

# Phoenix Pedestrian Safety Action Plan

## I. Introduction

### ***A. City of Phoenix Commitment to Pedestrian Safety***

The City of Phoenix is committed to improving pedestrian safety for all residents and visitors through continued application of sound engineering, educational and enforcement techniques.

### ***B. Overall Pedestrian Safety Goal***

The City of Phoenix is committed to an overall 10% reduction in pedestrian crashes, injuries and deaths by the end of calendar year 2016.

### ***C. Responsibility***

The City of Phoenix Police and Street Transportation Departments are responsible for achieving the overall goal. In doing so, these two departments have the committed resources of the rest of the City government.

## II. Specific Goals and Objectives

### ***A. Definitions***

1. **Pedestrian Crash** – any motor vehicle crash on a City of Phoenix public street where the primary harmful event was listed as impact with a pedestrian. Crashes where a pedestrian was hit secondary to another collision or other harmful event are not considered pedestrian crashes.
2. **Injury** – any person receiving possible, non-incapacitating or incapacitating injury severity codes as determined by the investigating officer or as indicated on the Arizona Traffic Accident Report form for a particular crash.
3. **Population** – City of Phoenix population estimate as of June of the year of interest as determined by the City of Phoenix Planning Department

## **B. Baseline values**

1. City of Phoenix Population – 1,477,730 as of June, 30 2005
2. Average Pedestrian Crashes (2001-2005) – 644 crashes/ year
3. **Crashes per Capita – 44.5 crashes/ 100,000 residents**
4. Average Pedestrian Injuries (2001-2005) – 612 injuries/ year
5. **Injuries per Capita – 41.4 injuries/ 100,000 residents**
6. Average Pedestrian Fatalities (2001-2005) – 53 fatalities/ year
7. **Fatalities per Capita – 3.59 fatalities/ 100,000 residents**

## **C. Specific Pedestrian Safety Goals**

1. **By 2016 the City of Phoenix will reduce (by 10% of baseline values) the five year average number of pedestrian:**
  - a. crashes to **below 39.2 crashes/100,000 residents,**
  - b. crash related injuries to **below 37.3 injuries/100,000 residents,**  
and
  - c. crash related deaths to **below 3.23 deaths/100,000 residents.**

## **D. Objectives**

The goals will be achieved through completion of the following objectives:

1. **ENGINEERING** – By 2016 the City of Phoenix will have:
  - a. installed:
    - i. new pedestrian safety islands at 30 locations,
    - ii. countdown pedestrian signals at 200 additional crosswalks at traffic signals,
    - iii. sidewalk along 100 additional miles of arterial or collector streets,
    - iv. ADA wheelchair ramps at 200 additional locations and,
    - v. speed humps in 50 additional neighborhoods.
  - b. established a Pedestrian Safety Advisory Committee (PSAC) composed of City of Phoenix safety and planning professionals.
  - c. conducted annual pedestrian safety audits of locations with high or unusual numbers of pedestrian crashes
  - d. established a program for traffic calming on collector streets.
  - e. reviewed 40 street segments for road diet consideration.
  - f. established a program to review street lighting at mid-block locations.

2. **EDUCATION** – By 2016 the City of Phoenix will have:
  - a. developed and implemented:
    - i. safe routes to school walking plans at 50 additional school,
    - ii. a light rail pedestrian safety campaign,
    - iii. a child pedestrian safety campaign and,
    - iv. an alcohol pedestrian safety awareness campaign.
  - b. conducted annual school crossing guard training for city schools.
  - c. updated and distributed the school crossing guard training video.
3. **ENFORCEMENT** – By 2016 the City of Phoenix will have:
  - a. TBD
  - b. TBD
4. **ENCOURAGEMENT** – By 2016 the City of Phoenix will have:
  - a. conducted annual school safety audits for all city schools and,
  - b. produced neighborhood walking plans in five neighborhoods.

### ***E. Pedestrian Safety Action Steps***

The objectives will be reached through completion of the following action steps:

1. **Data collection**
  - a. Collect and analyze all pedestrian crash reports and summarize findings in annual pedestrian crash report summary
  - b. Continue collecting individual crash reports, field reports and citizen feedback on specific pedestrian safety concerns
  - c. Perform annual pedestrian safety audits of high pedestrian crash locations (intersections and segments)
  - d. Perform periodic pedestrian crossing counts in areas of high pedestrian activity
  - e. Perform periodic field reviews of all Phoenix streets paying particular attention to areas of high pedestrian activity
  - f. Perform ADA compliance checks of all City of Phoenix pedestrian facilities
  - g. Continue working with pedestrian safety experts from surrounding communities
2. **Infrastructure Improvements**

- a. Review all submitted plans for pedestrian friendly infrastructure upgrades
- b. Continue to fund the sidewalk installation program
- c. Promote and fund expansion of ADA facilities citywide
- d. Continue to fund the Neighborhood Traffic Management Team (NTMT) speed hump program
- e. Expand efforts to obtain federal and state funding for pedestrian friendly infrastructure improvements and upgrades

**3. Educational outreach**

- a. Conduct pedestrian safety education training through police and fire departments in Phoenix elementary schools
- b. Periodically hold adult pedestrian safety training or discussion

### III. Stakeholders

#### ***A. Pedestrian Safety Advisory Committee (PSAC)***

The PSAC will be established from members of the Street Department Traffic Operations Division and at least eight additional members of the City of Phoenix Street, Public Safety and Planning Departments as well as other Departments as deemed necessary. The PSAC will serve as an advisory panel with the task of implementation, oversight and review of the Phoenix Pedestrian Safety Action Plan.

### IV. Data Collection

Pedestrian safety data is currently being collected through a series of venues within City government. It is the intent of the Pedestrian Safety Action Plan that the collection will continue and where possible and practical, be enhanced. The raw data and resulting analysis shall be funneled through the appropriate Section and Department heads to the PSAC.

#### ***A. Citizen Complaints***

Complaints on pedestrian safety issues as well as other traffic safety concerns can be generated by citizens, police and fire personnel and other city employees and are collected by the Traffic Operations Division of the Street Department. Once collected, the specific concern is evaluated and forwarded to the appropriate department or section for investigation. The investigation is tracked and followed up on by either assigning it a unique work order or work request number or by assigning a council action number. Once the investigation and/or work is completed, the citizen or requesting agency is notified by the appropriate staff member and the results are logged within the City filing system.

## ***B. Field reviews***

All city work crews, investigative staff, street maintenance and emergency personnel conduct informal field reviews each time they travel about the city. They are responsible for reporting any deficiencies to the Street Department as they identify them. In addition, the Traffic Operations Division conducts formal reviews of traffic infrastructure including pedestrian safety related infrastructure on a periodic basis. Deficiencies are written up in work orders and forwarded to the appropriate Department for disposition.

## ***C. Crash Histories***

The Street Department Traffic Safety Section is responsible for official traffic crash histories and can search traffic crash reports specifically for pedestrian related crashes. The Section relies on three databases for traffic crash records. The Accident Location Identification and Surveillance System or ALISS is maintained by the Arizona Department of Transportation (ADOT) and contains crash records from all jurisdictions in Arizona. The Traffic Accident Data System or TADS is maintained by the City of Phoenix Policed Department and contains only City of Phoenix crash reports. The final database is know as the Traffic Accident Records System or TARS and contains copies of individual crash reports from the previous year.

The results of the database searches are compiled in tabular and or diagram form and presented to the requesting individual. See Appendix A for example pedestrian crash summary tabular and diagram.

## ***D. Pedestrian & Vehicle counts***

Pedestrian and vehicle counts are conducted by the Traffic Operations Investigators and the Street Department Traffic Count Shop respectively. Pedestrian counts are conducted to determine pedestrian behavior such as frequency and location of pedestrian crossings. They are usually performed by hand but may also be conducted through video surveillance. Pedestrian counts are not stored in a master database.

Vehicle counts are usually conducted by pneumatic tube counters positioned across the road in question. Vehicle counts are conducted to determine traffic volume and average speeds and are usually performed over a two to three day continual basis. Traffic Investigators are also occasionally asked to conduct traffic speed evaluations using radar units. These counts look specifically at vehicle speeds and are usually conducted over a much shorter time period than tube counts. Count Shop tube counts are stored on a master database and every three years, are compiled into a master traffic volume map.

## ***E. Crosswalk Warrants***

Crosswalk warrants are a special form of pedestrian count is occasionally performed by traffic investigators. Such warrant counts are conducted at specific locations in areas of high pedestrian activity. The intent is to determine if a marked crosswalk is would focus pedestrian crossing activity into a single area and thus increase pedestrian activity and driver expectations in this location. Such warrants require a balance between pedestrian activity and vehicles traffic and installing them is generally approached with caution. Unwarranted crosswalks can actually create pedestrian safety issues.

See Appendix B for Traffic Operations Crosswalk Policy and Procedures

### ***F. Pedestrian Safety Audits***

Pedestrian Safety Audits are periodically performed by the Traffic Safety Section and the Traffic Investigators. They consist of a review of pedestrian crash records and a ranking of the intersections or segments with the highest number of reported pedestrian crashes over a predetermined period of time. Following identification, copies of the individual reports are analyzed and a checklist is crated. The reports and checklist are supplied to an investigator and an on-site audit is performed. Based on the results of the audit, changes or repairs can be recommended by the investigator.

See Appendix C for Safety Audit Procedures and Checklist

### ***G. Plan Review***

Plan reviews are conducted on two levels and help assure the pedestrian and bicycle access are maintained in both new and existing roadway designs. The general information gathered from plan reviews consists of pedestrian facilities and pedestrian access to specific areas.

#### **1. Site plans**

Individual site plan reviews are conducted with members of the Planning, Design and Programming (PDP) and Traffic Operations Divisions on a weekly basis. During these drawing reviews, pedestrian safety issues are addressed on site specific roadway development projects.

#### **2. Community developments**

Larger development plans are reviewed during the same meetings and during ad hoc meetings between members of Development Services Department (DSD) and both PDP and Traffic Operations. These meetings also address potential pedestrian access issues on a larger scale and often include large subdivisions and larger commercial complexes.

## **V. Analysis**

Data generated by the above activities is continuously analyzed by city staff with the intent of determining if crash patterns exist and what if any remedial action may reduce crash incidence at specific locations. Pedestrian data is usually combined with planning data including aerial photographs, maps, site plans and general knowledge of the surrounding area of interest. Typically, analysis is carried out manually by technicians and engineers from the Street Department who are looking for both crash patterns and possible remedial action.

Pedestrian crash pattern analysis looks for common types of pedestrian crashes and relative to specific locations. Factors that are examined include but are not limited to traffic direction and movements to determine if crashes are occurring in specific vehicle travel lanes or during specific vehicle movements such as right or left turns or driveway exits. Time of day and season are examined to determine if patterns arise under certain lighting conditions such as sun rise or sun set. Physical locations are examined to determine if crashes are occurring at specific pedestrian crossing points such as convenience store exits or park entrances. Pedestrian ages are examined relative to school traffic and pedestrian and driver physical conditions are examined relative to alcohol, drug use or other commonly observed physical impediment.

Analysis of field observations, pedestrian traffic patterns, crash data or citizen complaints does not necessarily either indicate the presence of a crash pattern or concern nor does it indicate that effective solutions are available or feasible.

## VI. Solutions

If an analysis of pedestrian data determines that crash patterns or other safety concerns exist, analysts then look for modifications in either infrastructure (engineering) or behavior (education, enforcement or encouragement) that are likely to have a beneficial impact on pedestrian safety, the following types of changes as well as others may be considered:

### ***A. Engineering Solutions***

#### **Walking along the road crashes**

##### **Rural environments (within Phoenix City Limits):**

Paved shoulders provide room for pedestrians to walk away from traffic; they also provide room for bicyclists and increase safety for motor vehicle operators. To be effective paved shoulders should be 6' wide or more; 4' is considered the minimum acceptable width.

Phoenix provides paved or graded shoulders along major roadways in rural areas of town where possible and appropriate.

##### **Urban and suburban environments:**

Sidewalks reduce walk-along-the-road crashes by providing positive separation from traffic. Continuous and connected sidewalks are needed along both sides of streets to prevent unnecessary street crossings. Sidewalks should be buffered with a planter strip to increase pedestrian safety and comfort; separation makes it easier to meet ADA requirements for a continuous level passage and for a clear passage around obstacles.

Phoenix provides sidewalks along both sides of arterial streets where and when possible and requires new development along collector streets to provide sidewalks where practical. Phoenix also funds sidewalk construction through street modernization programs where neighborhood support is present.

#### **Driveways:**

Access points clearly mark the area where drivers will be crossing the pedestrian's path. Continuous access to parking creates long conflict areas between pedestrians and drivers; this ambiguity complicates the driver's task of watching for pedestrians.

Where possible, Phoenix ensures that access points are limited and well defined and that visibility for both drivers and pedestrians is adequate.

Driveway Design should be made to look like driveways, not street intersections. Sidewalks should continue through the driveway, the level of the sidewalk should be maintained, and the driveway should be sloped so that the driver goes up and over the sidewalk. Driveways should be away from intersections. The number and width of driveways should be minimized.

Phoenix requires driveways on all new or newly redeveloped construction projects to be located a minimum of XXX feet away from intersections and where possible, requires that they be designed to look like driveways, not intersections.

#### **Illumination:**

Illumination greatly increases the driver's ability to see pedestrians walking along the road at night. Double-sided lighting illuminates both sidewalks for increased pedestrian safety.

Phoenix requires double-sided street lighting along arterial streets and along other roadways with high night-time pedestrian activity or where safety concerns exist.

#### **Crossing the road crashes**

Pedestrian crossing islands reduce crashes substantially at uncontrolled locations, especially on busy multi-lane streets where gaps are difficult to find. An island breaks an otherwise complex crossing maneuver into two easier steps: a pedestrian looks left, finds an acceptable gap in one direction, crosses to the island, then looks right and finds a second gap. Islands also have the affect of lowering traffic speeds by optically narrowing the street with curb and fencing in the center turn lane.



Phoenix installs pedestrian crossing islands on arterial streets at mid-block locations where heavy pedestrian traffic patterns dictate and where vehicular traffic volume makes pedestrian crossing difficult. Islands are installed they do not adversely affect established businesses or property owners on either side of the street.

Curb extensions reduce the total crossing distance on streets with on-street parking and increase visibility. Waiting pedestrian can better see approaching traffic and drivers can better see pedestrians who are waiting to cross the road, because their view is no longer blocked by parked cars. Similarly, approaching drivers can better see pedestrians preparing to cross prior to the pedestrian entering the street. Curb extensions also help slow traffic by narrowing the street.

Phoenix allows and encourages curb extensions on new construction but does not routinely install or retrofit extensions on existing intersections. Instead, Phoenix discourages or prohibits on-street parking on most arterial streets and on collector streets near intersections.

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Illumination greatly increases the driver's ability to see pedestrians crossing the road. Increased lighting should be provided at the primary crossing points. Double-sided high intensity, lighting should be provided along wide arterial streets; this enables drivers to see pedestrians along the road, who may decide to cross anywhere, anytime.

Phoenix provides double-sided lighting on all signalized intersections with high pressure sodium (HPS) street lights on all four corners of the intersection. In addition, where possible, Phoenix provides double-sided lighting is provided near mid-block pedestrian islands and in other areas of higher than normal pedestrian crossing activity.

### **Popular Crossing Countermeasures & how to improve them**

The public often responds to a tragic pedestrian crash with a call for an immediate solution. Commonly requested solutions include speed humps, traffic signals, pedestrian bridges or tunnels, flashers or marked crosswalks. While these can be effective solutions in certain places, in some instances they are not appropriate or effective.

#### **Speed Humps:**

Speed humps are asphalt mounds typically placed perpendicular to traffic across the entire width of local streets. Their primary purpose is to slow neighborhood traffic and discourage cut-through traffic. Speed humps require vertical curbing and standard center crown road profile. They also cannot be installed in locations that will create or exacerbate drainage problems. The primary drawback to speed humps is that they require all traffic including emergency vehicles to slow which increases response times and decreases effectiveness. As a result City of Phoenix policy is to install speed humps only on local streets and only with neighborhood participation.

The City of Phoenix will install speed humps where appropriate traffic conditions and neighborhood support exist. The Neighborhood Traffic Management Team (NTMT) is responsible for oversight of the neighborhood coordination and installation of the speed humps.

### **Traffic Signals:**

The primary purpose of a traffic signal is to create gaps in traffic that otherwise would be hard to find. The MUTCD warns against the overuse of signals for a variety of reasons. Inappropriate traffic signals may increase crashes and in fact in 2004, nearly 25% of all pedestrians involved in crashes were struck at intersections controlled by traffic signals. Traffic signals are expensive, from \$80,000 to \$120,000 for one intersection, not including any associated road widening or complex construction requirements.

The Phoenix experience with traffic signals reflects these same issues however, in some rare instances; the only solution to crossing a busy, multi-lane arterial street is to install a pedestrian crossing signal. This is especially true in locations where there is no other signal for a quarter of a mile or more in an area with lots of pedestrian activity.

Since it's difficult to meet MUTCD traffic signal warrants for a pedestrian signal based solely on existing pedestrian counts and since Phoenix does not use anticipated counts of how many pedestrians might cross once a signal is installed, Phoenix prefers to use two-stage crosswalk islands where these conditions exist.

### **Pedestrian Bridge or Pedestrian Undercrossing**

#### **Bridge or overpass:**

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In certain instances, Phoenix installs pedestrian bridges in an attempt to completely separate pedestrians from vehicle traffic. While pedestrians using the bridges are separated from traffic, several problems exist with these structures that make them less than effective.

The primary short coming with pedestrian bridges is the design considerations necessary to build them. Due to the need for complete accessibility, all such structures must be wheelchair accessible which requires a ramp of standard pitch. Due to the height above traffic (usually 20') this requires a ramp of roughly 12:1 or 288' which necessitates a large ramp foot-print on both sides of the street. This need for an extensive ramp system limits where bridges can be installed and significantly impacts the cost of installing such bridges. Additional design considerations include overhead utilities, visibility obstructions and the stability of the pedestrian traffic patterns.

Even if room exists to install a bridge and no other design considerations preclude installation bridges may not be a good solution. The out-of-distance travel required by long ramps is so inconvenient many pedestrians will refuse to walk this extra distance

and instead cross at-grade which pedestrians crossing at grade where drivers may not expect or see them.

If pedestrian bridges or overpasses are to be considered, they must be installed on heavy, stable pedestrian travel paths across unsignalized sections of high volume roadway (ADT > 25,000 vehicles/day). There must also be a local commitment to use the bridge and a coordinated educational campaign advertising the need for use of the bridge. The final requirement is that funding must be secured for design and construction. Pedestrian bridges are one of the most expensive remedial measures available for consideration.

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### **Undercrossing:**

Many of the issues affecting choice of a pedestrian bridge also affect the consideration of a pedestrian underpass. The one issue unique to an undercrossing is the fact that due to limited visibility, undercrossings are often prone to security problems which make them harder to patrol and tend to reduce the public willingness to use them especially at night when they would provide the best protection to pedestrians.

Under certain circumstances, the City of Phoenix installs both pedestrian bridges and pedestrian undercrossings however, the design conditions and security concerns expressed above make them an option of last choice in most instances.

### **Marked Crosswalks Alone**

Marked crosswalks should only be installed where there is an expectation of a significant number of pedestrians such as near a school, park or other generator. Without the associated features mentioned so far (islands, curb extensions, illumination etc.), marked crosswalks on their own do not necessarily increase the security of a pedestrian crossing the street.

Research has indicated that in general, pedestrians are just as vigilant in marked crosswalks as unmarked however, looking behavior for pedestrians in marked crosswalks increased significantly after crosswalks installed. While this is encouraging information, this same research also found that marked crosswalks have no significant crash reduction on two-lane roads or on multi-lane roads (3 or more lanes) with less than 12,000 ADT. On multi-lane roads with more than 12,000 ADT and no medians or multi-lane road with more than 15,000 ADT and medians, crashes actually increased in marked crosswalks versus unmarked. See Appendix D for the complete study results.

City of Phoenix does install marked crosswalks at unsignalized locations however engineering judgment, crash data and field observations are used for deciding on where or whether to install such crosswalks. When considered, marked crosswalks will be installed at non-signalized crossings where it is believed that such a marked crosswalk will consolidate multiple common crossing points into one area. Also, in order to be considered, there must be a reasonable expectation that a single marked crosswalk will

help clarify where pedestrian should cross, thus assisting both pedestrians and drivers. Finally and perhaps most importantly, there must be a stable and substantial pedestrian route in the area (>30 pedestrians per hour) in order for a marked crosswalk to be considered at an unsignalized location. See Appendix B for the specific requirements on where crosswalks are justified and who field measurements are taken.

### **Textured and/or Colored Crosswalks**

Marked crosswalks that are installed are designed for maximum visibility and contrast on roadway pavement both day and night. Techniques such as textured and/or colored crosswalks are another popular request. In reality, they are less visible to drivers than white marked crosswalks, may create maintenance problems, and are difficult for pedestrians with disabilities to negotiate.

Phoenix does not install textured crosswalks. When marked crosswalks are installed, Phoenix per the crosswalk policy (Appendix B) they are painted using high contrast, high visibility white (standard) or yellow (school zone) paint. In addition to paint, there are a number of other tools Phoenix uses to improve the visibility of crosswalks to both pedestrians and drivers. These tools include advanced warning signs, street lighting, advanced STOP bars as well as other techniques.

### **Improving Marked Crosswalks:**

1. Crosswalks with advance stop bar (or yield line) help prevent “multiple-threat” crashes on multi-lane streets. STOP bars help limit blind spots created when a driver in one lane stops to let a pedestrian cross, but does so too close to the crosswalk so as to mask a driver in the adjacent lane who is not slowing down; the 2<sup>nd</sup> driver does not have time to react and the pedestrian is struck at high speed. The advance stop bar (or yield line) requires the 1<sup>st</sup> driver to stop back 30 feet (+/-) so the pedestrian can see if a driver in the 2<sup>nd</sup> lane is not stopping. This enables the pedestrian to wait, or even pull back if he has started to proceed into the 2<sup>nd</sup> lane. It also allows that much more reaction time for drives in the second lane.

Where possible, Phoenix installs advance STOP bars at crosswalks both at intersection and mid-block locations. Phoenix installs STOP bars a minimum of 30 feet from the near-side crosswalk line. When STOP bars are installed at mid-block locations Phoenix usually removes all lane divider markings from the road between the STOP bar and the crosswalk. This gives the optical impression that the driver is approaching an intersection rather than a mid-block crossing.

2. Proper signing increases the driver’s awareness of a pedestrian crossing. Where possible, Phoenix will install advance warning signs, advance STOP signs and overhead warning signs. As with all signage, Phoenix is sensitive to sign over use and the related phenomenon of driver overload. As a result, Phoenix installs as many signs as necessary but as few as possible. This being said, Phoenix will install advanced

warning signs designating pedestrian crossing locations where possible and also where the mounting of such signs will not adversely impact driver work load or create visibility problems.

3. Illumination increases the driver's ability to see pedestrians crossing the road. Phoenix mounts high-wattage, high pressure sodium (HPS) streets on all four corners of all signalized intersections and where possible on both landings of any mid-block crosswalks. On mid-block crossings at high traffic volume streets, Phoenix also attempts to place at least two street lights one on either side of the crosswalk landing on both sides of the street.

### **Experimental Roadway Enhancements**

Occasionally, Phoenix will experiment with new products or techniques that may offer improved visibility or better advanced warning of approaching crosswalks however, these experimental applications are usually limited in scope and duration. Eventual wide scale use of any new product is dependent on several factors including the results of field studies in Phoenix, general industry acceptance, cost effectiveness and engineering judgment.

### **Intersection Geometry**

Intersection geometry has a profound effect on pedestrian safety as it determines to a large extent whether or not drivers will perceive pedestrians, the length of crosswalks, and the speed of approaching and turning vehicles.

The City of Phoenix does not have a specific intersection design policy geared towards pedestrian accessibility however; the City does follow appropriate and well recognized AASHTO, ADA and MUTCD design standards for all street design projects. Where appropriate and possible, the city also encourages use of the following design tools to assist in pedestrian mobility:

1. Tighter corner radii. Smaller (tighter) corner radii benefit pedestrians by shortening the crossing distance, bringing crosswalks closer to the intersection, increasing visibility of pedestrians, and slowing right-turning vehicles. They also force right turning traffic to slow more completely prior to entering the turn thus further protecting pedestrians crossing in front of turning traffic. The appropriate radius must be calculated for each corner of an intersection; difficult turns for the occasional event are acceptable (for example a large moving truck turning onto a local street).

Phoenix encourages developers and city staff to design intersection corners with tight radii where merging traffic conditions do not make such radii dangerous to right turning traffic. Intersection radii are dependent on intersecting street classifications and cross-sections. Phoenix does not typically modify existing radii at developed locations unless the site is being redevelopment.

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2. Pork-chop islands. Raised pedestrian or traffic channel islands between an exclusive right-turn lane and through lanes shorten the crossing distance, reduce pedestrian exposure and improve signal timing. Such islands enable pedestrians and drivers to negotiate one conflict separately from the others. These islands usually have the longer tail pointing upstream to the approaching right-turn driver; so drivers approach at close to 90° and are looking at the crosswalk. This type of layout also necessitates drivers slowing more completely prior to entering traffic. The crosswalk is placed one car length back from the intersecting street so the driver can move forward once the pedestrian conflict has been resolved. The right-turning driver can focus on traffic and the pedestrian can focus on cross or through traffic. Phoenix requires pork-chop islands where appropriate and reviews the designs of such islands to ensure that they regulate both vehicular and pedestrian traffic. Phoenix does not typically retrofit islands in existing locations unless general redevelopment is being considered.

3. Median islands. Raised median islands have several key benefits for pedestrian safety. Primarily, medians channelize and slow down left-turning vehicles thus significantly reducing or completely eliminating the potential threat that left turning traffic poses to crossing pedestrians. Islands also provide a refuge for pedestrians crossing wide, unsignalized portions of roadway at mid-block locations or large signalized intersections when crossing the entire street in one light cycle is not feasible. Where possible, Phoenix installs or encourages developer installation of median islands especially on high speed, high volume, limited access surface streets. Phoenix must balance the desire for median islands against the requirement for left turn access by local businesses. Where restrictions exist or where full medians are not feasible, partial medians, shadow islands or pedestrian safety islands are often considered as an alternative.

4. Proper Crosswalk & curb ramp placement and design. To ensure that all users cross in crosswalks, close to the intersection, where drivers can see them, and without undue delay. Ramps (wings not included) must be wholly contained within the marked crosswalk. Poorly placed or oriented ramps force wheelchair users to make long detours and they may not cross in the allotted time at a signalized intersection; they may be crossing outside the crosswalk lines where drivers don't expect them. The City of Phoenix routinely provides separate wheelchair ramps for each leg of each marked crosswalk and provides curb ramps at intersections where no marked crosswalk exists. In addition, the City has an ongoing ramp retrofit plan that installs new ramps at existing marked or unmarked crossings. The City also has an inspection program for all wheelchair ramps and other ADA facilities and schedules repair or replacement as needed on a continual basis.

### **Signalized intersections**

Signalized intersections where pedestrians are reasonably expected to cross need accommodations for pedestrians. Phoenix policy is to make signalized intersections with known pedestrian traffic as accessible as possible to all pedestrians.

Signal Design Considerations. There are currently no retrofit programs to add these features to existing signalized intersections however, on all new intersections that are expected to support pedestrian activity, pedestrian signals, actuation buttons and marked crosswalks. Phoenix traffic signal technicians periodically inspect all traffic signals and report any damaged or disabled pedestrian signal features.

1. Pedestrian signal indications. To ensure pedestrians know when the signal phasing allows them to cross, and when they should not be crossing pedestrian signals are added to all new or rebuilt signalized intersections. At many traffic signals close to schools or downtown, special pedestrian countdown signal heads are used to notify pedestrians of how much time is remaining in the signal. On one-way streets a pedestrian approaching from the opposite direction cannot see the vehicle signal heads and may not realize an intersection is signalized, nor know when it is safe to cross. Left turn arrows are generally not visible to the pedestrian.
2. Marked crosswalks. As outlined previously, Phoenix installs marked crosswalks at signalized intersections to indicate to the driver where to expect pedestrians and help keep the crossing area clear of vehicles. They also inform the pedestrian as to where to cross the street. All legs of a signalized intersection are be marked.
3. Push buttons. Most arterial/arterial intersections in Phoenix run on an automatic 90 second cycle. Most of these intersections have pedestrian signals but the automatic time eliminates the requirement for pedestrian activated push buttons. Push buttons are used at all loop controlled signalized intersections such as intersections of collector or local streets with arterial or collector streets. Phoenix ensures that all new loop controlled traffic signals have pedestrian push buttons. Wherever physically possible, Phoenix also ensures that push button access and design correspond to current ADA requirements.
4. Pedestrian Signal Timing. Phoenix recognizes the need for traffic signal timing that balances the need for pedestrian as well as vehicular traffic. Signals must be long enough for pedestrian traffic to clear the intersection but not so long that pedestrian actuated signals especially those at collector or local intersections with arterial streets unnecessarily delay through traffic flow. Such delays may result in increased risk taking behavior by motorists such as red light running or speeding, both of which may endanger pedestrians as well as drivers.

To balance out the conflicting demands for cycle time, Phoenix generally relies on pedestrian actuation signals for minor street signal activation across arterial streets. Once activated, the signal through movement is

calculated based on the arterial cross-sectional length and an assumed walking speed of 4 ft. /sec. from curb to curb. This timing allows pedestrians to cross completely out of the traffic lane prior to the yellow and all-way red clearance intervals.

Signal timing techniques. As a compliment to signal design features, the City of Phoenix evaluates each intersection signal plan to reduce the incidence of crashes that occur while the pedestrian are crossing with the WALK signal include. Some of the techniques used include protected left turn phasing and right turn on red restrictions.

1. Protected Left-turn Phases. Under certain conditions Phoenix allows installs protected phasing for left turning traffic. In all cases such movements accommodate dual left turn lanes. Because such phasing reduces the amount of time available for through traffic, they are installed infrequently and only where field observations, crash history and engineering judgment predicts that the benefit of exclusive left-turn only phasing will benefit traffic.

While this type of phasing eliminates a potential conflict with pedestrian traffic, this benefit by itself is not generally used to justify installation of protected left turn phasing.

2. Right-turn on Red Restrictions. At certain location with high pedestrian traffic and conflicting right turn traffic volume, right turn on red restrictions may help reduce conflicts. An unfortunate

#### **Other techniques to create a better pedestrian environment**

Road diets: Reducing the number of travel lanes a pedestrian has to cross can be beneficial to all users. A well-documented technique takes a 4-lane undivided street (2 lanes in each direction) and reconfigures it to 2 travel lanes, a center-turn lane and 2 bike lanes, edge lines or parking lanes (without changing the curb lines). The benefits for pedestrians include fewer lanes to cross and slower traffic speeds. The center-turn lane also creates space for pedestrian crossing islands. The bike and parking lanes add a buffer for pedestrians as well. Variations include reducing a multi-lane one-way street by one lane; narrowing the travel lanes to slow traffic and create space for bike lanes; or moving the curbs in to narrow the roadway.

Phoenix makes extensive use of road diets where appropriate, especially on collector streets where speed humps or other local street traffic calming measures are not permitted. Where bike lanes are added, parking is restricted which requires petitioning of the front facing homes that are affected. Edgelines or parking lanes generally do not require petitioning but do require notification and usually some form of official request by area residents or home owners.

Arterial Street Design: High speeds make it harder to avoid a crash, and increase the severity of a crash or the likelihood of a fatality. Speed reduction can be used as a tool



in reducing pedestrian crashes. Simply lowering speed limits is usually ineffective. Streets must be redesigned to encourage lower speeds.

Phoenix generally sets speed limits on arterial street based on several factors including, traffic volume, average vehicular speeds and pedestrian activity in the area. Speed limits are periodically evaluated and where conflicts exist, changing speed limits is considered. When speed limits are changed, Phoenix is conscious of the affect such changes are likely to have on traffic patterns. Phoenix also typically lowers speed limits at locations that are logical such as transition points between two different speed limits. Phoenix will not lower speed limits on very short stretches of roadway just to raise the speed back up again once vehicles clear the short stretch of slow speed limit.

Residential Street Design: Residential streets built in the last few decades are often wide and barren, encouraging speeds higher than appropriate for streets where children can be expected. Good residential street designs are narrow and have on-street parking, tight curb radii, short block length, buffered sidewalks with street trees, short building setbacks, and streetlights.

Phoenix does not typically build residential streets however, where practical, Phoenix attempts to encourage pedestrian friendly residential street design by developers and contractor teams.

Traffic Calming. Engineering solutions to neighborhood traffic speed and cut through volume also have a positive affect on pedestrian safety. Although not specifically used to enhance pedestrian safety traffic calming techniques generally improve road safety for pedestrians by reducing both speed and volume of neighborhood traffic. One side-effect of traffic calming is that engineering solutions generally require all vehicles including emergency response (police, fire and ambulance) to slow or find alternative routes. A second and sometimes unintended consequence of such efforts sometimes means that traffic restricted in one neighborhood simply finds a path through nearby neighborhoods without traffic calming infrastructure in place.

Recognizing these positive and negative aspects of traffic calming, the City of Phoenix allows extensive forms of calming on local streets and more limited forms on collector streets. The types and traffic conditions required for traffic calming are determined by the City of Phoenix Neighborhood Traffic Management Team (NTMT) which is responsible for investigation of traffic conditions and the coordination of any mitigation measures that result from such investigations. Such programs are developed in conjunction with neighborhoods and require both petitioning and some form of neighborhood support (financial or otherwise).

1. Local Streets. Speed humps, speed tables, diverters (semi- and diagonal), road closures, new signage and striping and neighborhood speed watch programs are used to help slow traffic on local streets inside neighborhoods.

2. Collector Streets. New signage and striping, chicanes and traffic circles are used on Phoenix collector streets.
3. Arterial Streets. No traffic calming measures are utilized on Phoenix arterial streets.

### **Miscellaneous Road Improvements**

In addition to the more modest improvements that are considered in addressing pedestrian safety, Phoenix also considers the following measures when evaluating specific new or existing road conditions:

Visibility Obstruction Removal: Phoenix continually looks for and removes obstruction to visibility from vegetation that either obscure traffic control devices or block pedestrian and driver visibility.

### **Transit-related crashes**

Many crashes involve a pedestrian crossing the street to access transit. All street-crossing techniques are applicable to transit stops. The local transit authority, Valley Metro and the City of Phoenix Street Department make every effort to ensure that all transit stops are accessible to all pedestrians. Phoenix recognizes this and takes appropriate steps to mitigate transit passenger/pedestrian risks.

All stops consider the safety of the pedestrian crossing. Phoenix does not necessarily install marked crosswalks at each stop location however; Phoenix makes every effort to locate most transit stops where it is possible for a pedestrian to cross safely at or very near the stop. Where mid-block transit stops are necessary due to pedestrian demand, every attempt is made to limit pedestrian exposure to traffic.

Provide a safe place to stand and wait. Phoenix recognizes that transit stops with a lack of space push people out into the roadway. As such, where possible, Phoenix makes every effort to provide a formal bus shelter or passenger standing pad at transit and school bus stops regardless of the presence of connecting sidewalks or other pedestrian infrastructure.

Transit stops connected to pedestrian infrastructure. All transit trips begin and end with a pedestrian trip; therefore Phoenix makes every effort to provide either contiguous sidewalk or paved shoulders to safely guide pedestrians from point of origin to transit stops.

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Street and/or shelter lighting provided at or near all bus stop locations. Phoenix attempts to provide adequate street and shelter lighting at all transit stops that are served during hours of darkness. This policy helps with both pedestrian safety and security.

Valley Metro and the City of Phoenix Public Transit Department also periodically review all its stop locations to facilitate access and crossing. Techniques include:

1. Eliminating transit stops in areas that are hard to cross
2. Consolidating closely-space stops to limit the number of crossings and improve transit efficiency as the buses stop less often
3. Moving stops to a location where it is easier to cross. In general, far-side locations are preferred for pedestrian safety, as pedestrians cross behind the bus, and the bus can leave without having to wait for pedestrians to cross. However, there are locations where a nearside stop is safer for operational reasons.
4. Placing crosswalks (where warranted) behind the bus stop at mid-block locations so pedestrians cross behind the bus, where they can see oncoming traffic; it also enables the bus driver to pull away without endangering pedestrians.

Valley Metro and City of Phoenix Public Transit Department also have their concerns:

1. Bus stops should be easily accessible: a stop should not be moved to a far side location if this location requires a lot of out-of-direction travel for users.
2. Bus stops should be located where the driver can easily stop and move back into traffic again.
3. Bus stops need to be located where passengers with disabilities can board the bus.

## **Planning Solutions**

### **Land Use and Site Design**

Land use patterns impact pedestrian crashes. Pedestrian crash severity is higher in suburban, auto-oriented locations where speeds are faster and drivers don't expect pedestrians. Pedestrian crashes are less severe in established, traditional urban areas where drivers are more aware of pedestrians and where vehicles speeds tend to be lower. Sample land use and site design techniques that can encourage more walking and help manage speed and therefore affect crash rates include:

Buildings that define streets such as those located at the back of the sidewalk give the driver sense of enclosure; buildings set back with large parking lots in front create wide high-speed roads.

Mixed-use development buildings with retail on the bottom and housing on the top encourage pedestrian activity.

Street connectivity encourages walking because of the reduced travel distance to reach destinations (cul-de-sacs without connector paths reduce pedestrian connectivity).

Parking should not be placed between the sidewalk and buildings; on-street parking is a very effective way to slow traffic and encourage pedestrian-oriented development. The

principles of access management should be extended to parking: single lots serving multiple stores are preferred over single stores each with its own parking and driveway.

Phoenix currently has no city codes designed specifically to encourage pedestrian traffic to the exclusion of vehicular traffic. Phoenix does encourage mixed use street and business development. This includes recommendations for adding sidewalks, bike lanes and connectivity between new and existing developments.

## ***B. Educational Solutions***

In addition to engineering solutions, the City of Phoenix also pursues educational and enforcement solutions to help solve pedestrian safety issues. Educational solutions generally concentrate on schools and neighborhood or community organizations with active participation.

### **Schools**

Safe Routes to School. The School Traffic Safety Team within the Phoenix Street actively assists public and private schools within the city who are interested in establishing safe walking plans for students walking or biking to the school. Members of the team work with parents and teachers from interested schools to establish walking routes for students that generally allow the students to travel to school along residential streets.

These safe routes to school plans generally limit the need for street crossing or channel such crossings to intersections controlled by crossing guards. Once developed the walking plan routes are then distributed to parents and students who live inside the walking boundaries of the school. The plans are periodically evaluated for changes and updated as necessary.

International Walk to School Day. The City of Phoenix Street, Fire and Police Departments also work with community schools on the annual International Walk to School Day which typically occurs in the fall. During the staged events, the City provides schools with safe walking and bicycling techniques and reinforces lessons learned on safe walking through out the year.

The School Traffic Safety Team from the Phoenix Street Department coordinates these events which are usually held at two schools in Phoenix each year.

School Safety Audit. The Phoenix Street Department also provides School Safety Audits for both new and existing schools to help control both vehicular and pedestrian traffic at arrival and dismissal times. Such plans generally require extensive input from the individual school or school board and rely on school officials to enforce.

The School Traffic Safety Team also conducts these audits. Schools interested in assistance contact the team and establish a traffic team similar to those established for

safe route plans. Traffic patterns in and around the school are examined and plans to minimize conflicts between vehicles and pedestrians as well as vehicles with other traffic are developed. These plans often involve signage or striping changes to the school parking lot, driveways and related public streets.

Each year, members of the team conduct inspections of the school grounds for updates, repair or replacement of any damaged, missing or faded signage and striping. Where requested they also review existing traffic control plans for continued relevancy.

### **Community**

Safe Walking Plan. If requested by neighborhoods or community organizations, the City of Phoenix Street Department will also help establish safe walking routes to pedestrian traffic attractors such as shopping areas, parks or other points of interest. Such plans are similar to safe routes to school plans developed by the Street Department and require both initial interest from citizen groups and continued input during the process.

Pedestrian Safety Classes. A final area of educational input is in pedestrian safety classes that the City of Phoenix Police and Street Departments occasionally hold for interested neighborhood or citizen groups. Such classes are usually held at the request of a citizen group in response to real or perceived problems with pedestrian crashes. They generally involve a discussion of pedestrian crash statistics followed by a review of safe walking or bicycling tips. Depending on the level of interest, such classes may result in additional safety audits, walking plans or other educational or engineering review of conditions in the neighborhood.

## ***C. Enforcement Solutions***

### **Pedestrians & Drivers**

The final component of the pedestrian safety solutions is enforcement of pedestrian safety regulations. Most of this effort is directed against motor vehicle operators. Police continually conduct routine and special enforcement of traffic regulations that benefit pedestrian safety. Occasionally Phoenix Police will conduct pedestrian jay-walking enforcement in specific areas based on either pedestrian crash history or observations of pedestrian behavior.

## **VI. Funding**

In an effort to continually improve pedestrian safety on Phoenix streets, the City of Phoenix funds pedestrian projects using a mixture of Departmental, Governmental and private funding paths.

### **Governmental**

Governmental funding is supplied by all three branches of government, local, state and federal.

City of Phoenix Funding This includes money from tax and bond programs that the city uses to upgrade pedestrian facilities. Specific programs the City funds with this money are street modernization programs and emergency sidewalk installation programs.

1. Street modernization. With this program the city typically funds the improvement of collector streets which generally means widening of the street and installation of sidewalks. Streets to be upgraded are identified and petitioned by neighborhood leaders and once petitioned, they are added to a running list of location. Limited availability of funds typically means that once on the list projects take 3-5 years to schedule.
2. Sidewalk installation. Limited funds are available each year for small segment sidewalk installation. These funds are typically used to install wheelchair ramps or to connect otherwise discontinuous segments of sidewalk.
3. Neighborhood Traffic Management Team. The NTMT has an annual budget for speed humps, traffic circles and other traffic mitigation projects that are used to slow or reduce vehicle traffic and thus directly or indirectly benefit pedestrian safety.
4. Other roadway improvements. Additional improvements are sometimes made to pedestrian facilities through development of arterial and collector streets, traffic signal installation, road re-striping or other normal city street improvement processes.

County/State/Federal Additional funding for specific pedestrian safety projects is available through other governmental agencies.

1. Maricopa Association of Governments (MAG) – occasionally makes funds available for projects within the county that benefit Phoenix.
2. Governors Office of Highway Safety (GOHS) – Federal funding for educational and enforcement campaigns is made available through GOHS on an annual basis.
3. Highway Enhancements for Safety (HES) – Federal funding for infrastructure improvement projects is made available through the Arizona Department of Transportation (ADOT) on a continual basis. Many of these projects include improvements to pedestrian facilities at high crash locations through out the city.

#### Private

The final and most overlooked source of funds for pedestrian safety projects is generated by continual private development of residential pockets throughout the city and county islands. Private development pays for most of the sidewalk construction in Phoenix and paves most of the local streets where residential homes are located.

## **V. Conclusion**

Phoenix is continually striving to improve the pedestrian safety. It is the intent of the pedestrian safety action plan to establish concrete and measurable goals on both towards this end. The document once approved will be reviewed and updated periodically to ensure that the information contained within it reflects both the goals for pedestrian safety and the techniques available for achieving these goals.

## Appendix A. 2006 Pedestrian Crash Summary Report

<http://phoenix.gov/STREETS/2006ped.pdf>


### 2006 Pedestrian Collision Summary


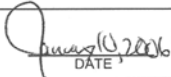


City of Phoenix  
Street Transportation Department



## Appendix B. Street Department Crosswalk Policy

CROSSWALK MARKINGS		M
January 16, 2006 DATE	 DEPUTY STREET TRANSPORTATION DIRECTOR	
<p><u>PURPOSE</u></p> <p>To channelize pedestrians by encouraging "consolidation" of multiple pedestrian crossing locations to a single location, thus increasing driver expectancy and to offer guidance to pedestrians as to the best crossing location.</p> <p><u>BACKGROUND</u></p> <p>Arizona Revised Statutes, Article 10, Sections 28-791 through 797, make it clear that crosswalks exist at all intersections regardless of whether or not markings are used to delineate them. In addition, A.R.S. 28-793 specifically allows for crosswalks to be added away from intersections where engineering judgment indicates it is in the best interest of traffic safety to so do. Currently, there are approximately 40,000 intersections within Phoenix meaning that approximately 160,000 intersection crosswalks exist (legally). As for marked crosswalks, as of December 2005, Phoenix has:</p> <ul style="list-style-type: none"><li>• 3555 signalized marked crosswalks;</li><li>• 1736 unsignalized marked crosswalks</li></ul> <p>Of the unsignalized marked crosswalks, 94 are the ladder design, and 415 are yellow marked crosswalks for 15 mph school zones.</p> <p>At one time engineers "assumed" that thin painted crosswalk lines somehow provided an additional safety measure to alert drivers that pedestrians may be crossing streets. Many citizens still believe this to be true. Additionally, many citizens think that marking crosswalks is done simply as another public service, such as providing water, city parks, or swimming pools. Those beliefs are understandable under the misconception that "something is better than nothing." However, those beliefs have been found to be wrong. During the early 1970's the City of San Diego became concerned with their pedestrian crash statistics and conducted some "breakthrough" research with surprising results. San Diego's comprehensive analysis measured the safety impact of marked crosswalks by pedestrians. That study was extensive, encompassing 400 unsignalized intersections, each with one marked and one unmarked crosswalk and crash records were examined for over a five year period. Findings showed that:</p> <ul style="list-style-type: none"><li>• 177 pedestrian collisions took place at <u>marked</u> crosswalks and 31 pedestrian crashes at comparable <u>unmarked</u> crosswalks (a ratio of nearly 6 to 1).</li><li>• Pedestrian counts verified that usage of marked crosswalks was not surprisingly higher than unmarked crosswalks (nearly three times as many pedestrians used <u>marked</u> crosswalks as <u>unmarked</u> crosswalks). These numbers indicate that perhaps markings are useful in encouraging channelization (consolidation) of pedestrians.</li></ul>		
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<b>M</b>	<b>CROSSWALK MARKINGS</b>
 DEPUTY STREET TRANSPORTATION DIRECTOR	 DATE 6/15/2006
<ul style="list-style-type: none"><li>Combining the above information led to the conclusion that twice as many pedestrian crashes (per user) occurred at <u>marked</u> crosswalks than at <u>unmarked</u> crosswalks.</li></ul> <p>The Arizona Department of Transportation, City of Long Beach, California and many others have since conducted similar studies that echoed San Diego's findings. Evidence was found in Germany that the same findings apply to "zebra" type marked crosswalks.</p> <p>None of the above necessarily provides statistically meaningful evidence that marked crosswalks are more hazardous than unmarked crosswalks. Certainly though, these findings dispel claims that marked crosswalks offer any substantial value in preventing pedestrian collisions. In the end, San Diego's concluded that a highly disproportionate number of pedestrian collisions happen at crosswalks with the painted lines. San Diego also concluded that the most logical explanation for these results had to be that the painted lines somehow led to a change in pedestrian behavior (relaxing their guard).</p> <p>The City of Long Beach, California did a follow-up study at crosswalks that were not co-located at traffic signals, STOP signs, or YIELD signs. Their study was even more comprehensive than San Diego, looking at pedestrian/vehicle crash records over a 10-year period. All intersection pedestrian crashes were studied and all crosswalk locations (marked and unmarked) were inventoried. Their results were more pronounced in that even a higher percentage of pedestrian collisions (7.5 times more) took place at marked crosswalks than in unmarked crosswalks. Long Beach assumed the same basic pedestrian usage as San Diego measured, and the numbers show that pedestrians in their city using a marked crosswalk are 2.6 times more likely to be hit than if they were in an unmarked crosswalk. Based on these findings, the consultant recommended that Long Beach ONLY install marked crosswalks at locations not controlled by STOP signs or traffic signals IF engineering judgment indicated that doing so might consolidate the pedestrian crossings to a single point.</p> <p>Ten other known agencies with populations greater than 100,000 in Los Angeles and Orange Counties have since written a policy to remove unnecessary marked crosswalks at locations which are not accompanied by STOP signs or traffic signals. It is important to note that no cities felt their results were sufficiently profound that they rapidly remove unnecessary marked crosswalks, but rather they:</p> <ul style="list-style-type: none"><li>Scheduled removal during future roadway resurfacing projects; and</li><li>Installed new marked crosswalks only when they met or exceed the new criteria.</li></ul> <p>"Unnecessary" marked crosswalks were defined as those that fall below warranting conditions and contribute little to consolidating pedestrian crossings.</p>	
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<b>CROSSWALK MARKINGS</b>		<b>M</b>
<p><i>January 16, 2006</i> DATE</p>	<p><i>Janet Sparks</i> DEPUTY STREET TRANSPORTATION DIRECTOR</p>	
<p>The above studies and resultant policies did not include school related crosswalks, which are assessed differently in most communities. Additionally, each of the above studies was predicated on well-maintained crosswalks, meaning their results are not transferable to crosswalks that may have previously existed or may scarcely show through. Obviously, for pedestrians to be able to react to crosswalk markings, the crosswalk lines must be substantially noticeable by pedestrians. To be noticeable, crosswalk lines must be complete and dominant rather than only partially showing.</p> <p>Other similar evidence came from a survey sent out by the Seattle, Washington Traffic Engineering Department in 1986 to thirteen cities. Seattle solicited input into developing an effective pedestrian safety program. In doing so, they asked for was pedestrian collision rates. When compiled, the survey showed that those cities with fewer marked crosswalks generally experienced better pedestrian safety results.</p> <p>In 2001, a major FHWA study by the University of North Carolina was published which compared pedestrian crashes at marked and similar unmarked crosswalk locations in several cities across the country. The study took into account traffic volume and pedestrian usage. The results found that there was typically no difference in pedestrian safety if crosswalks were marked or not marked on two-lane roads or multilane roads with traffic up to 10,000 vehicles per day. On multi-lane roads with more than 10,000 vehicles per day (slightly more on streets with raised medians), locations with unmarked crosswalks yielded fewer pedestrian crashes than did similar locations where crosswalks were marked. These findings again reinforce the previous findings that painting the lines on busy streets provides no safety benefit, and may even be a disservice to the pedestrian. As with prior studies, the study excluded school crosswalks.</p> <p>Arizona law specifies that crosswalks are created either by marking them or by simply constructing an intersection. This includes "T" intersections as well as 4-leg intersections where four crosswalks exist. The legal implication of having a crosswalk (marked or unmarked), is simply that the crosswalk changes the <u>relative rights</u> between the pedestrian and the driver. If crosswalks (marked or unmarked) exist, motorists are obligated to yield to pedestrians. This essentially means drivers <b>MUST</b> pick suitable gaps between pedestrians. Conversely, when crosswalks do <u>not</u> exist (marked <u>or</u> unmarked), pedestrians are obligated to pick gaps between vehicles.</p> <p>Overall, the Arizona statutes work very well IF pedestrians and drivers both:</p> <ul style="list-style-type: none"> <li>• Accept and exercise their personal responsibilities to safely use the road; and</li> <li>• Are mutually considerate of one another.</li> </ul> <p>Most people believe it is jay-walking to cross streets at locations other than crosswalks (marked or unmarked). However, the term "jay-walking" is not even defined in Arizona law (or most other state's laws). That does not, however, mean that pedestrians cannot be cited for improperly crossing streets. There are at least four instances when pedestrians can be cited for improperly crossing streets including:</p>		
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### CROSSWALK MARKINGS

  
DEPUTY STREET TRANSPORTATION DIRECTOR

  
DATE

- When crossing between two adjacent intersections which are both equipped with traffic signals (often referred to as "jay-walking"). If signals don't exist at two consecutive intersections, crossing between intersections (where no marked crosswalk exists) is perfectly legal. However, in doing so the pedestrian accepts the burden of picking a suitable gap in vehicular traffic (rather than the reverse per ARS 28-793).
- At a traffic signal when crossing against the **DON'T WALK** (or upraised hand) signal, or starting to cross on a flashing **DON'T WALK** signal, which is part of the pedestrian "clearance time" (ARS 28-646).
- At a traffic signal when a pedestrian "loiters or unduly delays crossing" after traffic has stopped to give them right of way (ARS 28-646).
- Anywhere a pedestrian suddenly leaves a curb or place of safety and walks/runs into the path of a vehicle so close it is impossible for the driver to yield. (ARS 28-792).

Regardless, ARS 28-794 requires drivers to exercise due care to avoid colliding with any pedestrian on any roadway. This means that avoiding a collision is always a joint responsibility, even when pedestrians violate the law. Following a pedestrian collision, police generally assess fault to either the driver or the pedestrian. However, in the vast majority of cases when pedestrian collisions occur, there is joint fault. It is a key point to realize that most pedestrian collisions could have been avoided if either the driver OR the pedestrian had complied with basic laws designed to separate vehicles from pedestrians, followed by being prepared to take evasive action (which is also a law).

Crosswalks at traffic signals are also a national and local concern. Most signals in Phoenix have marked crosswalks across all legs to help highlight the signalized intersection (an objective implied in the MUTCD), and to discourage drivers from stopping in the crossing area for pedestrians. However, repetitive analyses of pedestrian safety records at signals shows a highly disproportionate number of crashes occur at signals. In Phoenix nearly 40% of our intersection pedestrian crashes occur at signals, yet only about 2% of our intersections are signalized. In Long Beach, the facts are even more pronounced with 53% of the pedestrian intersection crashes occurring at signals. From these assessments it is clear that the same phenomena regarding pedestrian attitude/behavior at marked crosswalks must also exist at traffic signals.

#### PROCEDURE

To mark crosswalks with painted lines requires expenditure of taxpayer money (both initially and for continued maintenance). Since doing so provides only limited benefit and in only certain circumstances, Phoenix began using fewer marked crosswalks in the 1980's. Since then, such crosswalks have been selectively reassessed, retaining only those where engineering judgment of Phoenix staff shows a marked crosswalk may:

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<b>CROSSWALK MARKINGS</b>		<b>M</b>
<p><i>June 16, 2006</i> DATE</p>	<p><i>Janet Smith</i> DEPUTY STREET TRANSPORTATION DIRECTOR</p>	
<ul style="list-style-type: none"> <li>• Help encourage pedestrians to cross at a single location, rather than randomly spread out. For definition purposes, pedestrian levels of about 25 per hour during the peak hours (crossing an arterial street) may be considered sufficient to consider a marked crosswalk. Fifteen elderly or disabled pedestrian crossings per hour during the peak hours may also be used to justify a crosswalk.</li> <li>• Clarify a better location for pedestrians to cross (i.e. at offset intersections where one of several alternate crossing locations might potentially be safer for pedestrians, or the crosswalk closest to a streetlight if a sizable number of crossings occur during hours of darkness.)</li> <li>• Help guide traffic where to stop to support another traffic control device such as a traffic signal. Doing so does not preclude the use of stop lines with crosswalks where desirable (see stop lines under the Marking section.)</li> <li>• Be needed to comply with ARS 27-797 (15 mph school zones) or where engineering judgment shows it may be helpful to support a school walking plan.</li> </ul> <p>The rationale behind both of the first two conditions is to consolidate pedestrians, hoping to raise driver expectancy of pedestrians crossing activity. While the MUTCD allows use of advance warning signs to try to increase driver awareness of infrequent crossings, research has shown that warning signs used to warn of intermittent conditions have yielded disappointing results. The best evidence of this is the almost non-existent driver reaction to "DEER CROSSING" warning signs. This poor reaction is natural, because drivers become conditioned to traveling through deer crossing areas without ever seeing deer. On the other hand, warning signs are substantially <u>more</u> effective when they provide notice of a 24-hour-a-day condition, such as a curve or a STOP sign. At a curve, warning signs have a more pronounced effect because drivers <b>know</b> they <u>will</u> encounter a curve (as opposed to a pedestrian warning sign where motorists <b>might</b> encounter a pedestrian).</p> <p>The MUTCD (Section 3B-15) states that crosswalk lines shall be at least 6 inches in width, and that crosswalks shall not be less than 6 feet wide. Based on the large "move-in" costs required to send crews to mark a crosswalk, Phoenix has found it helpful to use more than the minimum amount of marking material. Consequently, our paint crews (using paint or thermoplastic) put down 10-inch lines rather than 6-inch lines.</p> <p>Typically on major streets, the crosswalk line nearest the intersection is placed about half way through the curb return, with the other line approximately 15 feet preceding it (10 feet on collector or local streets). The primary goal of placing the first crosswalk line at the radius midpoint is to keep pedestrians out of the street parallel to their walking path.</p>		
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CROSSWALK MARKINGS

*James W. Smith*  
DEPUTY STREET TRANSPORTATION DIRECTOR

*January 10, 2006*  
DATE

Downtown where more pedestrian activity exists, crosswalks widths are sometimes increased to as much as 20 feet. Conversely, at intersections with limited visibility for motorists and where few pedestrians exist, Phoenix has found it helpful to reduce crosswalk width to about 10 feet and move the crosswalk closer to the intersection. Doing so pulls drivers to where they can see better from the stopped position (even though they remain obligated by law to yield again to approaching traffic before they enter the intersection). It is important that the crosswalk include the wheelchair ramp within the marked lines. If curb ramps do not exist, curb ramps should be added at the first opportunity that it becomes fiscally practical to do so.

The Phoenix criterion for ladder crosswalks is defined elsewhere, but ladder crosswalks are used judiciously and must be approved by the Deputy Street Transportation Director. Ladder crosswalks can also be approved in rare cases when emotional considerations are such that it is deemed less expensive to taxpayers to put in more material via a ladder crosswalk than to spend additional staff time explaining the research results regarding marked crosswalks. There's absolutely no evidence that proves "more paint is better" in terms of pedestrian safety. A study of "zebra" striped crossings in Germany found identical results to those ascertained in the San Diego study. There is no limit to how intensive crosswalk markings could be, as evidenced by our neighbor city (Glendale) which at one time tried painting crosswalks solid white. This was a non-standard practice, but more importantly from a driver standpoint offered no additional driver recognition. That having been said there are still unusual circumstances when engineering judgment may yield a decision to use crosswalk lines wider than 10 inches.

Section 36-134 of the City Code and State Law (ARS 28-873) prohibits parking within a crosswalk and within 20 feet of an intersection crosswalk (marked or unmarked). Usually, it is good practice to remove more parking in advance of mid-block crosswalks. In areas where there is heavy demand for parking near a crosswalk, it may be beneficial to prohibit parking with signs or paint the curbs red if a problem persists.

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## Appendix C. Pedestrian Safety Audit Procedures and Checklist

As part of the ongoing efforts by Phoenix to promote and improve pedestrian safety, Traffic Operations staff will perform Pedestrian Safety Audits on a periodic basis or as needed under special circumstances.

### PURPOSE:

Pedestrian Safety Audits are conducted to periodically review areas of town with high pedestrian crash experience and determine if crash patterns exist, and if so, what if anything can be done to improve conditions. The Traffic Safety Section is responsible for identifying the audit locations and coordinating the audits.

### PROCEDURE:

1. Periodically, the Traffic Safety Section will produce a list of the locations with a high number of pedestrian crashes over a given time period.
2. Once the list is complete, the Safety Section will obtain copies of all collision reports at each location and prepare a Pedestrian Safety Audit checklist and collision diagram for each location. The collision reports, checklist and diagrams will be verified by the Safety Section Lead before distribution to the Investigations Section Lead.
3. A Work Order will be issued for each audit location and the police reports/collision diagram will be provided to each appropriate traffic investigator by the Principal or appropriate Chief Engineering Technicians.
4. The area investigator will review each collision report and conduct a safety audit of the location checking for infrastructure repair or improvements to the location that might improve pedestrian service, accessibility, or safety. If a nighttime collision pattern exists, a nighttime check may be authorized to evaluate lighting and other nighttime conditions.
5. Once complete, the investigator will complete the Pedestrian Safety Audit checklist for each location and return the checklist and all other documents to an Investigative Lead for work order close out.
6. All documents will then be forwarded to the Safety Section Lead.
7. The Traffic Engineering Supervisor, the Safety Section Lead and the area investigator will jointly review the crash reports and documentation and close out the audit. Additional traffic counts or other studies may be requested, which will be conducted under a separate Work Order.

\*\*\*\*\*DRAFT\*\*\*\*\*

8. The closed work order, collision reports, diagrams and checklist will then be placed in archive in the Traffic Safety Section. The electronic Work Order will be retained in the SPARKS II work order tracking system.

\*\*\*\*\*DRAFT\*\*\*\*\*

Phoenix Pedestrian Safety Action Plan

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# 2005 PEDESTRIAN SAFETY AUDIT

LOCATION: \_\_\_\_\_

Audit Timeframe: \_\_\_\_\_ Total Collisions: \_\_\_\_\_ Day/Night:<sup>1</sup> \_\_\_\_\_ Intersection:<sup>2</sup> \_\_\_\_\_

Date of Notification: \_\_\_\_\_ Investigator: \_\_\_\_\_ Area: \_\_\_\_\_

INTERSECTION GEOMETRICS:		Width	Speed Limit	Width	Speed Limit
E/W Street _____	East _____	_____	_____	West _____	_____
N/S Street _____	North _____	_____	_____	South _____	_____

Signal Present (Y/N): \_\_\_\_\_

COLLISION HISTORY:

## CHECKLIST

Date(s) of Audit: \_\_\_\_\_ Date Night Visit: \_\_\_\_\_ Time: \_\_\_\_\_

School Safety Section Notified (Rqd if within school zone)? Yes \_\_\_\_\_ NA \_\_\_\_\_

\*\* Please fill out one checklist per location \*\*

Good  
Condition  
Repair  
Required  
Not Present/  
Not Applicable

Include work order numbers for any repair or follow up work and return completed checklist with crash reports and copies of any completed work orders to supervisor

### General

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wheelchair ramps _____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Medians _____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sidewalks (Check for damage such as large cracks, buckling, etc.) _____

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Crosswalk pavement (Check for damage such as large cracks, potholes, etc.) _____
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Street lights (Check for presence on both sides of street and operation at night (if applicable)) _____
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Visibility (Check for overgrown vegetation, etc.) _____
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Crosswalk (Standard or Ladder) striping (Check for cracks, fading, etc.) _____
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### Signalized Intersections

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pedestrian signal head (Check for condition, word vs symbol, etc.) _____
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pedestrian signal pushbutton (Check function, presence of sign and sign matches signal) _____
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Left turn arrows (if present, specify which approaches) _____
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### Non-signalized Intersections

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pedestrian X-ing stencils _____
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pedestrian warning signs for motorists _____
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Warning signs for pedestrians _____
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### Other Features (Specify)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Pedestrian attractors (Specify type, name & location): \_\_\_\_\_

Investigator \_\_\_\_\_ Date: \_\_\_\_\_

Section Lead (Principal or Chief) \_\_\_\_\_ Date: \_\_\_\_\_

Division Manager (or Engineer) \_\_\_\_\_ Date: \_\_\_\_\_

Notes: 1. Night crashes also include any occurring during dawn or dusk. Phoenix Pedestrian Safety Action Plan

2. Crashes labeled by investigating officer as being intersection related. June 15, 2006

# Appendix D. Neighborhood Traffic Management Policies

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 CITY COUNCIL REPORT      POLICY      AGENDA  
 DATE:      September 19, 1989      989 SEP 22 05      DATE: September 26, 1989  
 TO:      Sheryl L. Sculley      ITEM: 6  
          Deputy City Manager  
 FROM:      James H. Matteson, P.E.  
          Street Transportation Director  
 SUBJECT: A POLICY TO REDUCE "CUT-THROUGH" TRAFFIC  
 \*\*\*\*\*  
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The purpose of this report is to request Council endorsement of goals and the adoption of guidelines above which the City may provide expanded technical support to work with neighborhoods to achieve reduced cut-through traffic. To implement this pilot project requires additional staff and equipment.

### DISCUSSION

With the continued growth of Phoenix, concern continues to mount that traffic which tries to avoid congestion on Freeways and Arterial streets intrudes into neighborhoods. That intrusion seriously impacts the quality of life of the neighborhood, with the negative impacts of increased accidents, noise and pollution.

To counter intrusion, Council and staff have attempted to deal with each problem on an ad hoc basis. The City Council Transportation Subcommittee asked staff to propose a set of Goals, Policies and Guidelines to take a more comprehensive approach to the problem. The following has been proposed to, and modified by, the Surface Transportation Advisory Committee and bears their endorsement.

### Goals

- 1) The welfare of the city requires that residential neighborhoods be protected from blighting influences. The use of residential local and collector streets by "unwanted" traffic can be such an influence.

"Unwanted" traffic is defined as either: (a) traffic using a residential local or collector street as a shortcut or detour or; (b) an excessive volume of traffic on a residential local or collector street or; (c) traffic operating at excessive speeds or; (d) vehicles with an origin and destination outside the neighborhood.

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- 2) The welfare of the city requires the safe, efficient and economical movement of persons and goods. To accomplish this, it is essential to develop and maintain a complete transportation system (freeways, major streets and public transit) adequate to accommodate travel demands. Doing so is the most effective way to discourage unnecessary use of residential local and collector streets.
- 3) The intensity of land development and the travel demand produced by it, must be in balance with the planned capacity of the transportation system. If this balance is not maintained, the inevitable result is traffic intrusion into residential local and collector streets.

In order to accomplish the Goals, the City Council reaffirms the following:

Policies

1. The establishment of a hierarchy of streets consisting of major, collector and local streets, each with a distinct traffic service function. The functional classification of each street will be shown on an Existing Street Classification Map, adopted by Resolution.
2. The adoption of right-of-way width standards adequate to construct or reconstruct major streets with sufficient capacity to accommodate existing and projected traffic volumes safely and efficiently. Such widths will be shown on the Minimum Right-of-Way Standards Map, adopted by ordinance.
3. The continued use of street design standards appropriate to the functional classification and anticipated traffic demand, particularly on major streets.
4. The continuation, at adequate funding levels, of the Six Year Major Street Program, other major street improvement programs, and the street maintenance program.
5. Maintaining the capacity of major street intersections through the Bottleneck Removal and S.A.M.E. programs so at least 90% of these vital locations can accommodate peak hour traffic at a tolerable degree of congestion (defined as Level of Service of "D").
6. Application of traffic control devices in such a way that traffic is further encouraged to use major streets, including the expansion of the computerized synchronization of traffic signals, proper spacing of new signals, control of access to major streets through driveway regulations, and posting of realistic speed limits on major streets.

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7. Strong support for the expansion of the public transit system, to provide an attractive alternative to those who cannot, or choose not to drive, and to support overall transportation needs in corridors of highest travel demand.
8. Strong support for the expeditious implementation of the adopted MAG freeway plan. Priorities should be set so that early construction is programmed in corridors of greatest need, while continued capacity and traffic management improvements are made to existing freeways.
9. Thoughtful planning of land use patterns and intensities so that a balance is maintained between traffic generation and the capacity of the transportation system to accommodate the traffic. Integration of the Street Environment Policy would enhance use of the system as well.
10. Continued efforts to design new residential local and collector street networks to discourage unnecessary non-local traffic through the use of loop streets, cul-de-sacs, T-type intersections and discontinuous alignments, while providing for adequate access for residents, visitors, emergency and service vehicles.
11. Expanded technical assistance to neighborhoods through dedicated staff should be pursued through the budget process to define the nature of perceived traffic problems, and develop solutions which can be implemented technically and financially. Solutions may include placement of physical devices such as chokers, diverters, street narrowing or street closure; or install regulatory devices such as permit parking programs, turn restrictions or one-way operation.

A pilot program this fiscal year would require one Traffic Engineer III and two Traffic Engineer II positions with support equipment. The cost to establish the program is \$160,000, with an annual continuing cost of \$150,000. To accomplish this program, additional funds are needed, or three sign maintenance positions could be eliminated to pay for the new positions, if new funds were not available. Cutting one of the five three person sign crews would cause a 20% reduction in the response time for installing or repairing signs.

Policy Items 1-10 are substantially in place today. Council endorsement of this entire policy statement would serve to reaffirm and strengthen Council resolve to pursue each policy element. Implementation of Policy Item #11 would be an entirely new policy that, if funded, would enable a visibly strengthened City effort. Integration of the new Street Environment Policy in this effort would further aid in the City effort.

Guidelines

1. A residential local or collector street is defined as one whose abutting land use is at least 65% residential when considered in segments of one-quarter mile.

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2. Traffic on residential local and collector streets (total both directions) should not exceed:

Local Street

Low Density	1000 vehicles per day;	100 vehicles per hour
High Density	2000 vehicles per day;	200 vehicles per hour

Collector Street	3000 vehicles per day;	300 vehicles per hour
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Neighborhoods with traffic near or in excess of these guidelines may benefit from a study to determine possible remedial measures. Neighborhoods with less traffic on their streets may also request help and staff will, as always, work with them in solving problems.

3. Vehicle speeds (for at least 85% of vehicles, established by radar or equivalent method) on residential local and collector streets should not exceed:

Local Street	25 miles per hour
Collector Street	35 miles per hour

Traffic speeds in excess of these guidelines would normally indicate the need for increased Police enforcement and may require a traffic study to determine other possible remedial measures.

4. Level of Service D should be provided at intersections; Level D occurs when all vehicles waiting at the start of the green portion of the signal cycle are able to clear the intersection by the end of that green portion, for at least 90% of the signal cycles during the peak traffic hour. The peak traffic hour normally occurs between 7 and 9 a.m. and 4 and 6 p.m.

5. Residents along a residential local or collector street(s) experiencing "unwanted" traffic may ask the City's help in preparing a traffic study to recommend a traffic mitigation plan. Involvement of each neighborhood in their study to the maximum extent feasible will be encouraged and petitions indicating neighborhood concerns will be required. Request for studies shall be made to the Street Transportation Director. Requests will be prioritized based on relative need and if requests exceed staff capability, the neighborhoods will be offered the names of competent traffic engineering firms to perform a study. Even when this occurs, staff will work with the neighborhood and consultant and review any traffic mitigation plan prepared for implementation.

6. The Village Planning Committees may review proposed traffic mitigation plans for residential local and collector streets within the village, and may recommend approval as presented or with modifications. This recommendation, along with the recommendation of the Street Transportation Department, will be presented to the City Council Transportation Subcommittee. The Subcommittee shall make a recommendation to the City Council who shall have final approval of such plans.

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7. All proposed land use developments expected to generate at least 5000 vehicles trips per day, or 500 during either the morning or afternoon peak hour, may be required to submit a Traffic Impact Study as determined by the Street Transportation Director. This study will include both street and transit improvements necessary to accommodate total traffic at adjacent major intersections at a tolerable degree of congestion (defined as level of Service D), a draft Travel Reduction Plan, and such other elements as may be required by the Street Transportation Director.
8. The Village Planning Committee shall review all proposed land use developments for which a Traffic Impact Study is required. The Committee shall make a recommendation on the development plan to the Planning Commission. The Street Transportation Department will also review these land use developments and make a recommendation to the Planning Commission. The Street Transportation Department may also make a recommendation to the City Council Transportation Subcommittee.
9. Applications for local street closures will be processed through the existing abandonment procedure. The term "closures" is defined to include any physical restriction to traffic flow on a residential local or collector street such as a diverter or cul-de-sac.

#### RECOMMENDATION

The Goals, Policies and Guidelines listed above have been developed by staff from Engineering, Street Transportation, Development Services, and Planning Departments, and are recommended by the Surface Transportation Advisory Committee. The Council Transportation Subcommittee unanimously approved these concepts on September 18, 1989 and staff recommends Council approval.

The most significant new proposal (Policy #11) is to staff an aggressive pilot program for neighborhood traffic studies with three new positions and equipment for a first year cost of \$160,000 and \$150,000 each succeeding year. Recent restructuring of the Transportation Planning Team has made available one of the three positions and by filling the lead position January 1990, the first year cost would be \$104,000. Staff recommends this lower amount - \$104,000 - be funded using ABUR monies the remainder of FY 90 to enable an expanded neighborhood services program. Capital costs should be minimal in the current fiscal year. Based upon results of the pilot program, a budget proposal will be developed for FY 91.

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