appearance of pedestrians with a specific destination. The traffic in this area appeared to move at speeds closer to the posted speed limit, and pedestrians seemed to utilize street corners for the majority of crossing demand.

Northeast Alberta Street from NE 28th avenue to NE 29th avenue: this area is primarily just a small strip of commercial zoning occupied by restaurants and taverns, surrounded by a low density residential area. The nature of this area provided more visibility for pedestrians, and lower overall pedestrian activity, however the vehicles in this area appeared to travel faster than the posted speed limits making it difficult for pedestrians to make their appearance known to drivers.

The area of North Mississippi from N Beech street to N Failing street presents an area representative of the above areas combined. Although there is low density residential zoning, and a small commercial area, the streets are highly populated with parked cars resulting in poor visibility. The majority of pedestrian traffic was people visiting the small shops, and people utilizing the bus stop at the nearby corner. Pedestrians in this area mostly crossed at random locations mid-block.

Northeast Fremont Street between 41st avenue and 42nd avenue is another low density residential area. However, it is adjacent to both a school and a bus stop. There is a small commercial section here that generates some pedestrian traffic; however the majority of pedestrian traffic appeared to be affiliated with the school and bus stop.

Experimental Design

Based on observation of the data provided by the city of Portland and a preliminary observation of the five major streets described above, it was proposed that the primary measure of pedestrian activity in determining crosswalk criteria shall be based on peak summer and spring pedestrian flow data. As can be observed in chart 1.1, there is nearly a 50 percent reduction in pedestrian activity as soon as the rainy season arrives, this reduction in pedestrian activity most likely results in increased vehicle traffic, with lower speeds, the impact of which will require further sampling and analysis.

In an overall estimation of the need for a marked crosswalk, it was determined that this would primarily be a function of pedestrian flow, vehicle flow, visibility, and crossing demand. The latter parameter, crossing demand would be utilized in determining whether a crosswalk should be recognized and marked at a location other than an intersection.

In determining pedestrian flow, criteria and constraints that were previously established seemed to be adequate in recognizing how to obtain a realistic measure of pedestrian activity. See “Framework for Pedestrian Counts” by Nick Carey.

The vehicle flow parameter can be obtained by either manual or automated vehicle counting procedure. For the small sample in this preliminary investigation,

manual vehicle counts were taken. Traffic flow data was utilized to determine gap probabilities for given intersections. Gaps in traffic flow are an important feature in assessing how safely pedestrians can cross the street. Elderly and handicapped citizens often require more time than other pedestrians.

The visibility parameter is difficult to adequately assess in that it is of importance to account for pedestrian's ability to safely recognize vehicles, and assess a safe distance, as well as vehicle operator's ability to see pedestrians and assess whether or not they can safely yield to the pedestrians. Methods of ascertaining visibility parameters were discussed and came up inconclusive. In some areas it was noted that there are already no parking zones within a certain distance of intersections and crosswalks to increase visibility of both drivers and pedestrians, however in other areas where parking is a commodity, the loss of parking spaces from these no parking zones, can dramatically affect local businesses, and consequently have an adverse impact on the existing traffic problems as people tend to "troll" for parking". Thus it is inconclusive whether a minimum "no parking" distances should be mandated by the city. From our investigators' findings, it was noted that even a small distance of about 15 ft, (1 car length), greatly improved visibility at crosswalks and provided pedestrians a good sight distance to observe oncoming traffic without stepping into the flow of traffic.

The last parameter that seemed to have a large impact on the criteria was crossing demand. It was noted if there was cause for people to cross a busy street at a given location, they would due so regardless of the locality of nearby crosswalks. This really is difficult to assess in that certain businesses draw people from across the street and rather than walking to the nearest crosswalk and crossing, pedestrians have a tendency to "jaywalk". This problem is on unto itself in that perhaps the block is too long and necessitates a crosswalk mid block, or perhaps local law enforcement needs to enforce the illegality of not using a crosswalk with penalties in the hopes that pedestrians would make an attempt to safely cross at an intersection.

Pedestrian Counts and Traffic Flow

As can be seen in chart 1.3, a strong resemblance between crossing demand and traffic flow begins to appear. The relationship between traffic flow and crossing demand appears as though it would be the logical choice in establishing a measure of pedestrian activity and assessing the need for marked crosswalks. It has been proposed by several of our consultants that the ratio of traffic flow to crossing demand be utilized as a predominate factor in determining the need to designate and mark a crosswalk. In this proposal, a determination of crossing demand and criteria for assessing crossing demand needs to be formulated, as well as utilizing gap probabilities in assessing how safely pedestrians can cross the street given the traffic flow at various times of the day and the width of the street. For the intersections studied, gap probabilities are shown in chart 1.4.

It was initially proposed that crossing demand formulated by considering any pedestrians that step off the footpath in an effort to cross the street as "demand". The demand can then be sub-classified as demand at existing crosswalks, and demand at non-existing crosswalks. It is assumed that people will rarely walk more than 20 ft to utilize an existing crosswalk, thus if a person is within 20 ft of and existing crosswalk it is

implied that the demand is for the existing crosswalk, and if a person is greater than 20 ft. from and existing crosswalk, the demand may be to designate a mid-block cross walk.

Impact of Mass Transit on Pedestrian Activity

As a team, XYZ consulting deduced that bus stops always present a crossing hazard. In observation it has been noted that the primary location of bus stops is at intersection, or street corners. The use of bus stops often includes small children, elderly, handicapped, and people who are in a hurry to catch the bus and may not exercise proper safety when crossing the street. Due to nature of bus stops, it would appear that the safest action would be to mark all crosswalks at intersections containing bus stops. At a minimum, once a classification of traffic flow/ demand ratios is established, intersections with bus stops should have priority in getting designated and marked crosswalks.

Summary

In conclusion XYZ, consultants has determined the following criteria provide a sound analysis of any particular urban area in which a pedestrian crosswalk is being considered:

- Pedestrian Flow
- Traffic Flow / Gap Analysis
- Proximity of Schools and Parks
- Length of Block in Question
- Parking Conditions
- Zoning
- Public Facilities
- Mass Transit Activity

However, the information gathered for this investigation does not warrant a true decision as to whether or not crosswalks should be installed at the locations in question. Further data would need to be collected and analyzed to arrive at a confident decision to proceed with. The conclusions XYZ Consultants arrived at were based only upon this preliminary investigation and could change upon information found in future investigations. For example, a mid-block crosswalk would bring consequences (perhaps negative ones, economically) for local businesses. Since parking spaces would likely be decreased in order to install a safe crosswalk, the attraction to any particular nearby business would be less attractive to the typical customer traveling to that business by car. In addition, the City of Portland would lose significant revenue from a decreased number of parking spaces – revenue that ultimately ends up going towards repairing and maintaining transportation infrastructure. A detailed study of the safety history in the vicinities of the proposed crosswalks would be another important area to analyze. Proper cost/benefit analysis would be another area to concentrate on to arrive at more conclusive decision.

Chart 1.1 Pedestrian Flows 2006

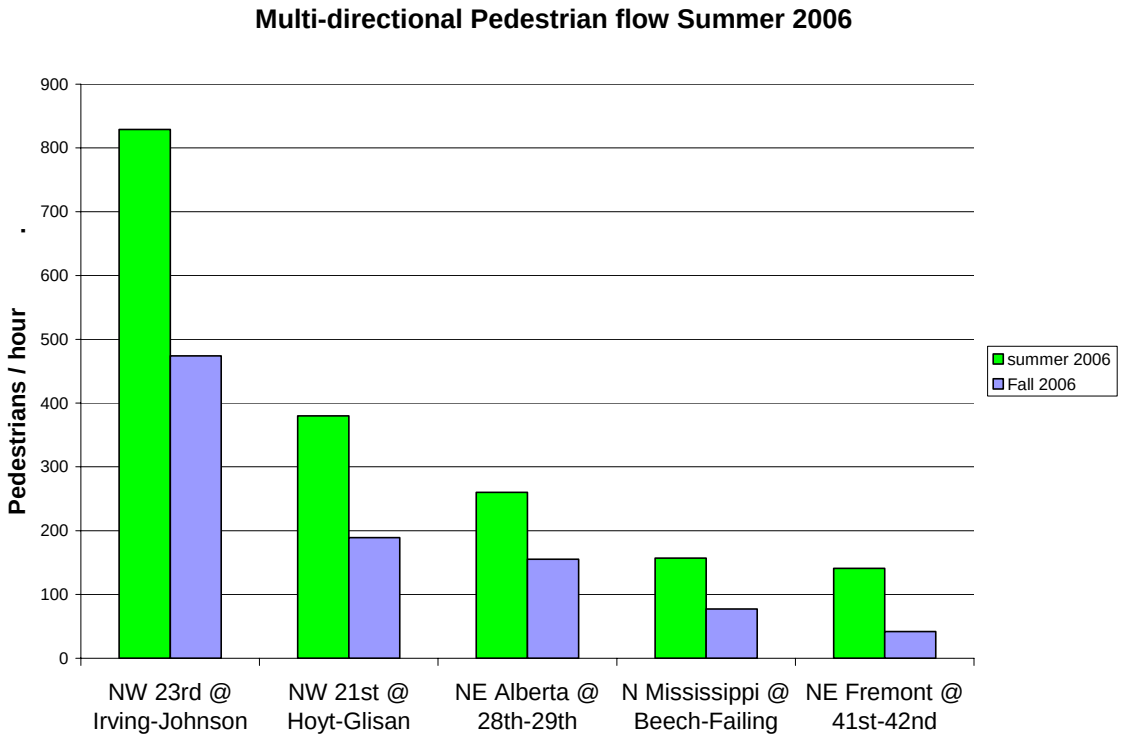


Chart 1.2 Pedestrian Flow vs. Crossing Demand

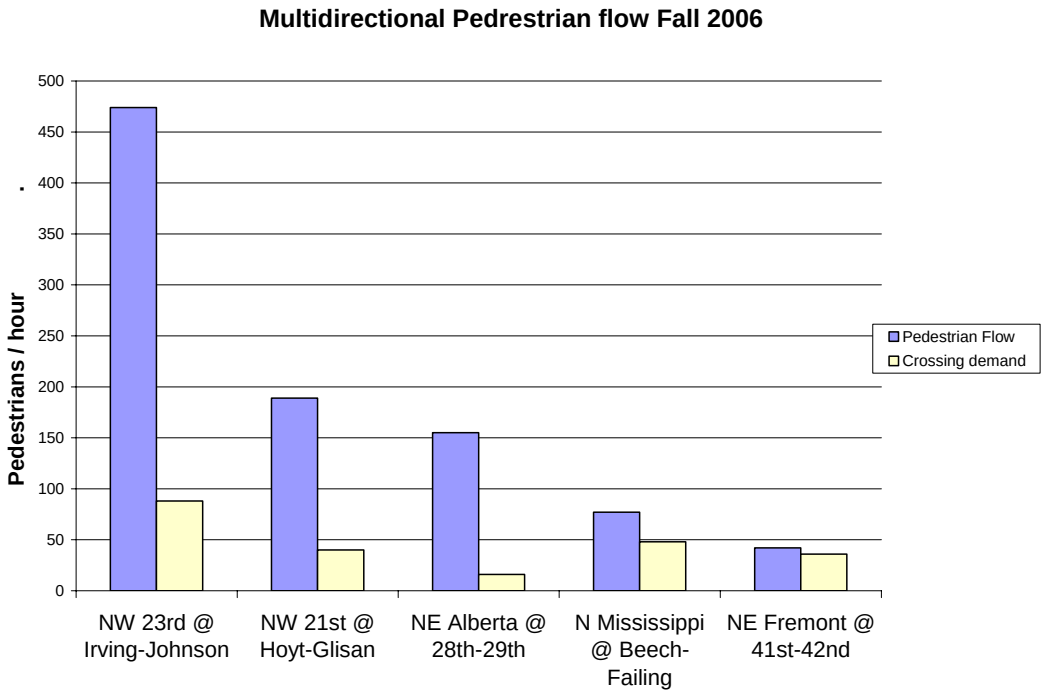
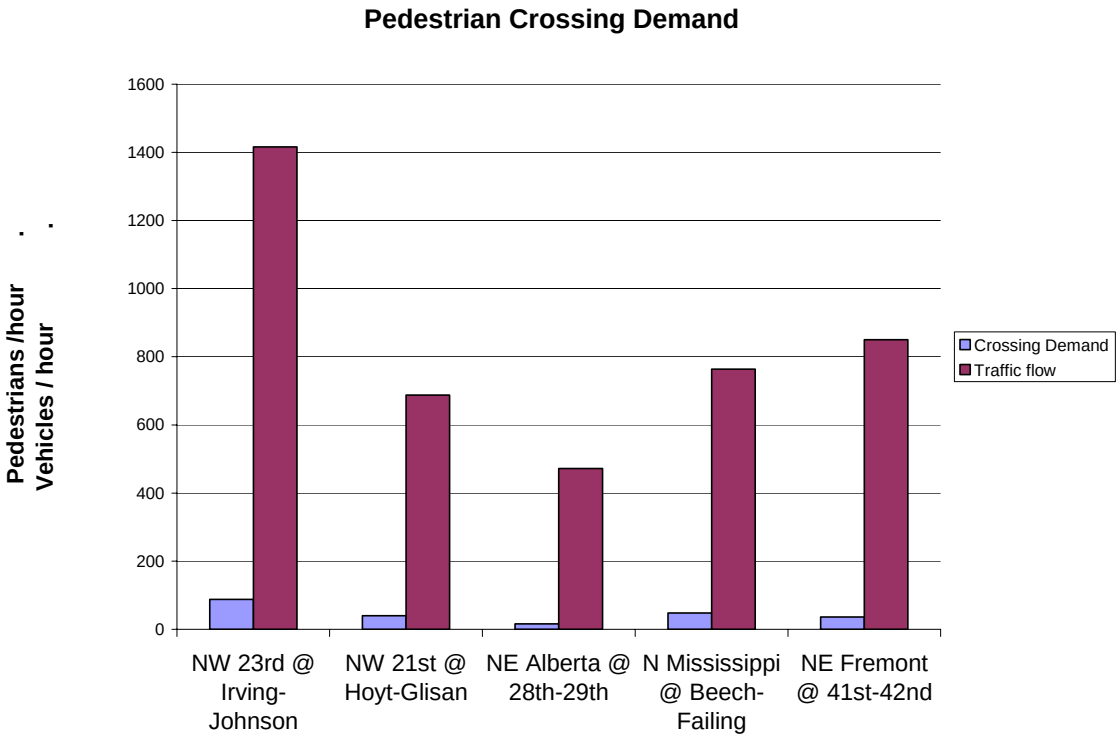


Chart 1.3 Pedestrian Crossing Demand vs. Traffic Flow



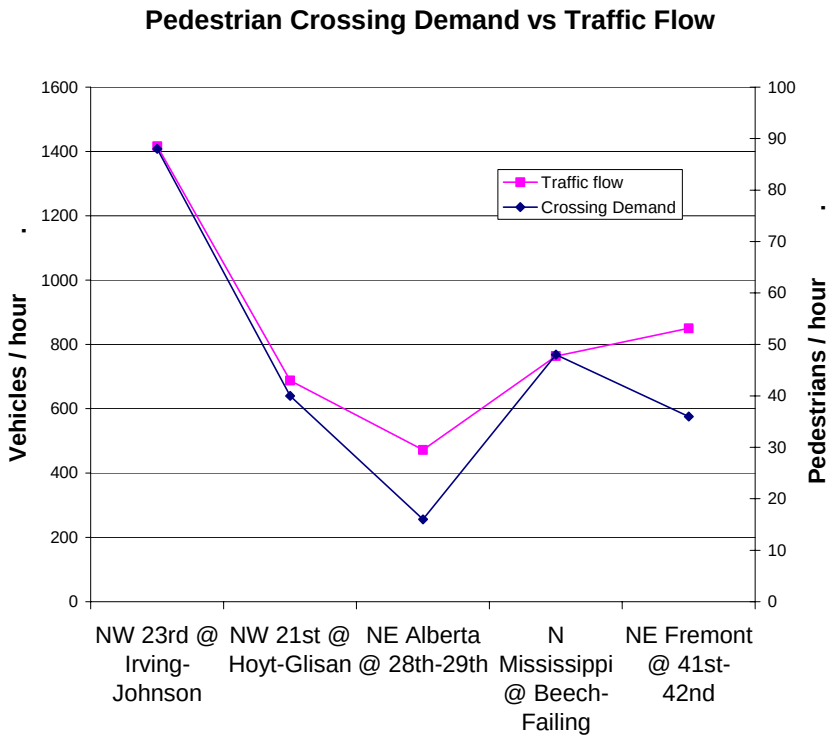
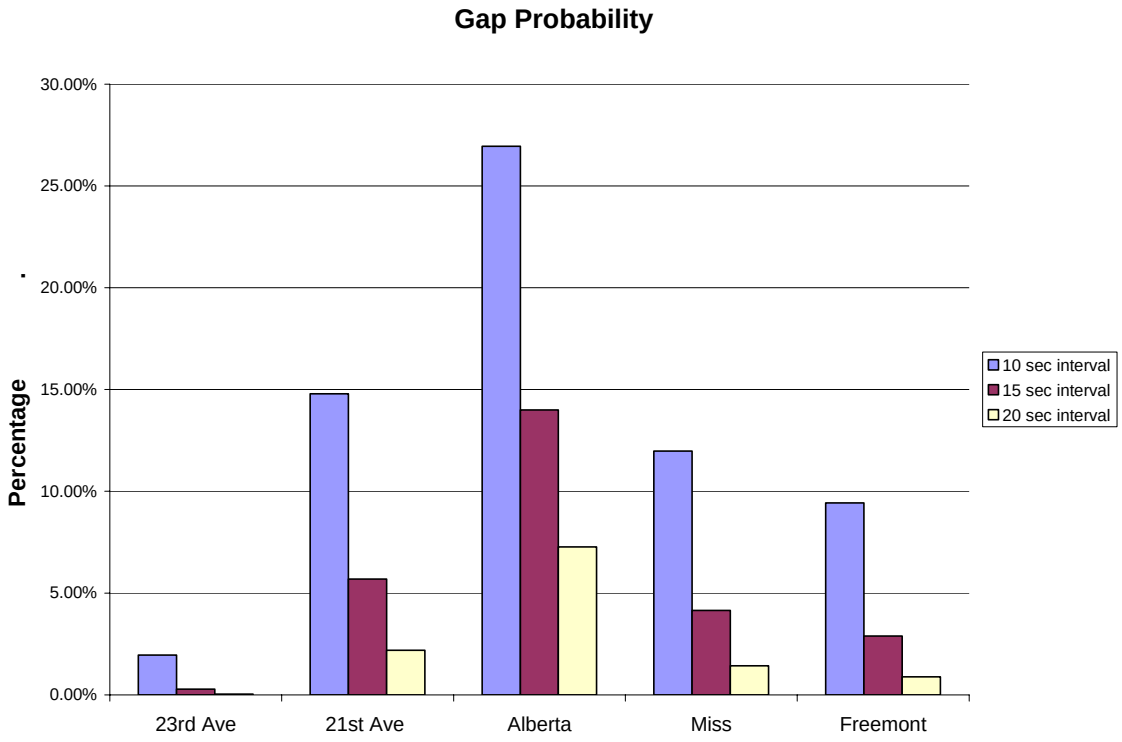


Chart 1.4 Gap Probability at Intersections Analyzed



References

Mannering, Fred, L; Kilareski, Walter P.; Washburn, Scott S. Principles of Highway Engineering and Traffic Analysis. Third Edition. John Wiley and Sons, 2005

Oregon Department of Transportation Highway Division. Traffic Manual May 2006. http://www.oregon.gov/ODOT/HWY/TRAFFIC/index.shtml

Appendices

Raw Data

location	Aug-06 peds/hour	time
NW 23rd @ Irving-Johnson	829	13:00-14:00
NW 21st @ Hoyt-Glisan	380	17:30-18:30
NE Alberta @ 28th-29th	260	12:15-13:15
N Mississippi @ Beech-Failing	157	12:00-13:00
NE Fremont @ 41st-42nd	141	12:15-13:15

ped crossing demand

Nov-06 peds/hour	time	Nov-06 peds/hour	time
474	12:00-13:00	88	12:00-13:00
189	15:00-16:00	40	15:00-16:00
155	12:30-13:30	16	12:30-13:30
77	13:00-14:00	48	13:00-14:00
42	12:00-13:00	36	12:00-13:00