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Development, Implementation and Evaluation of a Pedestrian Safety Zone for Elderly Pedestrians

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16. Abstract

The objectives of this study were to develop and apply procedures for defining pedestrian safety zones for the older (age 65+) adult and to develop, implement and evaluate a countermeasure program in the defined zones. Zone definition procedures were developed and applied to two cities: Phoenix and Chicago. Countermeasure development included a comprehensive video, five public service announcements and 13 flyers. Other available NHTSA and AAA education countermeasures were used in the study. A detailed engineering evaluation of each zone resulted in the selection of engineering countermeasures for the two cities. Extensive countermeasure programs were implemented in both cities. A complete evaluation was conducted only for the city of Phoenix. Data from Phoenix showed significant reductions in zone crashes to 65+ pedestrians over a period in which the city's population and overall pedestrian crashes increased. It was concluded that the zone process resulted in an effective and efficient means of deploying pedestrian countermeasures. A separate document describes procedures that program implementors in other cities can use in defining zones and applying the zone process to their pedestrian safety problems.

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This study represents a further step in the systematic efforts of both the National Highway Traffic Safety Administration (NHTSA) and the Federal Highway Administration (FHWA) to develop techniques to reduce pedestrian crashes. Older (65+) adults are involved in a smaller proportion of all pedestrian crashes (7.7%) than would be expected by their numbers in the population (12.8%). However, they account for almost one-quarter (22.4%) of all pedestrian fatalities. Older adults have the highest pedestrian fatality rate among all ages. This is likely because they tend to die in crashes that are survivable by younger, more resilient pedestrians. Since America's population is aging, the magnitude of this problem is expected to increase.

To combat this problem, NHTSA and FHWA sponsored the current study with the primary objectives of creating and evaluating a technique for defining zones that would permit efficient targeting of countermeasures for the older adult. The concept of employing "zones" or clusters of defined population groups as part of a countermeasures program has been used for years in targeting countermeasures to children. For the young, dissemination of pedestrian safety information through the school system has proved to be both efficient and effective. It was considered reasonable that zones could be created for similar targeting of countermeasures to other groups. The older adult was selected as the target group for the prototype effort.

The following objectives were established for the study:

- Develop procedures for defining older adult pedestrian safety zones within communities.
- Apply the procedures to the problem of older adult pedestrian crashes to validate the zone definition procedure and provide a basis for a field evaluation of the zone concept.
- Develop a set of countermeasures to reduce older adult pedestrian crashes in the defined zones to support the examination of the technique.

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- Conduct a field evaluation of the countermeasure program.

- Prepare a separate "how-to" manual that describes the zone process so that program implementors in other cities can adapt the procedures to their own pedestrian safety concerns.

Two cities were selected to be test sites: Phoenix, Arizona and Chicago, Illinois. As the study progressed, it became apparent that full program implementation and evaluation in both Phoenix and Chicago would not be possible or practical within the time and funding constraints of the study. Since Phoenix had completed its countermeasure program when this decision was made and Chicago had encountered a number of unforeseen setbacks in program implementation, it was agreed that full program evaluation would be based on the experience in Phoenix only. Chicago would provide supporting data on the countermeasure implementation process.

A crash-based approach was used for establishing zones. Since over three-quarters of the older adult crashes occurred within one mile of the victim's residence, circles with a radius of one mile were established as zones if 10 or more older adult pedestrian crashes occurred in them. Three years of Phoenix data (153 crashes) were mapped manually, and an acetate with a one-mile radius circle was moved around the map until it contained 10 or more crashes. The map was also examined for linear strips of roadway that contained six crashes in a two-mile segment. The Chicago data for one year (436 crashes) were mapped by a Graphical Information System (GIS) mapping tool. This system was used to create a circle with a one-mile radius that was moved over the computer map to identify circular areas with a minimum of 10 crashes. By this process, six circular zones and one linear zone were identified in Phoenix that accounted for 54.9% of the city's older adult pedestrian crashes in about 4.6% of the land area. For Chicago, the process led to the identification of 14 circular zones and one linear zone that encompassed 52.5% of the older adult crashes in just over 19% of the total Chicago land area.

A detailed examination was made of each of the zones for possible engineering countermeasures, and a list was prepared for consideration by city representatives. In addition, each city was provided with the same set of public information and education (PI&E) countermeasures. These included several materials developed specifically for the project, other NHTSA materials adapted for the study so that materials would have a common theme, and still other NHTSA and AAA education materials that were used intact. Developed as part of the study were a video entitled *Walking Through the Years* which provides pedestrian safety advice for the older adult and five television public service announcements (PSA) for the older adult. In addition, a set of 13 flyers sized to fit in a business envelope were developed to provide pedestrian safety advice to both pedestrians and motorists. Other materials provided to the two cities included brochures, posters, bus cards, bumper stickers, radio PSAs and slides.

From the materials provided, city representatives designed their own countermeasure programs. The resulting programs were quite different in the two cities. As an example, among other activities, Phoenix distributed project flyers as door hangers to each residence in the zones and mounted pedestrian signal information signs near pedestrian push buttons

in and near the zones. Phoenix also sponsored a survey to assess whether there were knowledge gains as a result of its program activities. Chicago concentrated its efforts on a community-based initiative that involved police presentations to the elderly. These presentations were made at senior centers, residences and other locations where older adults congregate.

Results from the Phoenix data showed that, while both the overall population and pedestrian crashes in the city *increased* over the study period, older adult crashes *decreased* by 13.7%. This decrease was greatest in the zones (46.3%), while an *increase* of 9.9% occurred outside the zones. A time series analysis which used all of the available data produced a multivariate model which estimated a significant decrease in older adult (65+) crashes in the zones coincident with the implementation of the countermeasure program.

The largest observed pedestrian crash decrease to the older adult occurred at intersections in the zones which was where the maximum project effort was focused. The pedestrian signal information signs as well as the vast majority of engineering improvements, such as increasing the available sight distance, were focused at these intersections.

The Phoenix-sponsored survey showed knowledge gains in an area (namely, daytime conspicuity) believed important to achieving a reduction in age 65+ pedestrian crashes. It also showed that Phoenix residents were aware of the program, and this awareness increased as the study progressed. Project flyers that were distributed as door hangers were reported to be the major source of PI&E information received by the respondents. In addition, the project pedestrian signal information signs were the most frequently seen signs giving information or advice to pedestrians in Phoenix.

Finally, there was clearly an "efficiency factor" in being able to deploy countermeasures in a small area and reach a relatively large proportion of the target population. This factor was especially prevalent in Phoenix where the door hanger campaign and the deployment of pedestrian signal information signs near the push buttons in the zones both proved to be successful in prompting recall and, presumably, positive behavioral change. It was economically feasible to use these approaches because the area of the city to be treated had been reduced to a small fraction of the total.

The successful application of the process together with evidence that the zone-based countermeasure program in Phoenix successfully reduced crashes lead to a conclusion that "zoning" is an approach that should be considered as part of pedestrian crash countermeasure programs. The same basic approach might also be beneficial in other crash and operational contexts such as drunk driving crashes or tracking and repairing roadway problems such as potholes. It is likely that maximizing the effectiveness of the concept for these uses will require refinements in some of the procedures that were developed for older adult pedestrian crashes. However, since the development process used in this study is not particularly difficult, refinements based on other problem-specific data should be relatively easy to make.

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The contributions of the following Phoenix representatives are acknowledged:

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- Grace Perry, independent consultant
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- Joseph Maratto, Police Department

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I. INTRODUCTION

This study represents a further step in the systematic efforts of both the National Highway Traffic Safety Administration (NHTSA) and the Federal Highway Administration (FHWA) to develop techniques to reduce pedestrian crashes. Older (age 65+) adults are involved in a smaller proportion of all pedestrian crashes (7.7%) than would be expected by their numbers in the population (12.8%). However, they account for almost one-quarter (22.4%) of all pedestrian fatalities. Older adults have the highest pedestrian fatality rate among all ages. This is likely because they tend to die in crashes that are survivable by younger, more resilient pedestrians. Since America's population is aging, the magnitude of this problem is expected to increase.

To combat this problem, NHTSA and FHWA sponsored the current study with the primary objectives of creating and evaluating a technique for defining zones that would permit efficient targeting of countermeasures for the older adult. The concept of employing "zones" or clusters of defined population groups as part of a countermeasures program has been used for years in targeting countermeasures to children. For this group, dissemination of pedestrian safety information through the school system has proved to be both efficient and effective. It was considered reasonable that zones could be created for similar targeting of countermeasures to other groups. The older adult was selected as the target group for the prototype effort. This led to establishing the following objectives for this study:

- Develop procedures for defining older adult pedestrian safety zones within communities.
- Apply the procedures to the problem of older adult pedestrian crashes to validate the zone definition procedure and provide a basis for a field evaluation of the zone concept.
- Develop a set of countermeasures to reduce older adult pedestrian crashes in the defined zones to support the examination of the technique.
- Conduct a field evaluation of the countermeasure program.
- Prepare a separate "how-to" manual that describes the zone process so that program implementors in other cities can adapt the procedures to their own pedestrian safety concerns.

The initial study plan provided for use of both a test city and a comparison site for the field evaluation. After an extensive review of several sites, Phoenix (Arizona) was selected as the test city because of its intense interest in being involved in the study and the leadership that the Phoenix Department of Street Transportation was willing to provide. In an attempt to strengthen any conclusions derived from Phoenix, a second experimental city was added in lieu of a matched comparison site. First, time series analysis techniques on crashes can provide great confidence in any crash reduction results without the need for a

comparison site. Second, it was reasoned that the possibility of a replication of any success arising from the use of the approach would provide stronger evidence of its efficacy than a statistical comparison. Because of its expressed interest in the program, Chicago (Illinois) was selected as the second test city.

As the study progressed, it became apparent that full program implementation and evaluation in both Phoenix and Chicago would not be possible or practical within the time and funding constraints of the study. Since Phoenix had completed its countermeasure program when this decision was made and Chicago had encountered a number of unforeseen setbacks in program implementation, it was agreed that full program implementation and evaluation would be based on the experience in Phoenix only. Chicago would provide supporting data on the countermeasure implementation process.

The study was accomplished with the following tasks:

- *Selection of test cities.* This task involved development of site selection criteria, personal contact with eligible cities to determine their interest in supporting the program, and final site selection.

- *Definition of pedestrian safety zones.* This task involved enumerating alternative methods for defining zones which led to the selection of a crash-based approach. It then involved an analysis of older adult crash data and development of formal procedures for the zone definition process. This process was then used to identify pedestrian safety zones for older adults in both cities.

- *Development of pedestrian safety countermeasures.* This task involved extensive public information and education countermeasure development (including a video, 13 flyers and five public service announcements) and identification of available print and audiovisual materials appropriate to the older adult. It also involved an engineering analysis of the defined zones in both Phoenix and Chicago and identification of applicable engineering countermeasures.

- *Design of the countermeasure implementation and evaluation plans.* This task involved selection of countermeasures and development of implementation and evaluation plans for both cities. For this task, Phoenix elected to sponsor a survey of knowledge gained as a result of the study as well as an analysis of crash data.

- *Evaluation of program results.* This task included analysis of Phoenix survey results and crash data as well as an analysis of process data for both cities.

This report includes the following sections:

- This first section (*Section I*) describes the study objectives and approach and shows how the report is organized.

- *Section II* describes program site selection.

- *Section III* provides a definition of the zone model and applies the model to the selection of zones in both Phoenix and Chicago.

- *Section IV* describes the development and identification of public information and education (PI&E) materials for use by the test cities.

- *Section V* describes the design and implementation of the Phoenix and Chicago engineering and PI&E countermeasure programs.

- *Section VI* describes program evaluation procedures and results including the Phoenix survey of knowledge, Phoenix crash data and process data for both Phoenix and Chicago programs.

- *Section VII* provides a discussion of the results obtained from the study.

The following appendices are included in the report:

- Appendix A provides descriptions of the Phoenix zones.

- Appendix B contains a copy of the *Chicago Prospectus* which describes the process for defining elderly pedestrian zones in Chicago, defines the zones that were identified in that city, describes major PI&E materials available for the study, and lists the major study tasks and cooperative inputs needed from groups in the city for the program to be successful.

- Appendix C contains copies of 13 flyers that were developed for the study and two small brochures developed by Dunlap and Associates, Inc. under a previous NHTSA contract that were adapted for use by the study. They were distributed as part of a cooperative "door hanger" campaign to each zone residence in Phoenix. They were also distributed widely to older adults in Chicago at senior citizen picnics and through the efforts of the cooperating Chicago departments.

- Appendix D contains the section of the Phoenix workbook that was prepared for zone 1 as an example of the working materials employed in the study. It describes the zone, provides samples of forms used for capturing needed engineering improvements and PI&E opportunities, lists the crashes in and near the zones, and provides a map of the zone.

- Appendix E contains the safety zone field survey checklist prepared for the engineering analysis of Chicago zones.

- Appendix F contains the procedures, form and instructions used for conducting the survey in Phoenix.

II. SITE SELECTION

It was originally requested that one test city and one control city be selected for study. However, since study zones would represent only a proportion of both the population and the land area of the city being studied, the city could in fact serve as its own control. Crashes occurring in the zones could be compared with those occurring outside the zones. In addition, by using the test city as its own control, the difficulties involved in locating two *matching* cities would be avoided. Also, if the zone procedure worked in reducing pedestrian crashes to older adults at one site, a replication of the effect at a second site would represent stronger support for the approach than a statistical comparison site.

It was also reasoned that more would be learned about the *process* of defining and using zones if the project had experience from two separate sites. It was therefore determined that adding a second *test* city (rather than a comparison site) would strengthen any conclusions derived from the study.

An initial study effort was directed toward specifying criteria for the two test cities. The criteria were as follows:

- The most important initial criterion in the process of identification of candidate cities was population, that is, the city needed a sufficiently large population to support a crash-based evaluation of the zone countermeasure program. In this instance, a population of at least 500,000 was considered necessary to produce adequate crash experience.

- The second major criterion in site selection was the existence of a sufficiently large older adult population. The dispersion of this population was also an important consideration since the zone concept was dependent on clustering of this population.

- The existence of previous positive contacts with the city was considered an important criterion since it is significantly easier to obtain the cooperation of a city when researchers are already known there.

- The ability and willingness of the city to support the study with countermeasure implementation efforts and provide police crash reports throughout the planned duration of the study (a minimum of three years of data collection after initiation of the countermeasure program).

A total of 25 United States cities with a population greater than 500,000 were selected for examination. In the first review cycle, city size was considered in conjunction with the existence of project contacts with highway safety personnel. This analysis resulted in identification of eight of the 25 cities as possible sites.

The second review cycle involved creation of profiles for the largest cities regardless of whether there had been previous staff contacts with the cities. These profiles listed the population, area in square miles, density of population, the older (65+) population, the 65+ crashes, crash rates and 65+ crash rates. The availability of crash data and presumed interest of the city in pedestrian safety programs were then considered. This analysis resulted in the identification of seven cities as possible sites, five of which were also included in the initial list.

The third review cycle involved discussions with pedestrian safety experts and traffic engineers to assess interest in the program. These discussions resulted in identification of the following six cities as recommended site contacts: Phoenix, Philadelphia, Chicago, San Diego, Milwaukee and Jacksonville.

Finally, the availability of local resources and the interest expressed by local traffic engineers resulted in the selection of both Phoenix and Chicago as test sites. Plans to select zones and initiate the program in Phoenix commenced immediately. Plans to select zones in Chicago followed zone selection in Phoenix. However, due to various local issues beyond the control of both project and site personnel, initiation of the countermeasure program in Chicago was delayed for over two years.

Once the delay in implementing the program in Chicago became obvious, the project had two basic alternatives. The first was to delay implementation in Phoenix until Chicago was ready. The second was to operate the sites independently and let Phoenix begin immediately since they were primed and eager to commence countermeasure activities. The latter course of action was selected because it was consistent with the desire of the cooperating Phoenix officials to get underway. It was also reasoned that there was little likelihood of any major change in the highway safety environment that might impact Phoenix and Chicago differentially if they implemented the countermeasure program at different times.

III. ZONE DEFINITION

The process of defining zones began with an examination of the various bases upon which a pedestrian safety zone for elderly pedestrians could be defined. These included census data (concentrations of older adults), facilities (existence of facilities such as senior centers which cater to the older adult), older adult pedestrian crashes themselves and combinations of these measures. After careful consideration the decision was made that crash data would be used as the analytical basis. No other data were as readily accessible to a local community, as familiar to the local countermeasure practitioner or as directly relevant to the problem as the incidence of crashes. This decision was confirmed with traffic safety representatives from both test cities.

Initial concepts for the definition of zones were developed using 72 Greater Miami (Miami and Miami Beach) older adult pedestrian crashes for 1988. These were analyzed manually using a variety of definitions of zones to determine an effective clustering. In this context, the primary criterion used to define effectiveness was the ability of the zone definition to capture as many of the older adult pedestrian crashes as possible in the smallest possible land area. This was deemed important as some factors which predispose pedestrian crashes, such as the existence of visual screens or visual clutter, can only be identified from an on-scene examination. A secondary criterion was to keep the absolute size of each zone manageable so that local countermeasure implementors could analyze each zone from a site survey.

The methodology was further refined and ultimately defined from an analysis of 153 older adult pedestrian crashes that occurred in Phoenix from 1988 through 1990. The Phoenix analysis, which was accomplished manually, resulted in the definition of zones for that city. The efficiency of the Phoenix model and its applicability to other cities was confirmed by its application to the previously used Greater Miami data. The only problem encountered was the extent of effort needed to map the crashes and examine alternative zone configurations manually. This led to an examination of the possibility of using Geographic Information System (GIS) software to simplify the process.

For the definition of Chicago zones, 436 older adult pedestrian crashes for the year 1990 were available on computer tape. It was decided to use commercially available GIS software combined with a project-derived data extraction program to apply the zone definition procedure to these crashes. Each of these analytical steps are described in the following paragraphs.

A. Initial Concepts

The following means of identifying pedestrian safety zones for the older adult were initially identified:

- Areas with a high number of older adult crashes.

- Areas with a large number of older adult residences.

- Areas where older adults congregate, for example, senior centers, shopping malls, medical/professional offices, etc.

It was decided based on experience with locally-derived data that the first two of these zone definition proposals were the most practical, and, therefore, the study of the Greater Miami data was designed to test them. To accomplish this analysis, each older adult pedestrian crash was coded according to NHTSA's *Manual on Accident Typing for Pedestrian Accidents*[1] and manually located on a pin map. Different pin colors identified the crash type as one of the following: vehicle turn/merge, backing, parking lot and other crashes. These crash type categories were selected because they separate the most frequent types in which the older adult is involved. The victim's residence was also located on the map; a color-coded thread was used to tie the residence with the crash location.

The subsequent plots revealed that there were pronounced clusters both of the crash locations and of the residences of the victims. Most crashes occurred close to the victim's home. The exception was a few of the vehicle turn/merge crashes which occurred well beyond a typical walking distance from the victim's home. Overall, 80.6% of the crashes occurred within 1 mile of the victim's home.

Examination of the Miami crash data revealed two different types of clusters. One was characterized by a circle with a radius of one mile from the victim's home. The other was based on capturing the largest possible number of older pedestrian crashes. These clusters could be defined as circles with a radius of three miles centered based on the position of the crashes observed. Although this second type of cluster encompassed somewhat more crashes, it had two operational problems. First, many pedestrian victims would be residing well outside the zone limits as defined by the three mile radius circle. This would eliminate the possibility of delivering countermeasures to their homes. Second, a three mile radius circle covers a land area of over 28 square miles compared with just over three square miles for the one mile radius circle. Analyzing the larger land area for possible pedestrian problems would be significantly more difficult and require much greater local resources.

B. Phoenix Zone Definition

To further refine and define the zone definition procedure, an analysis similar to the Miami analysis was performed on 153 Phoenix 65+ pedestrian crashes that occurred from 1988 through 1990. Because of the relatively low incidence of the crashes of interest in Phoenix, three years of data were used in order to provide a reasonable number of crashes for analysis.

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[1] *Manual on Accident Typing for Pedestrian Accidents: Coder's Handbook.* National Highway Traffic Safety Administration, U.S. Department of Transportation, Washington, DC.

As before, each crash was typed according to NHTSA's *Manual on Accident Typing for Pedestrian Accidents*[2], and all of the crashes were manually plotted on a map of Phoenix. Each crash location was color-coded by type of crash; fatalities were noted as were crashes involving transients. The crash types identified in the sample and color-coded on the map are summarized in Table 1.

Table 1
Crash types in the Phoenix sample

Crash Type	Frequency	Percent
Not in road	14	9.2
Vehicle turn merge	39	25.5
Other intersection	56	36.6
Midblock	32	20.9
Other or unknown	12	7.8
Total	153	100.0

For each Phoenix resident, the crash location was connected by a straight line to the pedestrian's home. All but 21 (13.7%) of the victims were Phoenix residents. Of the Phoenix residents, about half (49.2%) were struck within 1/4 mile (measured as a straight-line distance) of their homes, over two-thirds (67.4%) were struck within 1/2 mile of their homes and most (78.0%) were struck within 1 mile of their homes. These data are shown in Table 2.

Also plotted on the map was the location of some 25 senior centers. These centers typically provide daytime activities for older adults.

A visual scan of the map revealed the following:

- There was no apparent clustering of victims' residences; however, crashes tended to occur near victims' homes. This suggested that defining zones on the basis of older adult residences might not be a good way to reach potential crash victims.

- There was no apparent clustering of crashes by type. Thus, all older adult pedestrian crashes could be used to define zones.

- There was likely some tendency for clustering of crashes near some senior centers. However, an immediate relationship was not obvious.

Since over three-fourths of the Phoenix residents (and 80% of the Miami victims) were struck within one mile of their homes, this distance was accepted as a radius criterion for

[2]Ibid.

Table 2
Distance from Phoenix victim's residence to crash site

Miles (home to crash site)	Frequency	Percent	Cum Percent
<.10	37	28.0	28.0
.10 - .25	28	21.2	49.2
.26 - .50	24	18.2	67.4
.51 - 1.0	14	10.6	78.0
1.1 - 2.0	9	6.8	84.8
2.1 - 3.0	5	3.8	88.6
3.1 - 4.0	5	3.8	92.4
>4.0	8	6.1	98.5
Address unknown	2	1.5	100.0
Transient	21		
Total	153		

identifying circular zones based on crash location. This circle would define a region in which both homes and crash locations would be found and would encompass a manageable area for deploying local countermeasures.

To identify the one mile radius zones, a circle with that radius for the scale of the map being used was drawn on a piece of clear acetate. The acetate was then laid over the map and moved around until at least 10 crashes (approximately 7% of the total sample) were included in the circle overlay. The rationale for using numbers of crashes rather than a percentage of the total was that the process was looking for an area-based crash rate and *not* for relative incidence. If the rate was sufficiently high, countermeasure attention was considered to be warranted.

This process led to the identification of six circular pedestrian crash zones. A citywide map showing these six zones is provided in Figure 1. The individual zones are described in Appendix A.

In addition to the crashes which occurred within each circle cluster, a count was made of crashes that occurred within an additional one-half mile of each circle. This was done on the assumption that while analyzing the safety situation within a zone, safety program officials could easily examine several more crash locations which were within a short distance of the zone boundary. One-half mile was arbitrarily selected as that distance. One or more pedestrian crashes occurred in this space in five of the six circle clusters, making a total of an additional seven crashes that occurred outside the zones but within one-half mile of the identified circles.

An examination was also made of crashes that occurred along major north-south and east-west arteries to determine if there were particular roadways with high pedestrian

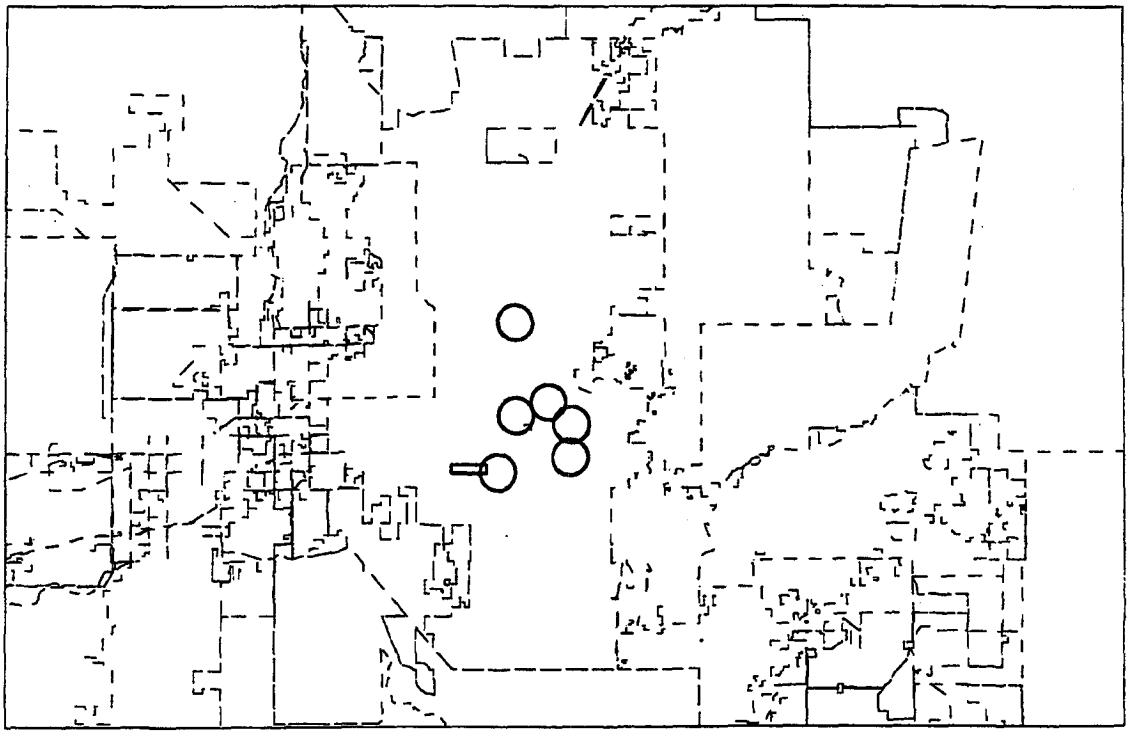

Figure 1. Citywide map of Phoenix zones.

crashes. Two roads were identified that had a minimum of six crashes (approximately 4% of the total sample) in a two-mile stretch of the road. One of these road segments was included completely in one of the circular zones. The second road segment was partially included in one of the circular zones. However, because of its high crash incidence outside of the zone, it was accepted as a linear zone. It is also shown in Figure 1 and described in Appendix A.

The crashes identified in each of the seven zones described above account for 54.9% of the Phoenix pedestrian crashes for 1988-1990 and about 4.6% of the Phoenix land area. If an examination is made of the crashes within an additional one-half mile of each circle cluster, 59.5% of the Phoenix crashes for the three-year period will be covered in less than 9.5% of the land area.[3]

As a result of this analysis, it was concluded that the procedure resulted in an efficient definition of zones in terms of coverage of a large number of crashes in a relatively small land area. Therefore, the following procedures were proposed for manually identifying zones and for using the defined zones to apply study countermeasures:

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[3] Note: The land area will actually be less than 9.5% since the calculation of that figure for the affected circles was based on using a radius of 1-1/2 miles for each circle. Since four of the five affected circle clusters are contiguous, the additional 1/2-mile circle would represent a considerable overlap.

- Make a pin (dot) map of the 65+ pedestrian crashes.

- On an acetate overlay, draw a circle with a radius of one mile.

- Move the acetate over the map in an attempt to identify circle clusters that contain at least 10 older adult pedestrian crashes. Consider each circular area identified as a zone that will receive complete countermeasure dosing and an engineering analysis of every intersection.

- Examine additional crashes that occur within one-half mile of each circular zone. Study each *crash site* in this additional one-half mile area to determine if engineering improvements should be considered at that *site*.

- Examine crashes occurring along major city streets and consider as a linear zone any street segment that has a cluster of six or more 65+ pedestrian crashes in a two-mile stretch.

To confirm the procedure, the Phoenix model was applied to the Miami data. Two circular zones were identified--one in Miami and one in Miami Beach. The Miami Beach zone represented 60.0% of the Miami Beach crashes and 22.1% of the land area. The Miami zone represented 34.6% of the Miami crashes and 20.2% of the land area. The somewhat lower efficiency than in Phoenix was to be expected because the Miami metropolitan area is much less sprawling than Phoenix. Nevertheless, the model resulted in reasonable efficiencies and the identification of locations with high numbers of older adult pedestrian crashes. It was also concluded that the number of crash cases in the available sample was likely too small to present a stable picture of the crash problem in the Miami area.

C. Chicago Zone Definition

It should be noted that the manual process described above can be tedious and time-consuming particularly if the number of crashes being used is much larger. In addition, locating crash sites on a standard road map requires some estimation. Manual application of the process is therefore practical only when the number of crashes is small. In Chicago, however, there are over 400 older adult pedestrian crashes in a year. This suggested the need for a more automated method for defining zones in that city. Hence a commercial off-the-shelf computerized mapping system (sometimes called a Graphical Information System or GIS) was used.

The criteria used for defining zones in Chicago were the same as those used in Phoenix except that only a single year's crash data were used (1990). This yielded a sample of 436 crashes involving a pedestrian 65 years of age or older. Instead of manually locating the site of each crash on a map, the following procedures were used:

- A computer tape of all Chicago traffic crashes for 1990 was obtained from the city.

- Crashes involving older adult pedestrians were separated from other pedestrian crashes and from other traffic crashes. The older adult crash file contained the basic police crash report information as well as two numeric location codes corresponding to a Chicago-unique location coding scheme.

- A computer file of the code book corresponding to the Chicago location codes was prepared.

- The Chicago location codes were converted to a text form which was compatible with the computerized mapping system.

- The older adult pedestrian crash file was brought into the computerized mapping system and coded into latitude and longitude coordinates. In this process, 434 of the 436 crashes were located.

- The mapping program was used to generate a circle with a one-mile radius. This circle was moved around the electronic map using the mouse and cursor keys. At each candidate zone location, the program was used to count the number of crashes within the circle. When the circular area contained a minimum of 10 crashes and appeared to maximize the number of crashes within the circle for that area of the city, the zone was "fixed." Road segments containing a minimum of six crashes in a two-mile segment were also identified manually on the computer display.

This process resulted in the definition of 14 circular zones and one linear zone. The 15 zones encompass 228 (52.5%) of the 434 older adult pedestrian crashes for 1990. The efficiency of the process is shown again by the fact that these 52.5% of the crashes are addressed in just over 19% of the total Chicago land area.

A citywide map of the Chicago zones is provided in Figure 2. A map of each individual zone is included in the *Chicago Prospectus* presented in Appendix B.

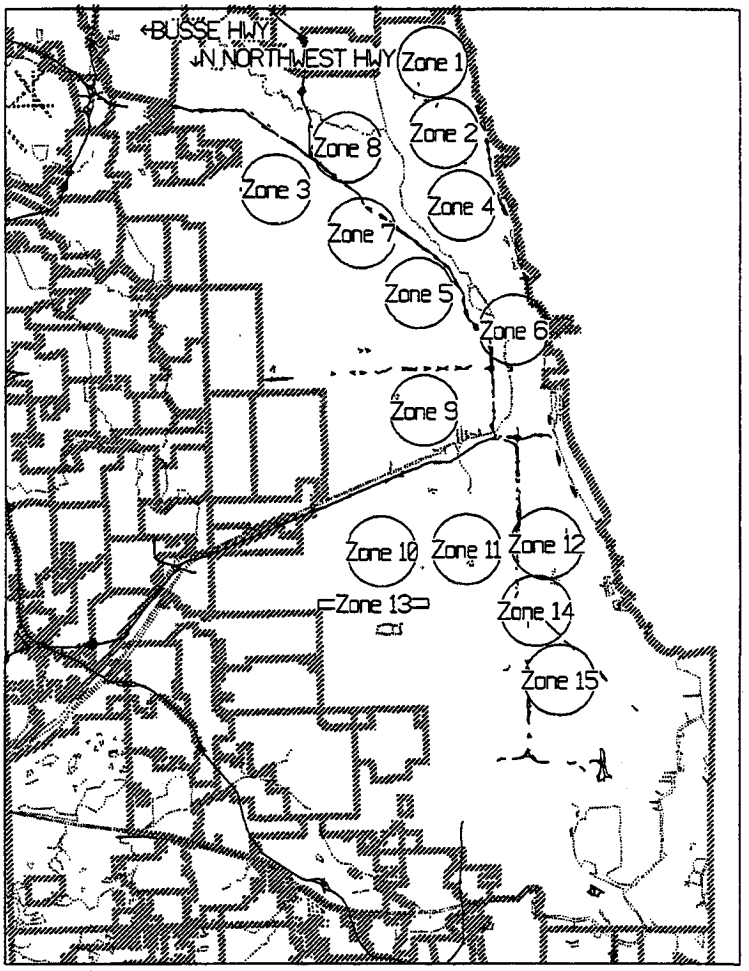

Figure 2. Citywide map of Chicago zones.

IV. THE PI&E COUNTERMEASURE PACKAGE

Several print and audiovisual materials for the older adult were assembled for use as PI&E countermeasures in this study. Some were developed as part of the field test of the study. Others were prepared by Dunlap and Associates under previous NHTSA contracts. Still others were produced by the American Automobile Association (AAA) using NHTSA research on the older adult. All of the materials were coordinated through the use of the campaign title: *Walking Through the Years.*

Included in the PI&E package are brochures, flyers (envelope stuffers or door hangers), posters, bus cards, print advertisements, bumper stickers, radio and television public service announcements (PSAs), a slide set and presenter's guide, and a video and discussion guide. The total PI&E package covers virtually all media forms relevant to the older adult. Some media types not covered explicitly, such as billboards, could easily be addressed by an adaptation of one or more of the available materials. It is important to note that all materials, including the audiovisuals, were designed with space for local sponsorship. Thus, it is simple for a city department or cooperating private organization to add its logo to any materials prior to duplication.

The total PI&E package also covers virtually all pedestrian crash situations relevant to the older adult. Most of the materials are targeted to the pedestrian; a few are directed to the driver. Each of the materials is an outgrowth of prior research on the older adult crash problem.

Some products are general-purpose materials that address all of the older adult pedestrian safety risks. Some are devoted to specific pedestrian concerns, as follows:

- Turning cars
- Multiple threat/visual screens
- Looking first before entering the street
- Backing cars
- Parking lots
- Conspicuity
- Waiting for a fresh green light
- Driveways and alleys
- Meaning of the flashing DON'T WALK signal.

Each item is described briefly in the following paragraphs. Materials produced as part of this study are discussed first. They include a video and discussion guide, five television PSAs and 13 flyers. They are followed by materials developed previously and adapted by the study for this program. Finally, items developed under previous studies and available intact are described. A summary of the entire PI&E countermeasure package appears in Table 3. Details on each item and the form in which it was available to the test cities is included in the *Chicago Prospectus* contained in Appendix B. The 13 program flyers and two small NHTSA brochures developed for the study are reproduced in Appendix C.

Table 3

The PI&E Countermeasure Package

Type of Material	Problem Addressed
Developed Materials:	
Video and discussion guide	Entire older adult pedestrian problem
Television PSAs (5)	Turning vehicles, right-turn-on-red, parking lots, conspicuity, waiting for a fresh green light
Flyers/envelope stuffers, door hangers (13)	**Motorist**--making turns, passing stopped cars, backing **Pedestrian**--searching before stepping off the curb, turning cars, stopped vehicles, a green light means look first, crossing driveways and alleys, backing cars, parking lots, understanding the DON'T WALK signal, waiting for a fresh green light, conspicuity
Adapted Materials:	
Pedestrian/motorist brochures (2)	Multiple threat, turning vehicles
Posters/print ads (2)	Multiple threat, turning vehicles
Bus cards/posters (3)	Multiple threat
Bumper stickers (2)	Multiple threat, turning vehicles
Materials Used Intact:	
Radio PSAs (2)	Turning vehicles (English and Spanish), multiple threat/visual screens
Slide set and presenter's guide	Entire older adult pedestrian problem
Basic 16-page brochure	Entire older adult pedestrian problem
12-page flyer	Entire older adult pedestrian problem
8-page AAA flyer	Entire older adult pedestrian problem
2-page AAA flyer	Seeing and being seen

A. Materials Developed by the Study

Materials developed as part of this study effort include a video and discussion guide, five television PSAs and 13 flyers that can be used as handouts, envelope stuffers or door hangers.

Video and Discussion Guide. A video, entitled *Walking Through the Years* (total run time 12:52), was developed specifically for this study. It provides pedestrian safety advice about the following: the basics of stopping at the curb and looking left, right, and then left again before entering the street; procedures for checking for turning vehicles and the importance of looking in *all* directions including *behind* the pedestrian; the importance of checking for traffic even when the light is green or the signal says WALK; providing the most time to cross the street by waiting for a fresh green light or WALK signal; the meaning of the flashing DON'T WALK signal; checking for cars when there is another vehicle or object blocking the pedestrian's and driver's views of each other; being alert to the signs that a car might back up; treating a parking lot like an intersection; and making sure that the pedestrian is conspicuous to the driver. A two-page discussion guide describes the video and recommends procedures for presenting the video to groups of older adults.

Television PSAs. Five television PSAs (closed captioned, 30-second length) were developed for the following pedestrian concerns: turning vehicles, right-turn-on-red, parking lots, conspicuity, and waiting for a fresh signal.

Flyers/Envelope Stuffers/Door Hangers. A set of 13 flyers sized to fit in a business envelope was developed to provide pedestrian safety advice for motorists and pedestrians. These flyers can be distributed as handouts or envelope stuffers or can be designed as door hangers. Three of the flyers address the motorist and provide advice on the following: watching for pedestrians while making turns, being alert to the possibility that a stopped car may be hiding a pedestrian and checking carefully for pedestrians before backing a vehicle. The remaining 10 flyers address the pedestrian and provide advice on the following: looking carefully for cars *before* stepping off the curb, looking in *all* traffic directions for turning cars before stepping off the curb, stopping at the outside edge of a stopped vehicle and searching around it, recognizing that a green light or WALK signal means *look first* to make sure it's safe, treating a driveway or alley like a roadway, being alert to signs that a car may back up, treating parking lots like roadways, understanding the DON'T WALK signal, waiting for a "fresh" green light or WALK signal to obtain the most time to cross, and making oneself conspicuous to the driver both during the day and at night. Each flyer is reproduced in black and white in Appendix C. The flyer design, however, also permitted them to be printed in a two color version.

B. Materials Adapted for the Study

A variety of print materials which had been previously developed on other NHTSA contracts were available. These included pedestrian and motorist brochures, posters/print advertisements, bus cards/bus posters and bumper stickers. While the basic content of these

materials was retained, all were redesigned and re-executed to incorporate the *Walking Through the Years* campaign theme.

Pedestrian and Motorist Brochures. Two four-page brochures (3" x 6") were available for distribution to both pedestrians and motorists. Both are entitled *You and You Should Never Meet Like This.* One addresses the multiple threat risk. The second is directed toward the turning vehicle threat. The brochures are reproduced in Appendix C.

Posters and Print Advertisements. Two posters and their accompanying print advertisements (1-, 2-, and 3-column) were available for the motorist. One set of materials addresses the multiple threat risk and advises drivers that a stopped car may be hiding a pedestrian. The second set addresses the turning risk and advises drivers to take a last look for pedestrians before turning.

Bus Cards and Posters. Two bus cards and one bus poster were available for the project. All are directed to the pedestrian and address the multiple threat risk. One bus card advises the pedestrian to stop and look around any stopped vehicle. The second bus card and the bus poster advise a pedestrian who is crossing in front of a bus to stop and look around it.

Bumper Stickers. Two bumper stickers were available for the program. Both are directed to the motorist. One addresses the multiple threat risk and advises the motorist that a stopped car may be hiding a pedestrian. The second bumper sticker addresses the turning vehicle risk and advises the motorist to take a last look for pedestrians before turning.

C. Materials Utilized Intact

Several items were prepared under previous NHTSA studies or were produced by AAA based on NHTSA research. They were used by the project in their current form. These included radio PSAs, a slide set and presenter's guide and a variety of brochures. All except the radio PSAs are entitled *Walking Through the Years.*

Radio PSAs. Both 30-second and 60-second radio PSAs were available for the following risks: turning vehicles and multiple threat/visual screens. The turning vehicle PSAs were available in both English and Spanish.

Slide Set and Presenter's Guide. An available 25 slide set of 35 mm slides summarizes research on the problem of older adult pedestrian safety and provides advice on the same topics covered in the video. An accompanying document serves as an aid in presenting the slides. Called a *Presenter's Guide*, it describes the slide contents and provides certain background information that the presenter may wish to use to amplify the contents of selected slides as appropriate.

Basic (16-Page) Brochure. This 16-page brochure (8-1/2" x 11") summarizes research on the problem of older adult pedestrian safety, describes the major risks facing older adults and recommends specific ways for them to improve their safety. It covers all items described previously for the program video and slide set. Originally prepared under a previous NHTSA contract[4] for individuals or organizations that would serve as "gatekeepers" to the older adult audience, it became apparent that it could be distributed directly to the target group or to the population at large.

12-Page Flyer. This flyer (4" x 9") summarizes information provided in the basic brochure described above.

8-Page AAA Flyer. This flyer (4" x 9") summarizes information presented in the basic brochure. It was produced by AAA.

2-Page AAA Flyer. This flyer (4" x 9") was also produced by AAA. It emphasizes the importance of seeing and being seen.

***Street Smart Seniors* Video.** This 16 minute video was developed by the Pedestrian and Bicycle Safety Program at the University of Texas Health Science Center. It covers the same basic problems and remedial behaviors that are addressed in the *Walking Through the Years* video prepared by the project but uses a different creative approach.

It is interesting to note that, although Phoenix and Chicago were provided with the same package of materials, the resultant countermeasure program implemented in each was quite different. These programs are described in the next section of this report.

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[4] Blomberg, R.D., Cleven, A.M. and Edwards, J.M. *Development of Safety Information Materials and Media Plans for Elderly Pedestrians.* Final report to the National Highway Traffic Safety Administration, Contract No. DTNH22-89-C-07397, June 1993, Dunlap and Associates, Inc., Norwalk, CT. Report No. DOT HS 808 132.

V. PROGRAM DESIGN AND IMPLEMENTATION

Early in the study effort, the project staff and representatives from both test cities agreed that the countermeasure program should focus on education and engineering activities. There was insufficient lead time for the development and enactment of legislative countermeasures (e.g., state laws or local ordinances). In addition, it was not practical to attempt to implement ordinances at the zone level. Enforcement countermeasures were excluded because it was not considered politically viable to base a program on giving summonses to the older adult. It was recognized, however, that the police have high source credibility for safety information with the older adult community and might, therefore, serve as excellent information transmitters.

It was recognized that it would not be possible to direct all PI&E countermeasures to the zones. Some (e.g., radio and television PSAs) would, of necessity, be directed to the entire city.

It was determined that countermeasure activities should be mounted at a level that was practical and implementable within the typical operating budgets of the test communities even when paid by the project. To this end, the project agreed to supply all needed copies of PI&E materials and be responsible for their distribution. City resources would be used only when they were routinely available (e.g., use of the city print shop for small runs and use of local police to make presentations to older adults as part of an ongoing police community relations program). The city itself would implement any engineering improvements within its routine operating budget.

Development of the countermeasure programs for the test sites was initiated by two activities:

- A detailed review by city representatives of available print and audiovisual PI&E countermeasures (described in Section IV) and selection of those to be implemented in their countermeasure programs.

- An on-site analysis of each zone in the sites to identify the need for engineering countermeasures. This activity resulted in a list of suggested roadway improvements from which city representatives could select those that were implementable within their operating budgets. The zone analysis also provided for identifying PI&E resources in the zones (e.g., libraries, senior residences, senior centers, etc.) that might serve as distribution points for program materials.

The design and implementation of the resulting PI&E and engineering countermeasure programs in each city are described in the following paragraphs.

A. The Phoenix Countermeasure Program

1. Engineering Program

The zone analysis in Phoenix was conducted in January of 1992. It was performed by the project staff and representatives from the Phoenix Street Transportation Department.

A detailed loose-leaf workbook was prepared as an aid for the analysis. It provided a description of each zone and of each older adult pedestrian crash in the zone (including the neighboring 1/2 mile area). A diagram of each zone showed the location of each pedestrian crash. Data sheets were provided for diagramming those locations where engineering improvements might be made and for noting PI&E opportunities, for example, the locations of senior centers, senior housing, billboards, hospitals/clinics, etc. A section of the workbook (prepared for Zone 1) is reproduced in Appendix D. An accompanying document contained police crash reports for each crash in the zones (and the neighboring 1/2 mile area) as well as any citizen complaints received for the area. Specific crash locations and PI&E opportunities were documented on a video tape by the project/city team as they surveyed the crash locations within the zones.

With the exception of activities such as tree trimming for improved sight distance, repair of road surfaces and refreshment of crosswalks (which continued throughout the duration of the project as needed), all roadway improvements were made in the spring of 1992. The engineering activities were:

- Installation of signs explaining the meaning of each phase of the pedestrian WALK/DON'T WALK signal (see Figure 3).

Figure 3. Phoenix pedestrian signal explanation sign.

- Installation of overhead advanced pedestrian warning signs.
- Repair of pavement in pedestrian crossing area.
- Trim or removal of trees/shrubs and removal or relocation of signs and other impediments to sight distance.
- Installation, removal, relocation or repainting of crosswalks, as appropriate.
- Installation of a wheelchair ramp and high visibility crosswalk for the main pedestrian access point between two hospital facilities.
- Installation of "Use Caution When Entering Street" signs.
- Replacement of "generic" push button signs at a five-point intersection with custom signs that specify which street each push button controls.
- Traffic signal timing improvements.
- Installation of a rumble strip in advance of a high-use marked crosswalk.

2. PI&E Program

A comprehensive PI&E program on pedestrian safety was designed for the older residents of Phoenix. The program was planned in cooperation with representatives from the Phoenix Street Transportation Department.

Samples of all materials available to the project (see Table 3) were provided to Phoenix representatives for program planning purposes. Print materials were initially provided in negative or glossy form. Subsequently, the City of Phoenix Community Traffic Safety Program (CTSP) agreed to print 10,000 copies of each of four program flyers and two small pedestrian/motorist brochures for the project. In addition, NHTSA agreed to provide 50,000 copies of all 13 program flyers and the two small pedestrian/motorist brochures. The project video and television PSAs were customized for the City of Phoenix by adding the city logo to the end.

All of the materials *developed* by the study were selected for inclusion in the PI&E program. These consisted of the video and discussion guide, the five television PSAs and the 13 flyers (envelope stuffers/door hangers). Of the materials *adapted* to provide a common *Walk Through the Years* theme, the bus cards and the two pedestrian/motorist brochures were selected for the program. Of the materials previously developed and *used intact*, only the radio PSAs (English and Spanish) were selected for inclusion in the program. It was also agreed that every attempt would be made by the Phoenix representatives to distribute materials through a variety of organizations and to encourage program coverage by the media.

Since the PI&E program was a major countermeasure in this study, the Phoenix Street Transportation Department sponsored a survey to assess whether there were gains in pedestrian safety knowledge that could be attributed to the PI&E program. Baseline data for this survey were collected in 1993 and post-PI&E data were collected throughout the PI&E program. Survey results are presented in Section VI.

The original countermeasure plan provided for PI&E to be scheduled over a period of one year starting in the spring of 1994. The time was extended to one and one-half years in order to permit the distribution of the 13 program flyers and two small pedestrian/motorist brochures that were not available from NHTSA until the spring of 1995 (see Appendix C). The PI&E program therefore started in the spring of 1994 and ended in the fall of 1995.

A chronological listing of the PI&E program activities implemented in Phoenix follows:

May 1994 - Radio PSAs on the multiple threat problem were delivered to seven radio stations that cater to the older audience.

Jun 1994 - Bus cards were mounted in 200 city buses.

Jun 1994 - The Phoenix City Council released a report on the study.

Jun 1994 - A radio interview on the study was conducted with a Phoenix Street Transportation Department representative.

Jul 1994 - An article on the project was printed in the *Arizona Informant*--a newspaper oriented toward the African- American audience.

Aug 1994 - An article on the study was printed in the city's August water bill mailer.

Aug 1994 - An article on the project was printed in both valley newspapers--the *Phoenix Gazette* and the *Arizona Republic.*

Sep 1994 - A section of the 5:00 pm news on one television station was devoted to the study.

Sep 1994 - Four program flyers and two brochures printed by the local CTSP were distributed to four homeowner's associations in the zones.

Sep 1994 - The four program flyers, two brochures and video were delivered to the American Association of Retired Persons (AARP).

Oct 1994 - The four program flyers, two brochures and video were distributed to 17 senior centers in the city.

Oct 1994 - The four program flyers and two brochures were given to the City's Senior Services Division for distribution at their retirement fair.

Oct 1994 - The four program flyers and two brochures were distributed to 10 privately-owned retirement communities in the zones.

Nov 1994 - The four program flyers and two brochures were delivered to 11 elderly City of Phoenix Housing Department residences.

Nov 1994 - The four program flyers and two brochures were delivered to five Phoenix motor vehicle offices.

Nov 1994 - The four program flyers and two brochures were delivered to four zone libraries.

Dec 1994 - The video was delivered to the local education and city cable channels.

Jan 1995 - PSAs on turning vehicles were delivered to seven radio stations that cater to the older audience and in Spanish to four Spanish-language stations.

Jan 1995 - The program flyers and two brochures were delivered to eight police precincts for distribution through their Neighborhood Police Officer Patrol Program in which officers communicate with residents on a variety of topics including traffic safety.

Feb 1995 - Television PSAs were delivered to seven television stations.

Apr 1995 - Three of the project flyers were distributed as door hangers to each residence in the circular zones.

Apr 1995 - A Phoenix Street Transportation Department representative was interviewed on one television channel.

May 1995 - The Phoenix Street Transportation Department representative made presentations on the project to the Surface Transportation Advisory Committee (a citizen's subcommittee that makes recommendations to the City Council) and the Traffic Subcommittee of the City Council.

Jun 1995 - A local television station requested and received copies of project materials.

Sep 1995 - Five of the project flyers and one brochure were distributed as door hangers to each residence in the circular zones.

Nov 1995 - The remaining five project flyers and brochure were distributed as door hangers to each residence in the circular zones.

In summary, some PI&E activities were directed to the city at large, some to older adults in the city, some to the zones at large and some to older adults in the zones. Those directed to the city at large made use of television, radio, newspapers, the city water bill mailer, bus cards, motor vehicle offices and police precincts as distribution points. Those directed to older adults in the city made use of AARP, senior centers, a retirement fair and senior housing as distribution points. Those directed to the zones at large made use of homeowner's associations, libraries and *all* individual residences (for distribution of door hangers) as distribution points. Those directed to older adults in the zones made use of retirement communities as distribution points.

The *major* targeting accomplished in Phoenix consisted of the zone distributions made in April, September and November of 1995. For these distributions, 50,000 copies of each of 15 different materials (the 13 flyers and two small pedestrian/motorist brochures) were delivered as door hangers to *each* zone residence.

B. The Chicago Countermeasure Program

The Chicago program was initiated by preparation of a document entitled *Chicago Prospectus* (see Appendix B). It explained the zone definition process and provided illustrations of the zones identified in the city. It also described the available PI&E materials and listed specific tasks that needed to be performed to implement the zone concept in Chicago. It was intended both as a promotional piece to help enlist relevant Chicago agencies in the program and as a working guide for the program participants.

1. Engineering Program

The zone analysis in Chicago was conducted in August of 1994. It was performed by the project staff and representatives from the Chicago Department of Transportation. A safety zone field survey checklist (see Appendix E) was prepared to aid in the analysis. The checklist was designed to capture many of the key factors known to contribute to crash causation. It included four main areas: factors that can limit the driver's or pedestrian's search, potential or observed conflicts, driver and pedestrian behaviors that indicate unsafe situations, and factors that increase the likelihood that a driver or pedestrian will commit an error leading to a crash.

As a result of the zone analysis, the following activities were selected for the roadway improvement program in Chicago:

- Remounting of post-mounted "No Turn on Red" signs next to overhead span-mounted traffic signals.

- Checking of WALK signal timing to ensure adequate walking time and proper functioning.
- Checking of intersections for visual clutter and relocation of any impediments to site distance.
- Addition of span-mounted traffic signals where there are currently side-mounted signals.
- Installation of curb parking restrictions within 50 feet of signalized intersections.
- Installation of large pedestrian signal heads at selected intersections.
- Review and upgrade of nighttime lighting as appropriate.
- Installation of pedestrian barriers at selected intersections where pedestrian crossings are prohibited.

Cut-backs in engineering personnel following the zone analysis prevented Chicago personnel from actually performing any of these roadway improvements except for those that were part of on-going programs. The latter included adding span-mounted signals and installation of larger pedestrian heads at selected intersections.

2. PI&E Program

The PI&E program in Chicago was planned in cooperation with representatives from the Chicago Department of Transportation, Department on Aging and Police Department. The same package of materials (see Table 3) provided for the Phoenix program was made available to the Chicago representatives.

As was true of the Phoenix program, all of the materials *developed* by the study were selected for inclusion in the Chicago PI&E program. These consisted of the video and discussion guide, the five television PSAs and the 13 flyers (envelope stuffers/door hangers). Of the materials *adapted* to provide a common *Walk Through the Years* theme, both bus cards and the two pedestrian/motorist brochures were selected for the program. Of the materials previously developed and *used intact*, the slide set and presenter's guide and the 8-page AAA flyer were chosen for the program. NHTSA provided 60,000 copies of each of the 13 flyers and two small pedestrian/motorist brochures. The project provided 20,000 copies of the AAA brochure. The project video and television PSAs were customized for the City of Chicago.

The Chicago program was initiated in June of 1995 and was completed in the fall of 1996; as with the Phoenix program, therefore, the Chicago PI&E program was in existence for about one and one-half years. However, the number of activities involved was not as extensive as that for Phoenix. Shortly after the program was initiated, coping with a

severe heat wave of the summer of 1996 took precedence over program activities. In addition, cut-backs in personnel prompted elimination of many planned program activities.

The Chicago Department of Transportation agreed to sponsor a survey to assess whether there were gains in pedestrian safety knowledge that could be attributed to their PI&E program. A very small set of baseline data for this survey was collected in the spring of 1995. Since personnel were not available to collect additional data, the survey effort was not pursued further.

A chronological list of the PI&E activities performed in Chicago follows:

Jun 1995 - A teacher-training session was conducted for approximately 50 Police Department Neighborhood Sergeants to prepare them to make presentations to older adults on pedestrian safety. The police were provided with videos, the slide set and presenter's guide and all project print material.

Jul 1995 - Project print materials were distributed at the Mayor's senior picnics.

Nov 1995 - Television PSAs were delivered to Chicago television stations.

Jan 1996 - Police presentations were made at three senior centers and to three older adult groups.

Feb 1996 - Notice of the available police presentations was printed in the Department on Aging publication *Issues and Events*.

Feb 1996 - Police presentations were made at two senior centers.

Feb 1996 - Print materials were distributed at the city auto show.

Mar 1996 - Police presentation was made to one older adult group.

Apr 1996 - Police presentations were made at one senior center and to one older adult group.

Apr 1996 - Project video and PSAs were delivered to the city cable channel.

May 1996 - Police presentations were made at the city health fairs.

Jun 1996 - Police presentations were made at additional city health fairs.

Jun 1996 - The project video was sent to all libraries in the zones.

Nov 1996 - Bus cards were mounted on 200 buses whose routes go through the zones.

In summary, the Chicago PI&E program relied heavily on police presentations made at senior centers and to other senior groups. At these presentations, the project videos was shown and print materials (13 flyers, two small pedestrian/motorist brochures and the 8-page AAA brochure) were distributed.

As with the program in Phoenix, some PI&E activities in Chicago were directed to the city at large, some to older adults in the city, and some to the zones at large. No activities were directed to older adults in the zones. Those directed to the city at large made use of television and the auto show as distribution points. Those directed to older adults in the city made use of the senior center presentations and health fairs as distribution points. Those directed to the zones at large made use of bus cards and libraries. Thus zone targeting of countermeasures was minimal in Chicago.

VI. PROGRAM EVALUATION

This section describes program evaluation procedures and results. Although both Phoenix and Chicago participated as test cities in this study, various unanticipated problems that occurred in Chicago prevented full program implementation and evaluation in that city. Therefore, a full crash-based evaluation was performed only on the Phoenix data. For Phoenix, the discussion that follows includes evaluations of the survey of knowledge, the pedestrian crash data and process data. For Chicago, the evaluation covers process data only.

A. Phoenix Knowledge Survey

Since the PI&E program was a major countermeasure in this study, the Phoenix Street Transportation Department sponsored a survey to assess whether there were gains in pedestrian safety knowledge that could be attributed to the PI&E program. Specifically, answers were sought to the following research questions:

- Did the messages get across?
- Who received the messages?
- How strongly were they received?
- Which messages (in terms of content and media) worked best?

Data were collected in 10 waves. There were three waves of data collected *prior to* the initiation of PI&E countermeasures (baseline waves) and seven waves of data collected *after* the initiation of PI&E countermeasures (post-PI&E waves). Table 4 shows the dates of the 10 survey waves and the PI&E activities that occurred prior to (or during) the conduct of each wave.

Table 4 shows that, during waves 4 through 6, there was program coverage in the media, at senior activities and residences and in certain locations open to the public (buses, libraries, motor vehicle offices and police precincts). For the last three waves, the primary activity involved the distribution of program flyers and brochures as door hangers to *each residence* in the zones. In all, 15 pieces on pedestrian safety were distributed to each zone residence in the last three waves.

Survey data were collected on age, gender, zone residence and walking habits of the respondents as well as specific PI&E that they had seen, heard or read recently in Phoenix and knowledge of selected pedestrian safety issues. In addition, as part of its engineering countermeasure program, the Street Transportation Department had erected signs in the zones that explained the meaning and use of the various phases of the WALK/DON'T WALK signal, and a question was added to the survey form to determine whether interviewees had seen the signs.

Table 4
Survey waves and project PI&E activities.

Survey Wave	Dates	PI&E Activities
Baseline waves:		
Wave 1	January/February 1993	
Wave 2	April/May 1993	No PI&E activities occurred during the baseline period
Wave 3	October 1993	
Post-PI&E waves:	(PI&E initiated May 1994)	Radio interviews, delivery of radio PSAs, newspaper articles, article in city's water bill mailer, television coverage, display at retirement fair, and delivery of project materials to homeowner's associations in the zones, AARP, city senior centers and retirement communities in the zones
Wave 4	October 1994	
Wave 5	November 1994	Delivery of project materials to motor vehicle offices, additional retirement communities in the zones and zone libraries
Wave 6	December 1994	Delivery of project video to cable channels
Wave 7	February 1995	Delivery of Spanish and English radio PSAs, delivery of project materials to police precincts for use in the Neighborhood Police Officer Patrol Program
Wave 8	April 1995	Delivery of television PSAs, television news interview and delivery of project flyers as door hangers to each residence in the zones
Wave 9	September 1995	Newspaper article and delivery of project flyers as door hangers to each residence in the zones
Wave 10	November 1995	Delivery of project flyers as door hangers to each residence in the zones

The final survey form (see Appendix F) consisted of 10 questions (Qs) that were used to obtain the following data about the pedestrian:

Q1. Gender (observed, not asked)

Q2. Age

Q3. Time spent in the Phoenix area

Q4. Distance lived from the interview site

Q5. Amount of outdoor walking the respondent does

Q6. Respondent's opinion on whether drivers have difficulty seeing walkers in the daytime and what pedestrians can do to help drivers see them in the daytime

Q7. What the respondent would do if part way across the street and the DON'T WALK signal flashes

Q8. PI&E on safe walking that the respondent has seen, heard or read recently in Phoenix

Q9. Signs that the respondent has seen on Phoenix streets that give information or advice to walkers

Q10. Whether the respondent has seen project flyers

Data were collected in each of the six circular study zones and in one non-zone location--selected to be at least two miles from any of the study zones. Procedures for collecting the data are described in Appendix E.

The information obtained from the surveys is presented below. The data are presented in terms of percentages, and "no answer" responses have been excluded except where noted. Numbers on which the percentages are based are provided. Significant associations between waves of data collection, e.g., before and after countermeasure distribution, were tested for those survey results which relate to the research questions addressed by the study using the chi-squared nonparametric test. Differences reaching the 0.05 level of significance or less are noted.

Q1. Gender

As shown in the following table, there were slightly more males than females in the baseline group. In the post-PI&E group, however, there were approximately 10% more females than males.

Gender	Baseline N = 2131	Post-PI&E N = 2749
Males	51.4%	44.6%
Females	48.6	55.4

Q2. Age

Pedestrians were only selected as potential respondents if they appeared to be 65 years old or older. If they refused to answer the second question (at least to admit to being 65 or older) or responded that they were under 65, they were omitted from the survey. A broad range of the elderly residents of Phoenix participated in the survey. Those interviewees who refused to give their exact age but were willing to admit to being 65 years of age or older are indicated in the following table by the 65+ category.

Age	Baseline N = 2133	Post-PI&E N = 2751
65+	15.5%	11.2%
65 - 69	32.4	31.2
70 - 74	19.4	20.4
75 - 79	15.0	17.7
80 - 84	10.1	10.7
85 - 89	4.7	6.1
90+	2.8	2.8

Ages for both males and females ranged from 65 to 99 and were similar for both baseline and post-PI&E groups. The average age for males who provided an age was calculated to be 73.3 and that for females was calculated to be 74.5 (in these calculations, an age of 92 was used for the 90+ category).

Q3. Time spent in the Phoenix Area

As shown in the following table, most of the respondents in both the baseline and post-PI&E groups (93.9% and 95.2%, respectively) were full-time residents of the Phoenix area. The data were similar for both males and females.

Time spent	Baseline N = 2133	Post-PI&E N = 2751
Full-time	93.9%	95.2%
Part-time	6.1	4.8

A part-time resident was defined as one who routinely spent one or more months a year in the Phoenix metropolitan area but less than 12 months. Of the small number of part-time residents, 60% spent six or more months annually in the city. As shown in the following table, the percentage was 68.8% for the baseline group and 51.5% for the post-PI&E group.

Months spent	Baseline N = 128	Post-PI&E N = 132
<6 months	31.8%	48.5%
6+ months	68.8	51.5

Q4. Distance Lived from the Interview Site

When asked how far they lived from the interview site, some respondents reported distance in miles and some in blocks. An examination of the responses made by zone residents who reported the distance in blocks revealed that 99% of those residents lived within 12 blocks of the interview site. For purposes of converting block data into miles, it was determined that six blocks would equal one mile. The results are shown in the following table.

Distance	Baseline N = 2116	Post-PI&E N = 2543
1 - 2 miles	69.5%	68.7%
3 - 5 miles	20.2	21.0
6 - 10 miles	6.9	6.2
11+ miles	3.4	4.1

The table shows that most of the respondents lived very near the interview site. Almost 70% of the respondents in both groups lived within two miles and an additional 20% lived within five miles of the interview site.

Interviewees who reported the distance in blocks or who reported living within two miles of the interview site were shown a map of the zone in which they were interviewed and asked if they lived within the circular area shown on the map. The results show that about half of the respondents were zone residents. There were slightly more zone residents in the baseline group than in the post-PI&E group (53.8% and 47.6%, respectively). These results are shown in the table that follows.

Zone resident	Baseline N = 2071	Post-PI&E N = 2691
Yes	53.8%	47.6%
No	46.2	52.4

The zone residence data are assumed to be conservative since interviewees were asked only if they lived in the zone in which the interview took place. Some of them may well have lived in one of the other study zones. In addition, this question was not asked of interviewees in the non-zone location since this location was specifically selected to be at least two miles from any of the circular zones. Some of these individuals may well have lived in one of the study zones.

The number and percentage of each zone's interviewees who were residents of that zone are shown in the following table.

	Baseline		Post-PI&E	
Zone	N	%	N	%
Zone 1	186	60.8%	226	61.4%
Zone 2	138	45.2	207	52.9
Zone 3	164	49.7	237	57.1
Zone 4	203	57.8	322	61.9
Zone 5	158	56.6	144	46.5
Zone 6	107	59.4	274	94.5
Non-zone	--	0.0	--	0.0

The table shows some differences in the data among the zones and between baseline and post-PI&E groups. The most marked difference is that for zone 6 where a senior residence replaced a grocery store following the collection of baseline data. This senior residence accounted for 94.5% of the post-PI&E group responses.

In terms of gender, in the baseline group, approximately equal numbers of male and female interviewees lived in the zone in which they were interviewed. In the post-PI&E group, however, there were more females than males who lived in the zones. These data are shown in the table that follows.

Zone resident	Baseline N = 955	Post-PI&E N = 1409
Male	50.6%	41.7%
Female	49.4	58.3

Q5. Amount of Outdoor Walking Respondent Does

In order to find out how frequently the respondents were pedestrians on the city's streets, they were asked how often they go for walks outdoors. The results are shown in the table that follows.

How often walk	Baseline N = 2111	Post-PI&E N = 2732
3-7 days/week	54.7%	54.8%
1-2 days/week	10.0	9.6
1-3 days/month	5.8	4.4
Few times/year	7.6	4.4
Never/city streets	10.1	11.1
Never walk	11.8	15.8

The table shows that approximately 55% of both the baseline and post-PI&E groups reported that they walk almost daily and approximately two-thirds reported walking at least weekly. However, about 21.9% of the baseline group and 26.9% of the post-PI&E group reported either that they do not walk at all or never walk on city streets.

As the following table shows, some differences were noted in the walking habits of males and females.

	Males		Females	
How often walk	Baseline N=1085	Post-PI&E N=1220	Baseline N=1024	Post-PI&E N=1510
3-7 days/week	60.5%	60.4%	48.5%	50.2%
1-2 days/week	8.8	9.1	11.3	9.9
1-3 days/month	4.9	3.8	6.7	4.9
Few times/year	8.1	4.4	7.1	4.4
Never on city streets	6.8	8.4	13.7	13.2
Never walk	11.0	13.9	12.6	17.4

The table shows that approximately 60% of the men in both groups reported that they walk 3 to 7 days per week in contrast to about 50% of the women. Although there are more respondents in both male and female post-PI&E groups who reported never walking at all in comparison to their baseline groups, the percentage for females (17.4%) is larger than that for males (13.9%). In addition, more women in both the baseline and post-PI&E groups (26.3% and 30.6%, respectively) reported either that they never walk on city streets or never walk at all than did the men (17.8% and 22.3%, respectively).

Q6. Do Drivers Have a Problem Seeing Walkers in the Daytime?

Respondents were asked if they felt drivers have a problem seeing walkers in the daytime. Responses are shown in the following table.

Problem seeing***	Baseline N = 2104	Post-PI&E N = 2716
Yes	13.9%	18.5%
No	78.9	75.1
Don't know	7.2	6.4

*** χ^2 = 18.84 with 2 d.f., $p < .001$

In general, most respondents in both groups felt that drivers do not have a problem seeing walkers in the daytime. A statistically significant increase of 33% (4.6 percentage points) between the baseline and post-PI&E groups was noted in respondents who felt that drivers *do* have a problem seeing walkers in the daytime.

One of the 15 flyers distributed to zone residents addressed this particular problem and stressed the importance of the walker's being conspicuous at all times--either by wearing something that makes the walker conspicuous both in the daytime and at night or by waving one's arms. The flyer was distributed prior to the final post-PI&E wave (wave 10).

The next table shows the numbers and percentages of "yes" answers to this question (that is, respondents felt that drivers *do* have a problem seeing walkers in the daytime) for different subsamples of the data--the total group, males, females, walkers on city streets, zone residents and respondents who reported having seen one or more of the project flyers. For this analysis, post-PI&E wave 10 has been separated from the other post-PI&E waves so that the effect, if any, of the distribution of the specific flyer addressing conspicuity can be shown. The chi square statistic compared the baseline frequencies with those for post PI&E wave 10.

For the total group, the table shows an overall statistically significant increase of 55% (7.6 percentage points) between baseline results and results of post-PI&E wave 10 in respondents who recognize that drivers can have problems seeing walkers in the daytime. The data for males and females are similar (increases of 53% and 56%, respectively). Zone residents show a statistically significant increase of 44%. The largest increase (74%) occurred with respondents who reported that they walk anywhere from seven days a week to a few times per year (those who never walk or don't walk on city streets were eliminated from this group).

Data Sample	Drivers have a problem seeing walkers Baseline Waves 1-3 N	%	Post-PI&E Waves 4-9 N	%	Post PI&E Wave 10 N	%
Total group***	292	13.9%	413	18.0%	90	21.5%
Males*	147	13.5	194	18.9	39	20.6
Females**	145	14.3	219	17.2	51	22.3
Walkers on city streets***	224	13.8	338	20.5	77	24.0
Zone residents*	133	14.1	207	18.0	48	20.3
Respondents seeing flyers	--	+	19	17.8	27	19.7

* Males: $\chi^2 = 6.54$ with 1 d.f., $p < .02$
Zone residents: $\chi^2 = 5.61$ with 1 d.f., $p < .02$
** Females: $\chi^2 = 8.98$ with 1 d.f., $p < .01$
*** Walkers: $\chi^2 = 21.43$ with 1 d.f., $p < .001$
Total group: $\chi^2 = 15.89$ with 1 d.f., $p < .001$
\+ The 15 flyers were distributed prior to waves 8, 9 and 10 only; baseline data were not collected for this group.

The increase for those who reported having seen the flyers was only 11%. However, the sample size is very small. In addition, comparisons are not totally similar since no baseline data were available for this group.

Those who responded "yes" to this question, that is, they felt that drivers do have a problem seeing walkers during the daytime, were asked what walkers can do to help drivers see them in the daytime. The responses obtained are shown in the following table. Numbers do not add to 100% since more than one response was permitted per person.

What walkers can do	Baseline N = 292	Post-PI&E N = 503
Wear something light, bright, contrasting, fluorescent	52.4%	42.3%
Move something (arms, body, scarf, cane)	7.2	5.8
Don't know, no opinion	23.6	27.4
Other	16.4	22.1

There was a decrease from baseline to post-PI&E data in mentions of major means of being conspicuous, that is, by wearing something conspicuous or by moving something. In addition, about one-quarter of respondents in both groups reported that they did not know what to do to help drivers see walkers in the daytime.

Q7. What to Do If the DON'T WALK Signal Flashes

Interviewees were asked what they should do if they are part way across the street and the DON'T WALK signal flashes. The results are shown in the following table.

What walker should do	Baseline N = 2098	Post-PI&E N = 2706
Continue crossing	50.1	47.7
Hurry/run across	24.1	28.0
Wait in middle	8.5	7.6
Return to curb	7.2	4.7
Don't know	8.7	9.3
Other	1.4	2.7

The correct response to this question is "continue crossing" since, if the pedestrian signal is properly maintained, there should be adequate time for the walker to cross the street when the light flashes. Since many people feel a little rushed when the DON'T WALK signal flashes, the category of "hurry/run across" could also be considered a correct response to the question. The combination of these two categories (which provides percentage values of 74.2% for the baseline and 75.7% for the post-PI&E group) shows that a large number of interviewees responded correctly to this question both before and after the program implementation and that there was essentially no improvement in this knowledge category.

Many people do not understand the meaning of the flashing DON'T WALK signal. Therefore, one of the flyers distributed as part of this study explained that the signal means "don't start to cross the street." The flyer noted that, if the signal flashes when the walker is in the street, the walker should continue to cross at a normal walking pace. The walker was also advised not to stop in the middle of the street or return to the curb. This flyer was distributed prior to the collection of data for post-PI&E wave 9. It was therefore of interest to examine responses to this question before and after the ninth wave of survey acquisition.

The next table shows the percentages of combined "continue crossing" and "hurry/run across" for different subgroups of the data. For this analysis, post-PI&E waves 9 and 10 have been separated from the other post-PI&E waves so that the effect, if any, of the flyer distribution can be seen.

Data Sample	Continue crossing or hurry/run across: Baseline Waves 1-3 N	%	Post-PI&E Waves 4-8 N	%	Post PI&E Waves 9-10 N	%
Total group	1558	74.2%	1483	75.8%	567	75.8%
Males	833	77.0	776	77.6	265	78.6
Females	723	71.2	805	74.2	302	73.5
Walkers on city streets	1270	77.3	1134	79.5	449	80.8
Zone residents	696	73.8	764	77.0	303	77.5
Respondents seeing flyers	--	+	43	86.0	153	79.3

+ The 15 flyers were distributed prior to waves 8, 9 and 10 only; baseline data were not collected for this group.

The table shows that all subgroups had a large percentage of correct responses to this question for the baseline and for the post-PI&E wave groups. There is no evidence that knowledge with respect to pedestrian signals was increased remarkably among any of the subgroups as a result of the PI&E program or, specifically, of the distribution of the flyer that explained the flashing DON'T WALK signal. Most increases between baseline and post-PI&E data were very small. The largest increases were obtained for zone residents (5%) and for individuals who report that they walk at least a few times a year (5%).

It should be noted that the post-PI&E wave 4-8 data for respondents who reported having seen the flyers are actually based on only a single wave (wave 8) when this question was added to the survey form. There was only a small number of cases in wave 8 for respondents seeing the flyer. Thus, the apparent drop between waves 4-8 and waves 9-10 is likely a result of data instability.

Q8. PI&E on Safe Walking Seen, Heard or Read Recently in Phoenix

Interviewees were asked if they had seen, heard or read anything recently on safe walking in Phoenix. The percentages of those who responded "yes" in each survey wave are shown in the following table along with the major project PI&E contacts that preceded collection of data for the specific study wave. (A complete list of PI&E activities was provided in Section V of this report and summarized in Table 4.)

The table shows that the percentage of people who reported having been exposed to PI&E on safe walking decreased markedly in the second post-PI&E wave (study wave 5) from that reported in the baseline data. There is no apparent explanation for this decrease. Slight and gradual increases occurred in the next two post-PI&E waves (study waves 6 and 7). Very large increases occurred in the last three post-PI&E waves (study waves 8, 9 and 10). The last three waves were preceded by the distribution of the 15 different project flyers and brochures as door hangers to all zone residents.

Study wave	% seen msg	Major project contacts
Waves 1-3	9.4%	None (baseline)
Wave 4	9.2	Zone homeowner's associations, bus riders, AARP, retirement fair, senior centers plus radio, television, newspaper and water bill contacts
Wave 5	2.6	Motor vehicle offices, zone retirement communities, zone libraries
Wave 6	10.3	Cable channels
Wave 7	12.1	Police precincts plus radio contacts (Spanish and English)
Wave 8	19.6	Each zone residence plus television contacts
Wave 9	25.1	Each zone residence
Wave 10	34.1	Each zone residence

At the completion of the PI&E countermeasure program, 34.1% of the residents reported having seen, heard or read something about safe walking in Phoenix. It is apparent from these data that the cumulative PI&E countermeasure program did get through to the residents of Phoenix. The particularly large increase in positive responses to this question supports a conclusion that the door hangers were likely an effective means of reaching the target audience.

It should be emphasized that, although specific PI&E materials were distributed at specific times, many of them were available to the public from the time of distribution until the end of the study. For example, radio PSAs distributed prior to wave 4 could have been played at any time during the conduct of the study. Bus cards, once mounted, were available throughout the program. Materials distributed to libraries, motor vehicle departments, police precincts, etc., were also available throughout the program. Hence, some cumulative PI&E effects might be expected.

Those who responded "yes" to Question 8 were asked to indicate where they had seen or heard the message. The results obtained are shown in the following table. In order to assess whether respondents were exposed to specific project PI&E, the data are broken down by survey wave as follows: baseline waves 1 through 3, post-PI&E waves 4 through 7, and post-PI&E waves 8 through 10. Percentages are based on those who responded "yes" to Question 8.

The table shows that door hangers (distributed by the project) were the largest source of PI&E information that the respondents saw in the three final study waves. With the exception of the door hangers, television and newspapers were the largest sources of information on safe walking reported by the respondents. It is interesting to note that the percentage of responses for both of these categories decreased from the baseline to the post-PI&E waves.

Where seen/heard	Baseline Waves 1-3 N = 198	Post-PI&E Waves 4-7 N = 136	Post-PI&E Waves 8-10 N = 298
Door hanger	--	--	45.3%
Newspaper	29.3%	21.3%	19.8
TV	41.4	33.8	19.1
Pamphlet/flyer	--	5.1	7.4
Radio	3.5	2.2	4.0
Poster	1.0	--	3.4
Billboard	1.0	0.7	0.7
Video	--	--	0.3
Other	27.3	31.6	12.4

Those who responded "yes" to Question 8 were also asked to describe what the message was. An open-ended response was recorded by the interviewer. Results obtained are shown in following table. Again, percentages are based on those who responded "yes" to Question 8.

Message seen/heard	Baseline Waves 1-3 N = 198	Post-PI&E Waves 4-7 N = 136	Post-PI&E Waves 8-10 N = 298
Be conspicuous	1.5%	1.5%	4.4%
Watch for cars, always look, look left-right-left	1.0	2.9	3.7
Stop and look around visual screens	--	--	0.3
Use ped signal, use signal correctly	1.5	6.6	--
Use traffic light/crosswalk	1.5	5.1	1.7
Follow pedestrian rules	2.0	2.2	1.0
Walk facing traffic	3.5	2.2	0.7
Non-specific advice (e.g., "lots of articles")	2.5	17.6	9.4
Ped advice for motorists	--	2.9	2.0
Don't walk alone	7.6	2.2	--
Watch for personal safety	9.1	8.1	2.0
Be careful, look around	10.1	7.4	4.0
Other	9.1	11.8	18.5

There appears to be no pattern evident in the data that shows that respondents remembered *specific* messages presented by the study. However, it should be noted that no *specific* messages or catch phrases were *emphasized* in the program materials. Rather, over 30 *different* pedestrian safety messages were presented in addition to messages for drivers to watch out for pedestrians. It is not surprising, therefore, that much of what was remembered was general in nature (e.g., "lots of articles"). In addition, respondents reported receiving messages on personal safety, for example, "Don't walk at night," "Don't use radio earphones." Much of that advice (including such messages as, "Don't walk alone," "Be careful" and "Look around you") is also good advice from a pedestrian safety standpoint.

It should be noted that 56.6%, 34.6% and 57.4%, respectively, of the sample in the three time periods did not respond to this question. Thus, many respondents reported that they had been exposed to PI&E but were unable to recall what the message had been.

Q9. Signs Giving Information or Advice to Walkers Seen in Phoenix

Interviewees were asked if they have seen any signs on Phoenix streets that give information or advice to walkers. The primary purpose of the question was to determine if residents noticed special WALK/DON'T WALK advice signs describing the meaning and use of the various phases of the WALK/DON'T WALK signal. However, all major signs and signals were included as possible responses to the question. The results are shown in the following table. Baseline and post-PI&E data are combined since the signs were part of the engineering program and were mounted before any baseline survey data were collected.

Seen signs	Total
Yes	44.2%
No	55.8

Of those who responded "yes," the specific signs they reported seeing are given in the following table in decreasing order of mention.

Signs/signals seen	Total
WALK/DON'T WALK advice	66.6%
WALK/DON'T WALK signals	52.6
Don't cross here, use crosswalk	31.5
Traffic signals	28.8
Press button for walk	26.8
Use caution when entering street	9.7
School zone	7.5
Other	7.1

The table shows that the WALK/DON'T WALK advice sign was the most frequently mentioned sign or signal; it was mentioned by two-thirds of those who reported seeing a sign giving information or advice to walkers. Of the total sample (4884 respondents), 29.2% mentioned seeing the WALK/DON'T WALK advice sign.

Q10. Project flyers seen

As reported previously, 15 different project flyers were distributed to each zone resident as door hangers. For ease of distribution, the corners of the circular zones were extended so that each zone became a square. Thus, the flyers were distributed to a few non-zone residents who lived very near the zones. In all, 85.3% of the respondents who reported seeing the flyers also said that they were zone residents.

Three distributions were made; one preceded each of the last three study waves. Three flyers were distributed in the first wave, and six each were distributed in the remaining two waves. For the last question, the interviewer displayed the project flyers and asked respondents if they had seen them. The question was included only for the last three study waves (post-PI&E waves 8, 9 and 10). The results for those who responded "yes" are shown in the following table.

	Post-PI&E wave			
Group	8	9	10	Total
Total	13.5%	17.5%	32.9%	21.9%
Zone residents	18.3	30.8	51.5	35.1

The table shows a gradual increase in the number of respondents seeing the flyers both for the total sample and for zone residents. Discussions with the distributor revealed that some senior housing had been omitted from the two initial distributions since they were listed as "business addresses" in their files, not as "residence addresses." Unfortunately, it took until the third wave to eliminate these types of distribution problems.

Of those who reported seeing the flyers, 97.3% said they saw them at home. Only 2.6% saw them at some place other than their own home.

The results of the survey may be summarized as follows:

- For the total group, there was an increase between baseline and post-PI&E groups in the number of respondents who said that drivers can have a problem seeing walkers in the daytime. Increases were also achieved for several subgroups including males, females, zone residents and respondents who walk on city streets at least a few times per year. Walkers achieved the largest increase.

- Most Phoenix 65+ residents knew how to use the WALK/DON'T WALK signal at the start of the study. It might be noted that a much larger correct response

was obtained from Phoenix interviewees regarding use of the WALK/DON'T WALK signal than is typical of adults.[5]

- When asked if they had seen signs on Phoenix streets that gave information or advice to walkers, respondents reported the WALK/DON'T WALK sign (see Figure 3, page 20) as the one most frequently seen. These signs were mounted prior to the conduct of the first baseline survey wave.

- The 65+ Phoenix residents were aware of the project PI&E program, and this awareness increased markedly as the program progressed.

- Door hangers proved to be an extremely effective way of presenting PI&E information. When they were used, respondents reported them as the major source of PI&E information they received.

- Although a fairly large number of respondents reported being exposed to PI&E on safe walking, many were unable to recall unaided (i.e., without multiple choice options) the specifics of the messages they had seen, heard or read. Respondents frequently reported messages that were general in nature (e.g., "Lots of articles") or messages related primarily to personal safety (e.g., "Don't walk alone")--many of which are also good advice for pedestrian safety.

B. Phoenix Crash Data

This study had as its ultimate objective the reduction of age 65+ pedestrian crashes in the City of Phoenix, particularly in the selected study zones. Therefore, an attempt was made to obtain police reports describing each pedestrian crash for the baseline and program years. Police reports for Phoenix pedestrian crashes involving victims who were 65 years of age or older were available for the entire study period, that is, for all four baseline years (1988 through 1991) and for all four program years (1992 through 1995). Police reports for *all* pedestrian crashes were available for only the last two baseline years (1990 and 1991) and for all four program years. The data available to the study are summarized in the table on the following page.

An analysis of pedestrian crash data is provided in the paragraphs that follow. Presented first is a discussion of the pedestrian crash problem in the City of Phoenix as it relates to changes in the city's population over the study time period. It is followed by a comparison of the number of 65+ pedestrian crashes that occurred during the baseline and

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[5] A study conducted for the AAA Foundation found that only about half of adults sampled at driver licensing stations and at AARP responded correctly to a somewhat differently-phrased question on use of the signal. That question asked the respondent to confirm whether a person should return to the curb if, after entering the street, the WALK/DON'T WALK signal starts to flash. Reference: Tidwell, J. *Driver and pedestrian comprehension of pedestrian law and traffic control devices.* AAA Foundation for Traffic Safety, Washington, DC, December 1993.

program time periods, the injury severity of these crashes, and the NHTSA/FHWA crash type. Finally, the results of the time series analyses performed on the crash data are presented.

Available Police Crash Reports

Baseline data	1988	1989	1990	1991
65+ pedestrian crashes	✓	✓	✓	✓
All pedestrian crashes	-	-	✓	✓
Program data	**1992**	**1993**	**1994**	**1995**
65+ pedestrian crashes	✓	✓	✓	✓
All pedestrian crashes	✓	✓	✓	✓

1. Phoenix Pedestrian Crash Data and Population Changes

Prior to a presentation of the 65+ pedestrian crashes, a brief discussion of the overall pedestrian problem in Phoenix during the study period is relevant. It would be anticipated that pedestrian crashes in Phoenix would increase as the population in the city increases. Over the *abbreviated* (last two years of) baseline and the entire program time period (1990 to 1995) for which *all* pedestrian crash data were available for this study, this population increase was 16.9%.[6] Therefore, increases in pedestrian crashes might be expected.

All Phoenix pedestrian crashes (regardless of victim age or crash type) occurring in and outside the zones during the *abbreviated* baseline and program periods are shown in the following table.[7] Since the number of baseline and program years is not the same, average yearly crashes (instead of totals) are presented.

As would be expected, the table shows an *increase* in all pedestrian crashes in Phoenix over the study time period for which data on all pedestrian crashes were available. These *increases*, which are less than the population increase, were as follows:

- In-zone crashes = +9.5%
- Out-zone crashes = +4.9%

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[6] Population estimates made by the City of Phoenix Planning Department at five-year intervals were 983,403 for 1990 and 1,149,417 for 1995.

[7] As noted earlier, data on pedestrian crashes involving victims 65 years of age and older were available for the entire study period (1988-1995 inclusive). Data on pedestrian crashes to victims of all ages were available for only an abbreviated baseline period (1990-1991) and for the entire program period (1992-1995).

All Pedestrian Crashes					
Baseline data	**1988**	**1989**	**1990**	**1991**	**Avg**
In-zone crashes	--	--	136	123	129.5
Out-zone crashes	--	--	540	536	538.0
Total crashes	--	--	676	659	667.5
Program data	**1992**	**1993**	**1994**	**1995**	**Avg**
In-zone crashes	136	128	155	148	141.8
Out-zone crashes	545	525	557	631	564.5
Total crashes	681	653	712	779	706.3

A comparison of average yearly 65+ pedestrian crashes for the same time period (1990 through 1995) revealed the following *decreases*:

- In-zone crashes = −20.0%
- Out-zone crashes = −16.3%
- Total crashes = −17.3%

Therefore, based on the *abbreviated* time period for which data on all pedestrian crashes were available, the City of Phoenix experienced a smaller *increase* (5.8%) in overall pedestrian crashes than the increase (16.9%) in its population over the same time period. This *increase* occurred both within (9.5%) and outside (4.9%) study zones. However, the 65+ pedestrian crashes did not follow this trend and showed an overall *decrease* (17.3%) over the same time period. This *decrease* occurred both within (20.0%) and outside (16.3%) study zones.

2. Phoenix 65+ Pedestrian Crashes

Pedestrian crashes to victims 65 years of age and older occurring within and outside the defined zones over the *entire* baseline and program periods are given in the next table.

The table shows an overall reduction in the number of 65+ pedestrian crashes of 13.7% between the *entire* baseline and program periods (from 226 crashes in the baseline period to 195 crashes in the program period). The in-zone crashes were reduced by 46.3% (from 95 crashes in the baseline period to 51 crashes in the program period). The out-of-zone crashes over the same time period actually increased by 9.9% (from 131 crashes in the baseline period to 144 crashes in the program period).

65+ Pedestrian Crashes					
Baseline data	**1988**	**1989**	**1990**	**1991**	**Total**
In-zone crashes	31	32	17	15	95
Out-zone crashes	31	14	33	53	131
Total crashes	62	46	50	68	226
Program data	**1992**	**1993**	**1994**	**1995**	**Total**
In-zone crashes	9	17	16	9	51
Out-zone crashes	35	29	35	45	144
Total crashes	44	46	51	54	195

In summary, the 65+ crash data changes between the *entire* baseline and program periods revealed the following changes in total crashes:

- In-zone crashes = −46.3%
- Out-zone crashes = +9.9%
- Total crashes = −13.7%

The number of 65+ in-zone pedestrian crashes and percentage change by individual zone are shown in the following table.

Number of 65+ Pedestrian Crashes			
Zone	**Baseline (1988-1991)**	**Program (1992-1995)**	**% Change**
1	11	3	−72.7%
2	18	12	−33.3
3	16	5	−68.8
4	18	15	−16.7
5	15	5	−66.7
6	10.5‡	6	−42.9
7	6.5‡	5	−23.1
Total	95	51	−46.3%

‡One crash occurred where zones 6 and 7 overlap.

It is noteworthy that reductions in 65+ pedestrian crashes occurred in every one of the zones. The largest reductions occurred in zones 1, 3 and 5. The smallest reduction occurred in zone 4. Since all zones were treated essentially equally in terms of both engineering and PI&E countermeasures, there is no apparent reason for the differences in reductions among the zones.

As a percentage of all 65+ pedestrian crashes in the City of Phoenix, the in-zone pedestrian crashes decreased from 42.0% in the *entire* baseline period to 26.2% in the program period, a reduction of 37.6%. The in-zone 65+ crashes as a percentage of all 65+ crashes were as follows:

Baseline:	1988 = 50.0%			
	1989 = 69.6	42.0%		
	1990 = 34.0			
	1991 = 22.1			
				Reduction = 37.6%
Program:	1992 = 20.5%			
	1993 = 37.0	26.2%		
	1994 = 31.4			
	1995 = 16.7			

It might be noted that the zones were selected on the basis of 65+ crash data for 1988 through 1990--all years with high 65+ in-zone crashes (and, consequently, relatively low out-zone crashes). Discussions with local traffic safety personnel revealed no reasons why these years should not be considered representative of 65+ crashes in Phoenix. Local representatives felt that a large number of older adult crashes would be expected in the selected zones because of the large number of seniors there. Therefore, they considered the zones to be good target areas for focusing on older adult crashes.

As a percentage of all in-zone crashes (including those involving individuals less than 65 years old), the 65+ in-zone crashes decreased from 12.4% to 9.0%, a reduction of 27.4%. In-zone 65+ crashes as a percentage of all in-zone crashes were as follows:

Baseline:	1988 = No data[8]			
	1989 = No data	12.4%		
	1990 = 12.5%			
	1991 = 12.2%			
				Reduction of 27.4%
Program:	1992 = 6.6%			
	1993 = 13.3	9.0%		
	1994 = 10.3			
	1995 = 6.1			

Finally, as a percentage of citywide crashes regardless of location, the 65+ crashes decreased from 8.8% in the baseline period to 6.9% in the program period, a reduction of 21.6%. The 65+ crashes as a percentage of all crashes were as follows:

[8] As mentioned earlier, only data for pedestrian crashes involving those 65 and older were available for 1988 and 1989.

Baseline:	1988 = No data	)			
	1989 = No data	)	8.8%	)	
	1990 = 7.4%	)		)	
	1991 = 6.5%	)		)	
				)	Reduction of 21.6%
Program:	1992 = 7.0%	)		)	
	1993 = 7.2	)	6.9%	)	
	1994 = 6.9	)			
	1995 = 6.1	)			

In summary, these analyses revealed significant reductions in 65+ pedestrian crashes between the baseline and the program time periods. These reductions were particularly large for 65+ in-zone crashes. For comparisons involving the *entire* baseline and program time periods, 65+ pedestrian crashes were reduced 13.7% overall and those in the zones were reduced 46.3%. Reductions occurred in all zones, with the largest reductions occurring in zones 1, 3 and 5.

As a percentage of all 65+ crashes, in-zone crashes were reduced 37.6% between the baseline and program periods. For the *abbreviated* baseline and program periods, in-zone 65+ crashes were reduced 27.4% as a percentage of all zone crashes, and 65+ crashes were reduced 21.6% as a percentage of citywide pedestrian crashes. These reductions to crashes involving the older adult were noted during a period when pedestrian crashes to other age groups were increasing.

3. Phoenix 65+ Crash Injury Severity

The police crash report provides an indication of the severity of the crash injury as follows: none, minor, moderate, serious or fatal. The 65+ injury severity data were grouped into three categories--none/minor, moderate, and severe/fatal injuries. The results are shown in the table which follows (data were not available for three in-zone and five out-of-zone cases).

The table shows that there was a higher percentage of crashes with no or minor injuries in the program period than in the baseline period for both in-zone and out-of-zone data. There were accompanying decreases in the percentages of both moderate and serious/fatal crashes. In terms of *numbers* of crashes, these decreases were more marked for the in-zone than for the out-of-zone data where there was actually a small increase in the number of serious/fatal crashes in the program period. Therefore, in-zone 65+ pedestrian crashes in the program period appear to be less serious than those in the baseline period.

In-Zone 65+ Pedestrian Crashes				
	Baseline		Program	
Injury severity	No.	%	No.	%
None/minor	7	7.5%	9	18.0%
Moderate	25	26.9	12	24.0
Serious/fatal	61	65.6	29	58.0
Total	93		50	

Out-Zone 65+ Pedestrian Crashes				
	Baseline		Program	
Injury severity	No.	%	No.	%
None/minor	13	10.0%	26	18.6%
Moderate	47	36.2	41	29.3
Serious/fatal	70	53.8	73	52.1
Total	130		140	

4. Phoenix 65+ NHTSA/FHWA Crash Type

As indicated previously, all records were manually coded by NHTSA/FHWA crash type.[9] The results are summarized in the following table.

In-Zone 65+ Pedestrian Crashes				
	Baseline		Program	
Crash type	No.	%	No.	%
Backing	1	1.1%	3	5.9%
Not in road	10	10.5	3	5.9
Vehicle turn merge	24	25.3	15	29.4
Intersection dash	8	8.4	3	5.9
Driver violation	20	21.1	4	7.8
Other intersection	12	12.6	4	7.8
Midblock	19	20.0	12	23.5
Other	1	1.1	7	13.7
Total	95		51	

[9] *Manual on Accident Typing for Pedestrian Accidents: Coder's Handbook. Op.Cit.*

Out-Zone 65+ Pedestrian Crashes				
	Baseline		Program	
Crash type	No.	%	No.	%
Backing	10	7.6%	12	8.3%
Not in road	19	14.6	17	11.8
Vehicle turn merge	26	19.8	21	14.6
Intersection dash	6	4.6	7	4.9
Driver violation	13	9.9	12	8.3
Other intersection	12	9.2	13	9.1
Midblock	35	26.7	49	34.0
Other	10	7.6	13	9.1
Total	131		144	

For 65+ **in-zone** crashes, the table shows that over two-thirds (67.4%) of the *baseline* crashes occurred at intersections. The largest number of these involved vehicle turn/merge crashes and crashes in which the driver committed some violation. Intersection crashes accounted for 50.9% of the 65+ in-zone *program* crashes. In terms of *numbers*, although there were decreases in crashes between baseline and program periods for all crash types except for the backing and other categories, the largest decrease occurred for intersection crashes (in which crashes were reduced from 64 to 26, a reduction of 59.4%). Of the intersection crashes, the largest reduction occurred in crashes in which the driver committed a violation.

For the 65+ out-of-zone crash data, intersection crashes also accounted for the largest percentage of both baseline (43.5%) and program (36.9%) crashes. However, the percentage of midblock crashes (34.0%) for the program period was almost identical. The differences in numbers between baseline and program data for out-of-zone crashes were very small (five crashes or less) with the exception of midblock crashes which increased in the program period by 14 crashes.

5. Phoenix Time Series Analyses

The previous sections showed an apparent decline in pedestrian crashes involving victims 65 years of age or older from the baseline period to the program period. This decline was most pronounced within the defined zones. Although the consistency of the reductions noted above is compelling, the simple numerical drops do not take possible seasonal or other time-dependent effects into account. Therefore, crashes involving pedestrian victims 65 years of age or older from 1988 through 1995 were subjected to a time series analysis. The primary series of interest was the 65+ in-zone crashes by month. This series is shown in Figure 4.

The time series analysis techniques used in this study are based on Box-Jenkins theory for discrete time series in the time domain for either the prediction of future events

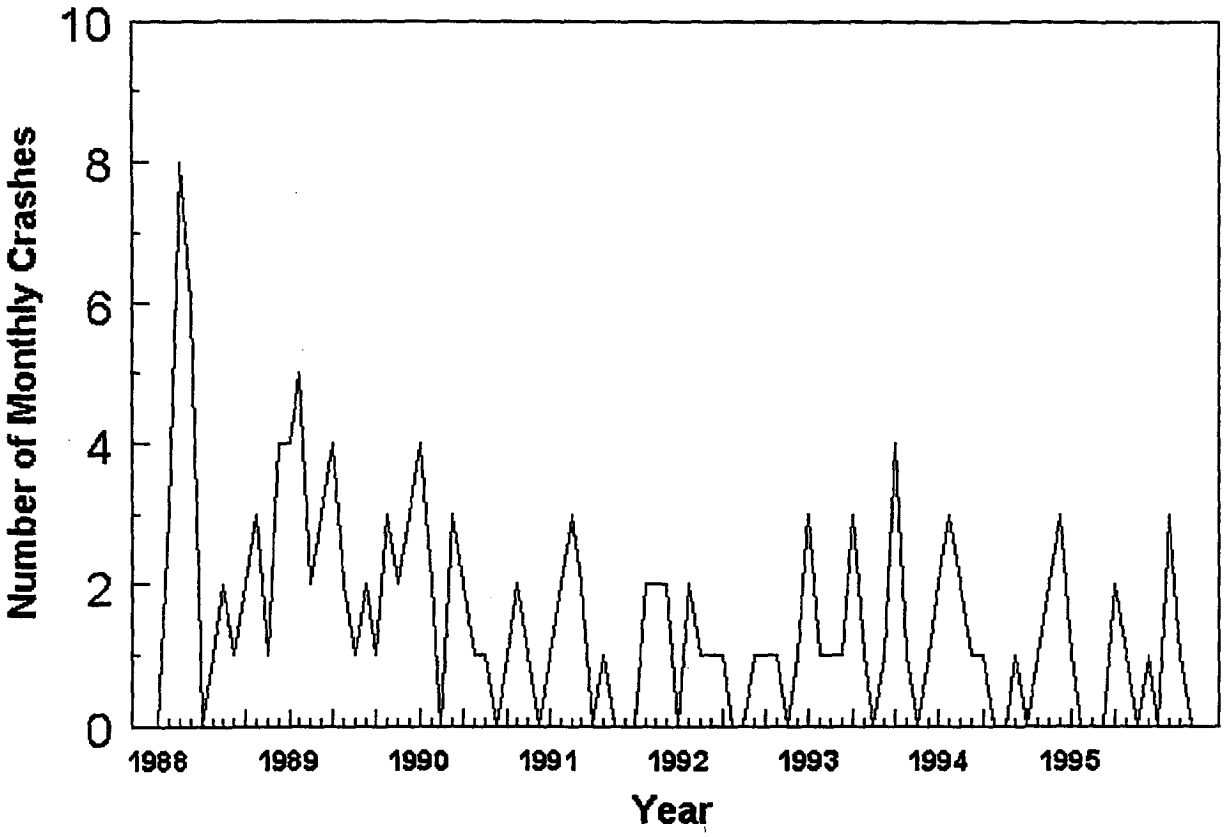

Figure 4. Phoenix 65+ pedestrian crashes in zones by month.

or for evaluation of known interventions.[10] These interventions can take the form of specific outliers either due to unusual events, such as fires, strikes etc., or due to the introduction of planned changes in policy or programs as was the situation in Phoenix during this study.

The need for use of Box-Jenkins methodology is to account and adjust for the dependent effects occurring among equally spaced observations and to characterize discontinuous variables as dummy variables where outliers and interventions have been hypothesized to have occurred.

Intervention analysis, an adaptation of Box-Jenkins time series analysis, can be considered a tool for testing the validity of an hypothesis based totally on prior knowledge of an existing situation rather than from the statistical properties of the series being analyzed. In building transfer function models (multiple time series consisting of one output and/or several output variables), the use of dummy variables (intervention analysis), provides for an effective methodology to deal with discontinuous input variables.

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[10] Box, G.E.P. and Jenkins, G.M. *Time Series Analysis: Forecasting and Control.* San Francisco, CA: Holden-Day, Inc., 1976.

The software selected to perform the time series calculations and modeling of the impact and comparative times series in this study was *Autobox* Version 3.0.[11] All models were developed by the automatic modeling feature in *Autobox*; however, final models were reviewed on an iterative basis with their specific autocorrelation functions (ACF), partial autocorrelation functions (PACF) and residual series analyses to ensure appropriate parameter selection and adherence to valid identification and estimation procedures.

Autobox permits the user to specify a number of model run parameters that can impact the nature of the output obtained. Therefore the parameter selections which were used for this study must be noted. The parameter settings listed below remained constant for all time series analyzed in this study and are generally conservative. That is, they will tend to show significant models only when the models are particularly robust.

- *Automatic initial model identification*--Automatic model building was used applying the iterative Box-Jenkins model building process based on sample ACF/PACF or CCF for multivariate analysis to include identification, estimation and forecasting.

- *Enable automatic fixup for necessity*--With this option on, the program automatically deletes non-significant parameters (one at a time) and re-estimates the model.

- *Enable automatic fixup for invertibility*--With this option on, the program automatically checks for invertibility (factor roots must lie outside the unit circle) and adjusts the model depending on the type of the non-invertible parameter.

- *Enable automatic fixup for sufficiency*--With this option on, the program automatically adds parameters to the model based on patterns detected in the residual ACF's and PACF's.

- *Enable automatic fixup for outliers*--Outliers can occur in many ways. They may be the result of errors in data recording, transcription, etc. or they may be the result of an exogenous intervention. With this option on, the program tests the residuals for need of possible outlier intervention variables. If detected, the intervention variables are automatically introduced into the model. Types of outliers included are: pulses, steps, and seasonal pulses. It should be noted that only single pulses were detected and included in the revised models. They were found to exist in the base time period almost without exception. No seasonal and/or steps were detected using the automatic procedure.

[11]Developed by Automatic Forecasting Systems, P.O. Box 563, Hatboro, PA. 19040.

- *Enable automatic fixup for variance stability*--If the residuals from the model do not produce constant variance, the standard estimation may be deficient. With this option on, a procedure is invoked which establishes weights to produce constant variance throughout the time series. This procedure was preferred to any Lambda transformation. Note: In the series analyzed in this study, only decreases in variances were found and they were found during the experimental time periods, i.e. after the interventions. Not adjusting for variance stability would have resulted in an overestimated program impact effect.

The major impact variable for this study is the time series representing monthly 65+ pedestrian involved crashes occurring in the defined zones for the eight year period 1988 through 1995 shown in Figure 4. The 96 data points are sufficient to determine presence of seasonality and to draw valid statistical inferences with respect to changes in level occurring between baseline and experimental periods. As part of the analyses, various intervention profiles were hypothesized in an attempt to characterize the actual effort on the part of the project to reduce pedestrian involved crashes in the zones and citywide. The basic intervention of a program beginning on January 1, 1992 and continuing for four years (an intervention series of 48 zeroes followed by 48 ones) was the primary profile used since it is the simplest and most straightforward description of the project activities.

The first step of the analysis was to develop a univariate model structure of the impact series and to measure the degree to which it represented the actual data. A first order autoregressive model was structured (1,0,0) having an R-square of 0.428 thereby explaining almost 43% of the total variation in the crash data series.

Three positive outliers were found at time periods 3, 4 and 14. They were accounted for by including three pulse variables in the model having a value of 1 at each of these time periods and zeroes everywhere else. The model representation is as follows:

Y(T) = 1.3097 (mean)	
+ X 1(T)[(+ 6.3126)]	value of pulse at time period 3
+ X 2(T)[(+ 4.9336)]	value of pulse at time period 4
+ X 3(T)[(+2.8079)]	value of pulse at time period 14
+ A(T)[(1- .282B)]**-1	first order autoregressive parameter and an error term.

In addition, a decrease in variance was noted at time period 29 and an increase in variance was noted in time period 65. Both variance changes were accounted for by proportional weightings of the final residual series.

The intervention variable was structured as discussed above to represent no program activity for the first 48 months (1988-1991) of the series and program intervention for the second 48 months (1992-1995).

A multivariate analysis was then conducted using this single step intervention variable as the input (independent) variable and the 65+ in-zone crashes as the output (dependent) variable. The model structure is as follows:

Y(T) = 1.6272 (mean)	
+ X 1(T)[(- .648)]	Omega, project effect, t = 2.35
+ X 2(T)[(+ 6.1180)]	value of pulse at time period 3
+ X 3(T)[(+ 4.7092)]	value of pulse at time period 4
+ X 4(T)[(+ 2.6985)]	value of pulse at time period 14
+ X 5(T)[(+ 3.0108)]	value of pulse at time period 69
+ A(T)[(1- .263B)]**-1	first order autoregressive parameter and an error term.

The introduction of the intervention variable shows that a significant reduction in level of pedestrian crashes occurred during the experimental time period. The Omega parameter (-.648, statistically significant at t = 2.35) represents the average monthly reduction in pedestrian crashes for the 48 month program time period (1992-1995) or a total of just under 31 pedestrian crashes. Actual crashes for the period totaled 51 rather than 82 (51 plus the reduction of 31). By dividing 31 by 82, it can be estimated that the program resulted in a 37.8% reduction in pedestrian crashes.

The multivariate and univariate model structures are almost identical in that the same pulses and values appear in both models and the autoregressive parameters are almost identical. In the multivariate case, there is an additional pulse at time period 69, which was over a year into the program period.

Similar time series analyses were conducted on the following other series:

- 65+ crashes out-of-zone
- Age less than 65 crashes in the zones
- Age less than 65 crashes out of the zones
- 65+ crashes citywide
- Age less than 65 crashes citywide

In all cases, reasonable univariate models could be developed, but there was no significant Omega parameter for the series which modeled the intervention of the program. This suggests that the program likely achieved its objective of concentrating its main effect on the target population within the defined zones.

A review of Figure 4 shows an apparent decrease in level around the beginning of 1990 during the baseline period. This decrease was not detected as a step in the time series modeling. It also cannot be explained by any effect known to the project or its contacts in Phoenix. For example, there was no applicable change in crash reporting requirements and no noteworthy change in the amount of police personnel involved in crash reporting. Nevertheless, the appearance of a drop during the baseline was believed to be of sufficient interest to warrant additional analyses.

In order to eliminate any influence of the apparently high level of crashes in the first two years of the baseline, the time series analyses described above were repeated using only data from 1990 through 1995 (72 months). This left only two years of baseline, which is a borderline amount for a robust time series analysis, particularly with the small monthly samples involved. None of the analyses showed a significant program effect with the program intervention again modeled as commencing at the start of 1992.

It is difficult to interpret the relative impact of small sample sizes and true effects on the foregoing analyses. Nevertheless, taken together, the pre/post and time series analyses paint a consistent picture of a significant crash reduction caused by the project with the largest impact taking place in the zones. Developing a confident estimate of the magnitude of the reduction, however, is difficult based on the small samples.

C. Phoenix Process Data

1. Program Conduct and Coordination

Project activities in Phoenix were coordinated through the Phoenix Street Transportation Department. The traffic safety supervisor assumed overall responsibility for the study for the city. He directed all project activities and ensured implementation of engineering countermeasures. He was supported by a media consultant who planned and carried out all PI&E activities for the program. This organization of the staff representing the city resulted in an effective means of running the program in Phoenix. Interviews with these individuals provided inputs for the process analysis.

The Phoenix zone analysis was conducted in January of 1992 and all engineering improvements (except for routine maintenance activities that were carried out throughout the study as needed) were completed in the spring of that year. It was the original intent of city representatives to time project PI&E activities with activities of an FHWA safety grant in order for both projects to achieve enhanced PI&E activities with reduced costs. However, due to delays in completing the project video and in obtaining copies of the project flyers and small brochures from NHTSA, the PI&E program was not initiated until the spring of 1994 after the FHWA grant was completed.

Even though maximum synergy was not achieved, it was the consensus of the Phoenix officials that the program was effectively coordinated and mounted. All of the available materials and engineering funds were apparently effectively utilized in support of the attempt to reduce older adult pedestrian crashes in the defined zones.

2. The Zone Process

The opinions of city representatives on the use of zones was positive. The zone process had not been used previously for pedestrian studies in Phoenix. However, a similar process had been used by other city agencies, for example, to define high crime areas for

implementation of crime prevention programs and to identify low economic areas for implementation of neighborhood enhancement programs.

City representatives found that older adult pedestrian safety zones helped to focus limited resources and staff in areas where they were most needed and would do the most good. They also felt that the selected zones targeted the elderly crash problem appropriately in Phoenix. They noted that some changes in the zones were needed for the current study and recommended some improvements for future studies. For the current study, it was noted that the edges of the circles did not define an area well enough for distribution of the program materials to each residence. Therefore, for the distribution of the flyers and brochures as door hangers, it was necessary to make squares of the circular zones. In addition, the linear zone was eliminated from this PI&E activity since it was considered impractical to distribute materials to residences along a two-mile strip. Possibly, one or two blocks could have been added on each side of the linear zone (forming a rectangle) to permit that zone to be included in the door-to-door distribution activity.

For future studies, it was recommended that zones be examined to see if they need fine tuning. For example, although there were no apparent problems of this nature in the current study, it was suggested that edges of zones be examined to determine if an additional block or two should be added to ensure that neighborhoods are not separated. In addition, since a city is dynamic, a periodic review and redefinition of the zones might be advisable, especially for countermeasure efforts that are extended over time.

Phoenix representatives were favorably impressed with the zoning process as developed for this study and with the zones the process identified. They would like to use the process again for pedestrian issues. In fact, they did use one of the zones identified in this study in an application for an elderly pedestrian grant that they recently received.

One drawback of the zone process occurred in the legal area. Two legal actions were brought against the city because of the zone study. One action resulted from a crash that occurred just outside a zone--the attorney for the plaintiff argued that if the city had given the same treatment to the location where the client was struck as was given within the zones, the crash would not have occurred. Another crash occurred on the fringe of a zone, and the plaintiff's attorney argued that the city should have done more since it was known that there was a problem in the area. Such claims make extra work for city employees in defending the city and also make certain officials reluctant to support such studies in the future. It is likely, however, that these sort of actions would be brought in response to any selective countermeasure actions. Simply, it can always be argued that more could be done to prevent any crash. That type of argument should not be allowed to daunt future countermeasure efforts of this type.

3. The PI&E Program

Overall, the PI&E package was considered to be excellent. Adequate supplies of all materials were received but, as indicated previously, the timing of the receipt of the flyers and small brochures lagged behind what had been planned. The availability of the project-supported media consultant to make contacts, to count and distribute materials to

various agencies and organizations (senior residences, AARP, libraries, homeowner's associations, police departments, motor vehicle offices, etc.) and to encourage contacts to display materials was a big plus to the program. These activities can be tedious and time-consuming for a city department with a naturally high workload.

It was noted that products that are customized for local use are much more favorably received than those that are not customized. City representatives reported that it is particularly important for videos and television PSAs to show local scenes or at least reflect images of the southwestern part of the country. It was felt that, had the program video and PSAs been shot locally, they would have been better received by the Phoenix population. Receipt of air time for both television and radio PSAs was reported to be poor, although this was only anecdotal reporting as no monitoring was possible. City representatives noted that pedestrian safety is not often covered by the media unless a tragedy occurs.

The flyers and two small NHTSA brochures were particularly well liked. Their distribution as door hangers to each residence in the zones was considered by local representatives to be the best and most effective part of the program in Phoenix. Again, some means of identifying individual flyers and brochures with the city might have improved the acceptability of the materials at the local level. To this end, an additional flyer was inserted in each delivery that identified the materials as being supplied by the City of Phoenix (the city logo and telephone number were included). However, city representatives felt that the distribution would have been more effective if the information had been placed directly on each flyer and brochure. They also noted that different colors or some other means of differentiating the flyers should have been used. Some recipients apparently felt that the city was sending them multiple copies of the same flyer.

It must be noted that the door hanger delivery mechanism was economically feasible only because of the use of zones. The cost per 50,000 households for three separate door hanger deliveries to each household in the zones was $23,655. Instead of targeting the zones (which encompassed 54.9% of the older adult crashes and, presumably, the same percentage of older adults involved in those crashes), the deliveries could have been made to *all* households in the city or to a randomly selected group of 54.9% of the city's households in the hopes of reaching 54.9% of the older adult population involved in crashes. To make the same deliveries to the *entire* city (population in 1995 was estimated to be 1,149,417[12]), the cost would have been $271,895 on the assumption that there were two residents per household. A random distribution to 54.9% of the population (again assuming two people per household), would have cost $149,270. Thus to reach the entire city with door hangers would have cost approximately 11.5 times what it cost to deliver to the zones; to reach 54.9% of the city's households would have cost approximately 6.3 times what it cost to reach all households in the zones.

[12] As noted previously, the City Planning Department estimated the population of Phoenix in 1995 to be 1,149,417.

There was a problem in distributing materials as door hangers to some senior residences. A local service handled the distribution. Since senior citizens can be easy prey to con men, there was tight security at several of the residences, and the distributor was not always able to ensure that the materials reached individual senior citizens. In many instances, materials had to be left at the front desk rather than at individual doors.

The bus cards were also considered to be an excellent part of the PI&E program. Some were displayed in the buses for extended periods of time.

City representatives felt that more (and more effective) use should have been made of the media in getting the pedestrian safety messages across. A news conference to kick off the program would have been helpful as well as better utilization of city outlets for media distribution. If the program were to be repeated, city representatives would like a larger citizen input in distributing PI&E materials. Specifically, they would like city staff and community planning committees to work together in reaching the target audience. They would also like more and better press contacts.

The city's water bill mailer proved effective in promoting the study, and its use should have been pursued further. The city employee newsletter was mentioned as another avenue that should be explored. City representatives also recommended more use of street fairs (particularly in the zones) for display of project materials and use of the medical community for reaching the target audience.

City representatives found that the survey sponsored by the city also was effective in making residents aware of the program. When the interviewer approached prospective interviewees, she asked them to participate in a study on safe walking being conducted by the city. Some interviewees were approached more than once and came to recognize the interviewer.

4. The Engineering Program

The traffic safety representative reported that the engineering analysis of the zones performed for the study was useful in directing scarce resources to those areas. An even more extensive analysis of the zones would have been appreciated. Although some of the recommended improvements were not economically realistic, this was not considered to be a negative. Budget constraints proved to be the primary reason that countermeasures were not implemented. Therefore, the list of recommended improvements provided a wide range of suggestions from which the city could select those that fit within the operating budget. It is likely that some of the more expensive improvements will eventually be implemented.

City representatives continue to look for ways to implement improvements in the zones as well as in other areas of the city. Phoenix has recently received a grant for two engineering improvements. One is the installation of an automatic pedestrian detector at one of the primary crossing locations in a study zone. The other will make the underpass to the main city library handicapped accessible and more walkable for elderly pedestrians.

D. Chicago Process Data

As indicated previously, various unanticipated problems that occurred in Chicago prevented full program implementation and evaluation in that city. Therefore, only a process evaluation was conducted. Interviews with city representatives who worked actively on the program provided data for the evaluation. The interviews were designed to determine what went well with the program and why as well as to identify problems that were encountered and how those problems affected program implementation. In addition, suggestions for improving the program were solicited. The results of these interviews are discussed in the following paragraphs.

1. Program Conduct and Coordination

Chicago agreed to serve as a study site in the summer of 1991, and preliminary study zones were selected about one year later. However, due to various problems in coordinating project activities with Chicago representatives, the engineering analysis of the zones was not conducted until the summer of 1994. In the meantime, not only were there serious cutbacks in traffic safety personnel (as well as other city employees), but also the Chicago traffic safety representative who agreed to oversee the study was promoted to a new position. Although that individual continued to represent the city on the project, the time and staff he had available for the study were markedly reduced.

Due to the severe cutbacks, personnel were not available for enacting planned engineering countermeasures, for conducting the survey planned by the city and for assisting in promoting the various program activities. Planning for the Democratic National Convention also placed heavy demands on city personnel and prevented or delayed the conduct of planned countermeasures.

One additional problem had a major effect on the conduct of the study. Arrangements had been made to kick off the study at the mayor's senior picnics in the summer of 1995, and information on the study was prepared for inclusion in the mayor's speech. These picnics are a tradition in Chicago and are held in most of the major parks in the city. The mayor visits each picnic and delivers some remarks. Unfortunately, the city was hit with a major heat wave that resulted in many deaths that summer, particularly of the elderly. As a result, the mayor made very brief speeches (deleting mention of the study) at the picnics, and some picnics were cancelled completely.

It was the opinion of interviewed representatives that, if a high-level person (such as a representative from the mayor's office) had been involved as a coordinator of project activities, more personnel would have been made available for study activities. In actuality, although the mayor supported the program, there was no one assigned to the program who had the "clout" to ensure that needed project activities took place. It was also suggested that a larger working group might have resulted in additional useful PI&E activities. Other groups that were recommended included libraries (who sponsor many senior activities) and the Chicago Housing Authority.

It might be noted that Chicago also had basic and ongoing problems with its data system. These problems remained throughout the conduct of the study and were still not resolved at the time when it became necessary to complete countermeasure activities and analyze study data. Therefore, no analysis of crash data in the city was possible in time for this report. The lack of an effectiveness evaluation was regretted since representatives felt that the program might have produced positive results.

2. The Zone Process

The zone process had not been used in the city prior to the study although some pedestrian activities had been carried out at selected intersections, on selected road segments and in different police districts. Interviewees considered the zone process to be useful and noted that computer mapping of crashes is now being used for many projects based on the success of the zone effort. It is anticipated that the zone process will be used a great deal when their data problems are resolved.

The *Chicago Prospectus* that described the zone process, defined the zones, and identified available PI&E materials was considered to be very helpful in defining study needs and resources. The GIS-produced "pin maps" were particularly helpful in identifying where elderly pedestrian crashes occur in the city.

3. The PI&E Program

Overall, the PI&E package was favorably received. The *Walking Through the Years* video was especially well-liked. Police representatives reported that senior audiences really enjoyed the video and felt that it was a major plus in their presentations. They also felt that the presentations were adequately promoted. The presentations were considered to be the best PI&E activity performed for the program in Chicago.

The police teacher training session was also very favorably received. It was particularly appreciated by inexperienced officers. It prepared all officers well for their subsequent presentations to the elderly. The slide series used in the training session was considered very useful for training of the police officers but not for direct presentations to the elderly.

Of the various flyers and brochures, the AAA brochure was liked the best by both city representatives, program presenters and seniors. The 13 flyers and small brochures were too similar in appearance and, when people picked up one and were offered another, they felt they were being offered a duplicate. Interviewees felt that some means of differentiating the flyers and small brochures should be used in future printings (for example, using different colors, different designs, or other means of assuring that recipients can see at a glance that the materials are different).

Although not distributed widely by the study, the 12-page NHTSA *Walking Through the Years* brochure was liked by city representatives. They reported that they plan to reproduce copies for their future use.

Adequate supplies of all materials were provided, but the logistics of distributing the various brochures proved to be a problem. Since 60,000 copies of each brochure were delivered to the city project representative, it was his responsibility to ensure that appropriate numbers were counted out and distributed to the Police Department and Department on Aging personnel for various program activities. With the lack of supporting personnel, this activity proved to be especially burdensome.

Television and radio stations accepted PSAs. However, they did not appear to be particularly interested in airing them, and information on the extent of their use was not available.

The bus card countermeasure was easy to implement. The city printed the cards and the project paid for their placement. The costs limited the effort to selected buses whose routes went through the zones. Interviewees felt that the cost of mounting the bus cards was probably high for the number mounted.

4. The Engineering Program

City representatives reported that the engineering analysis of the zones was useful, and several countermeasures were selected from the recommended list for implementation. However, the lack of funds and personnel to follow through on the recommendations prevented implementation of any of the roadway improvements recommended by the study analysis. Some signal improvements that were made in the zones had previously been planned by the city. As with the PI&E program, city representatives felt that a high-level project coordinator (preferably from the mayor's office) would have been required to ensure that roadway improvements in the zones were made during the study period in view of the severe cutbacks that had been sustained in city personnel.

VII. DISCUSSION

Individual results previously reported and the cumulative pattern of findings provide a great deal of information related to the objectives of the study. Overall, it is possible to conclude that the concept of using pedestrian safety zones leads to a productive method of allocating countermeasure resources. Further, the test implementation in Phoenix resulted in a significant reduction of crashes to older adult pedestrians.

It must be acknowledged that the process of "zoning" is not totally novel. Highway safety professionals have long employed pin maps of crashes to help in the identification of "hot spots" worthy of countermeasure treatment. The current study, however, has refined the process in several ways with respect to older adult pedestrian crashes.

First, the concept of using zones rather than clusters or individual intersections enabled the countermeasure implementors to extend their focus beyond specific crash locations. This directed attention to correcting problems typically associated with the predisposition to be involved in a pedestrian crash as well as to locations which had already been crash-involved.

Second, the use of a circle of one-mile radius to define zones combined both crash density and distance of the crash site from the victim's residence. It is likely that this combination, together with the relatively small land area encompassed by the circle, was instrumental in facilitating the cost effective deployment of countermeasures.

Third, the use of computerized Graphical Information System (GIS) tools facilitated the zoning process. The added flexibility inherent in GIS proved invaluable in defining zones and in creating a multi-use database.

Finally, observations of the two test cities using the defined zones as well as discussions with city personnel suggested that the zones were effective in focusing their attention on regions within their jurisdictions that apparently had a homogeneous problem (older adult pedestrian crashes). Pin maps tend to draw attention to problem points in space, e.g., intersections, or to relatively amorphous regions of a larger entity. One-mile radius circular zones, on the other hand, appeared to prompt a higher degree of introspection in an attempt to uncover what common factors might be in play to have caused the zones to exist.

The results of the present study also lead to the conclusion that the zone process achieved its objective of making it possible to utilize countermeasures that would be prohibitively expensive to deploy to the entire population. In Phoenix, a sprawling western city, about 55% of the older adult pedestrian crashes were addressed in less than 5% of the city's land area. In Chicago, an older more densely packed urban area, it was still possible to encompass about 53% of the crashes of interest in only 19% of the total land area. Further, the benefits of this "efficiency factor" were clearly demonstrated in Phoenix. The door hanger campaign proved to be successful in prompting recall and, hence, presumably knowledge gains and positive behavioral changes. It was economically feasible to use door hangers and other approaches, such as deployment of pedestrian signal information signs,

because the area of the city being treated had been reduced to a small fraction of the total. Likewise in Chicago, it was a reasonable undertaking to train community police officers to deliver older adult pedestrian safety advice to the affected population because the physical area to be addressed was greatly delimited.

Positive feedback was received on the use of the zoning technique from representatives in both cities. They noted the simple way in which zones are defined and the fact that they are based on crash data that most safety specialists have readily available. These facts suggest that "zoning," at least for older adult pedestrian crashes, is a productive process. There is no reason, however, to believe that the use of zones based on definitional strategies such as those employed in this study cannot be extended to other aspects of the pedestrian crash problem and, perhaps, beyond. For example, the same basic approach was attempted by the authors in another research effort related to pedestrians and alcohol in Baltimore, Maryland.[13] It was possible to encompass 73% of the crashes in which the pedestrian had been judged by the police officer to have been drinking in only 21% of Baltimore's land area. There is good evidence that drinking pedestrians involved in crashes, like the older adult, tend to be struck near their homes. Therefore, the use of a one-mile radius circle to define zones likely provides the same crash and residence clustering benefits as were obtained in Phoenix and Chicago during the present study.

It also must be noted that the present study coupled with the referenced effort in Baltimore showed that the use of zones does not constrain a program from adopting considerably different countermeasure approaches. Phoenix and Chicago both addressed the older pedestrian crash problem. They did it, however, in quite different ways each of which involved the use of zones. Baltimore focused on another problem altogether, pedestrians who had been drinking. The countermeasure battery directed at this pedestrian problem was quite different from the ones used in Phoenix and Chicago. Nevertheless, the apparent efficiency and effectiveness of all of these countermeasure efforts speaks to the benefits of zoning.

After concluding that the zoning process is viable, efficient and reproducible, it is necessary to examine its association with successful countermeasure outcomes. As discussed earlier in the report, data on knowledge survey and crash results after the deployment of countermeasures focused in zones were available only from Phoenix, and the crash sample sizes there were small. Nevertheless, Section VI of this report contains compelling evidence that the countermeasure efforts were successful. This evidence includes the following:

- First, the Phoenix-sponsored survey showed knowledge gains in an area (namely, daytime conspicuity) believed important to achieving a reduction in age 65+ pedestrian crashes.

- Second, the residents of Phoenix were unusually knowledgeable about the meaning of the WALK/DON'T WALK sign, and this knowledge was evident

[13] NHTSA Contract No. DTNH22-91-C-07202, *Development, Implementation, and Evaluation of a Countermeasure Program for Alcohol-Involved Pedestrian Accidents.*

when the baseline survey data were collected. These pedestrian signs were mounted *prior* to the initial collection of project survey data and may well have accounted for the large number of residents who understood how to use them.

- Third, the "simple" comparisons of the number of crashes to older adult pedestrians before and after the program implementation were uniformly favorable. While pedestrian crashes to those under 65 years of age were increasing, crashes to those 65 and older declined. The total decline between baseline and study years was 13.7%. This decline was greatest within the zones (46.3%), while an increase of 9.9% occurred outside the zones. This is fully consistent with the relative intensity of countermeasure deployment. The entire city was dosed with public service print and broadcast announcements, discussions of the program, and an increased engineering and police awareness. The zones themselves received the localized media efforts which were so prominently mentioned in the survey.

- Fourth, the largest observed pedestrian crash decrease to the older adult occurred at intersections in the zones. This is precisely where the maximum project effort was focused. The pedestrian signal information signs as well as the vast majority of engineering improvements, such as increasing available sight distance, were focused at these intersections. It is therefore consistent that they should display the largest crash reductions.

- Finally, the time series analysis which used all of the available data produced a multivariate model which estimated a significant and highly meaningful decrease in 65+ in-zone crashes coincident with the implementation of the countermeasure program. Even though this model could not be replicated using only part of the baseline period, its existence in the context of the pre/post crash data lends further support to a conclusion that the Phoenix program was successful in reducing the targeted crashes.

The successful application of the process, augmented by ample evidence that the zone-based countermeasure program in Phoenix reduced crashes, leads to a conclusion that "zoning" is an approach that should be widely considered as part of pedestrian crash countermeasure programs. The same basic approach might also be beneficial in other analogous crash and operational contexts such as drunk driving crashes or tracking and repairing roadway problems such as potholes. It is likely, however, that maximizing the effectiveness of the concept for these uses will require fine tuning of some of the procedures developed for older adult pedestrian crashes. For example, the one-mile radius circle and minimum count of 10 events within the circle might need refinement based on the specifics of the problem being addressed. Since the development process for problem-specific zoning used by this study is not particularly difficult, these types of refinements based on actual data should not prove daunting.

APPENDIX A

PHOENIX ZONES

A description of each of the seven zones identified in Phoenix follows. Included are the boundaries of the zone, number and type of pedestrian crashes, residence information on the victim, and selected structures located in the zone at the time of zone definition.

Zone 1

Boundaries: West - East: 13th Av to 13th St
North - South: Becker Ln to Loma Ln

Crashes: 13 pedestrian crashes (4 vehicle turn merge, 6 intersection other, 1 not in road, 2 midblock) (3 fatalities)

Victim residence: All victims were Phoenix residents. All but two lived within 1 mile of their crash sites. One lived within 1-1/2 miles of the crash site, and the address for one victim was not locatable on the map.

Zone structures: Zone 1 contains: one senior center - John C. Lincoln Hospital - Sunnyslope High School.

Zone 2

Boundaries: West - East: 12th Av to 13th Pl
North - South: Pierson St to Roanoke Av

Crashes: 16 pedestrian crashes (7 vehicle turn merge, 4 intersection other, 2 not in road, 2 midblock, 1 other) (2 fatalities)

Victim residence: One victim was a transient. All but three Phoenix residents lived within 1 mile of their crash sites.

Zone structures: Zone 2 contains: one senior center - Central Shopping Center - Phoenix Country Club - U.S. Veteran's Hospital - Phoenix Indian School - Brophy Preparatory College - Central High School.

Zone 3

Boundaries: West - East: 11th St to 27th St
North - South: Montebello Av to Clarendon Av

Crashes: 12 pedestrian crashes (2 vehicle turn merge, 4 intersection other, 6 midblock) (1 fatality)

Victim residence: Two victims were transients. All but one of the Phoenix residents lived within 1 mile of their crash sites.

Zone structures: Zone 3 contains: no senior centers - Colonnade Mall/Town and Country Shopping Center - Biltmore Fashion Park - Phoenix Indian Hospital - Town and Country Golf Course.

Zone 4

Boundaries: West - East: 24th St to 39th St
North - South: Sells Dr to Cypress St

Crashes: 14 pedestrian crashes (3 vehicle turn merge, 7 intersection other, 1 not in road, 3 midblock) (2 fatalities)

Victim residence: Three victims were transients, and one gave no local address. All but two of the remaining victims lived within the zone.

Zone structures: Zone 4 contains: one senior center - part of Tower Plaza Shopping Center.

Note: In the search for linear zones, six crashes in a 2-mile road segment were noted on Thomas Rd. This road segment is included completely in Zone 4.

Zone 5

Boundaries: West - East: 21st Pl to 37th Pl
North - South: Yale St to Jefferson St

Crashes: 14 pedestrian crashes (5 vehicle turn merge, 4 intersection other, 1 midblock, 3 other) (3 fatalities)

Victim residence: Two victims were transients. All but one of the Phoenix residents lived within a mile of their crash sites.

Zone structures: Zone 5 contains: one senior center - Maricopa County General Hospital - Arizona State Hospital.

Zone 6

Boundaries: West - East: 22nd Av to 1st St
North - South: Moreland St to Pima St

Crashes: 10 pedestrian crashes (7 intersection other, 1 not in road, 1 midblock, 1 other) (3 fatalities)

Victim residence: Two victims were transients. All Phoenix residents lived within 1 mile of their crash sites.

Zone structures: Zone 6 contains: Three senior centers - Memorial Hospital - The State Capitol -The Federal Center - City Hall - County Court - Sheriff's Office - Police Station -Union Station.

Zone 7 (linear zone)

Boundaries: West - East: Van Buren St from 35th Av to 19th Av

Crashes: 6 crashes in a 2-mile stretch of the road, 5 of which occurred in a 1-mile stretch of the road. The sixth crash is included in Zone 6. (3 intersection other, 1 not in road, 2 midblock)

Victim residence: All victims were Phoenix residents, and all except one lived within 1 mile of their crash sites.

Zone structures: Zone 7 contains no senior centers.

APPENDIX B

CHICAGO PROSPECTUS

The *Chicago Prospectus* was prepared as an aid to Chicago representatives in conducting a zone program in that city. It contains the following information and materials:

- An overview of the background and objectives of the study.
- A description of the process for defining elderly pedestrian safety zones.
- A map showing a city-wide view of the Chicago zones as well as individual maps of each of the 15 identified zones. Fly sheets separating the maps have been excluded from this copy of the *Prospectus*.
- PI&E materials that are available for the project.
- Cooperative tasks to be performed to accomplish study objectives.

PEDESTRIAN SAFETY ZONE FOR ELDERLY PEDESTRIANS

Chicago Prospectus

August 1994

Prepared for:

City of Chicago
Department of Public Works
Traffic Engineering & Operations
320 North Clark Street
Chicago, Illinois 60610

Prepared by:

Dunlap and Associates, Inc.
1010 Summer Street
Stamford, CT 06905

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INTRODUCTION

Research has shown that pedestrian accident countermeasures can be effectively delivered when the target audience *congregates* for some routine life purpose. An example of a group that congregates is school children who have successfully been addressed with in-school curricula and public information and education (PI&E) programs. One of the potential benefits of addressing discrete groups or clusters of the population at risk for pedestrian crashes is its increased efficiency for countermeasure delivery. This may be a particularly effective way to deploy limited resources for localized education programs and traffic engineering changes.

A natural outgrowth of looking at clusters of a problem is the definition of *physical zones* within a city as a way to apply countermeasures in a highly cost-effective manner. A project was funded by the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) and Federal Highway Administration (FHWA) entitled *Development, Implementation and Evaluation of A Pedestrian Safety Zone for Elderly Pedestrians* to assess the benefits of applying the "zone" concept to pedestrian crashes involving older adults (65 years of age and older) and to produce a manual for implementing the idea beyond two test cities.

The focus on older adults was logical. First, they are a significant part of the pedestrian crash problem. America's population is aging, and the effects of this development will ripple through many aspects of our society. As pedestrians, older citizens present a special problem. Although the group is likely underrepresented in the pedestrian flow, it has the highest fatality rate among all ages coupled with an extremely low injury rate. This is typically attributed to a *frailty factor.* That is, older people tend to die in crashes which would be survivable by a younger pedestrian.

Second, the elderly, particularly when they retire, tend to congregate more than middle aged adults. The availability of special residences and recreational facilities for this group suggests a degree of assemblage not typical of other adult ages. Dedicated departments of the aging, such as the one in Chicago, provide a vitally important expertise for implementing a program with this population.

The objectives of the "zone" study are to: 1) Develop the procedures for defining elderly pedestrian safety zones simply and with readily available data; 2) Develop countermeasure materials for use in the zones; 3) Implement a prototype zone program in two major cities; and 4) Assess the effectiveness of the program in improving the safety of the pedestrians within it. As part of the work effort, the selected contractor, Dunlap and Associates, Inc. of Stamford, Connecticut (Dunlap) assisted by the Highway Safety Research Center of the University of North Carolina (HSRC), has secured the agreement of Phoenix and Chicago to serve as the test cities. Dunlap and HSRC have also prepared an extensive package of public information materials and traffic engineering countermeasure advice.

This prospectus presents:

- A description of the process for defining elderly pedestrian safety zones
- The definition of 15 zones in Chicago.
- A description of the PI&E material available for distribution in Chicago.
- A list of the major study tasks and the cooperative inputs needed from groups in Chicago if the program is to be successful.

The Chicago Department of Public Works, Bureau of Traffic Engineering and Operations has agreed to coordinate Chicago's efforts and serve as a liaison with the project for countermeasure development and application and the acquisition of evaluation data.

THE ZONE DEFINITION PROCESS

The process of defining zones began with a decision that crash data would be used as the analytical basis. Other information, such as census data and the location of facilities for the elderly, was considered as the input to the process. None of these data, however, were as readily accessible to a local community or as directly relevant to the problem as was the prior incidence of crashes. This decision was confirmed in discussions with city personnel from Phoenix, Arizona and Chicago, Illinois, the two cities which agreed to serve as test sites.

A crash-based criterion for defining zones was defined first in Phoenix. Phoenix has a relatively low rate of pedestrian crashes with only about 30 elderly (65+) pedestrian crashes per year. It was therefore decided to adopt a criterion that a minimum of 100 elderly crashes had to be used in the zone definition activity. As a result, three years of accident data were used in the Phoenix analysis.

All 153 of the elderly pedestrian accidents for the three year period were plotted on a map of Phoenix. A straight line was drawn from each crash location to the residence of the victim. A visual scan of the map revealed a slight tendency for clustering of crashes near senior centers but no apparent clustering of the residences of crash-involved pedestrians.

The victim's residence was determined, and a straight-line measurement was made of the crash-to-residence distance. The results of this analysis showed that all but 21 (13.7%) of the victims were Phoenix residents most of whom (78%) were struck within one mile (measured as a straight-line distance) of their homes.

Since over three-fourths of the residents were struck within a mile of their homes, it was decided to use this distance as a radius criterion for identifying zones. In addition to matching the observed residence to crash data, a land area of one mile radius (approximately 3.14 square miles) was considered a manageable area in which to concentrate traffic engineering and local educational countermeasures.

In order to define zones in Phoenix, a circle with a 1-mile radius was drawn on a piece of acetate. The acetate was then laid over the spot map of crashes and moved around until at least 10 crashes (approximately 8% of the sample) were included in the circle overlay. This process led to the identification of six pedestrian crash clusters. In addition, several roads seemed to have multiple crashes within a reasonably short stretch. Therefore, one additional zone was defined based on a criterion of six crashes within a two mile span on a single roadway.

THE CHICAGO ZONES

The relatively small number of crashes in Phoenix made it possible to address the zone definition procedure manually. In Chicago, however, there are over 400 elderly pedestrian crashes per year. In addition, once zones are defined based on elderly crashes, it is also of interest to examine pedestrian and vehicle crashes within them other than those involving the elderly. This suggested the need for a more automated method of defining zones. Hence, a computerized mapping system was used in the definition of zones for Chicago.

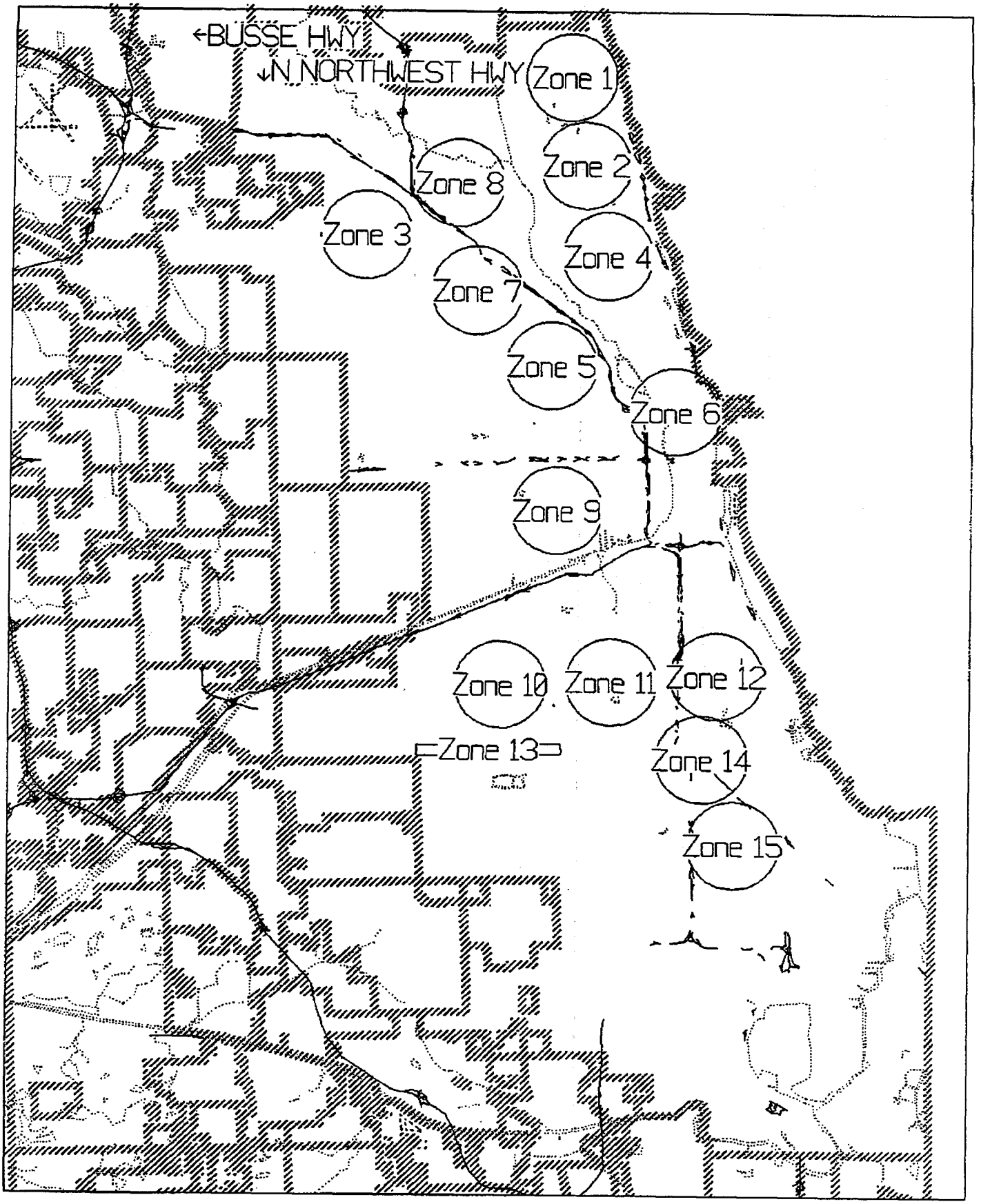
The criteria used for defining zones in Chicago were the same as in Phoenix except that only a single year's crash data were used (1990). This yielded a sample of 436 crashes which involved a pedestrian 65 years of age or older. Instead of manually locating the site of each of these crashes on a map, the following procedure was used:

- A computer tape of all Chicago traffic crashes for 1990 was obtained from the City.
- A program was written to prepare separate files of:
  - elderly pedestrian crashes
  - all other pedestrian crashes
  - all other traffic crashes.

  Each of these files contained the basic police crash report information as well as two location codes corresponding to a Chicago location coding scheme.
- A computer file of the codebook corresponding to the Chicago location codes was prepared.
- A program was written to convert the location codes to a narrative form which was compatible with the computerized mapping program.
- The elderly crash file was brought into the computerized mapping system and coded into longitude and latitude coordinates. In this process, 434 of the 436 crashes were located.
- Areas of one mile radius and linear zones were examined manually on the computer.

This process resulted in the definition of 14 circular zones (approximately 44 square miles total) and one linear zone on West 63rd Street. For each zone, a map of the zone follows. The 15 zone maps are preceded by a schematic city-wide map showing the relative locations of the zones. It should be noted that the numbering of the zones is completely arbitrary and was based primarily on the order in which they were manually identified.

The 15 zones encompass 228 (52.5%) of the 434 elderly pedestrian crashes for 1990. The "efficiency" of the zone approach is indicated by the fact that 52.5% of the crashes are addressed in just over 19% of the total Chicago land area of 228 square miles.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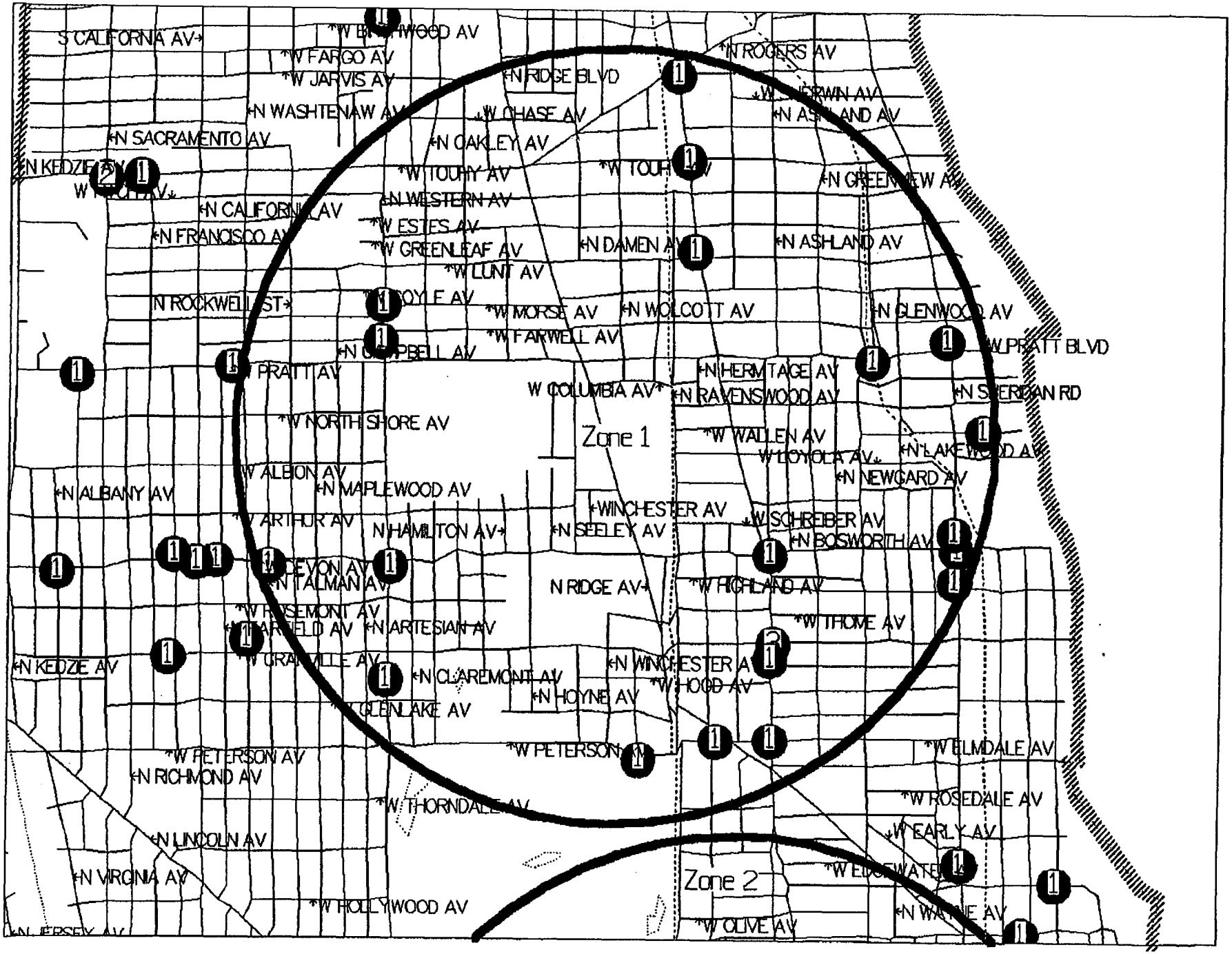
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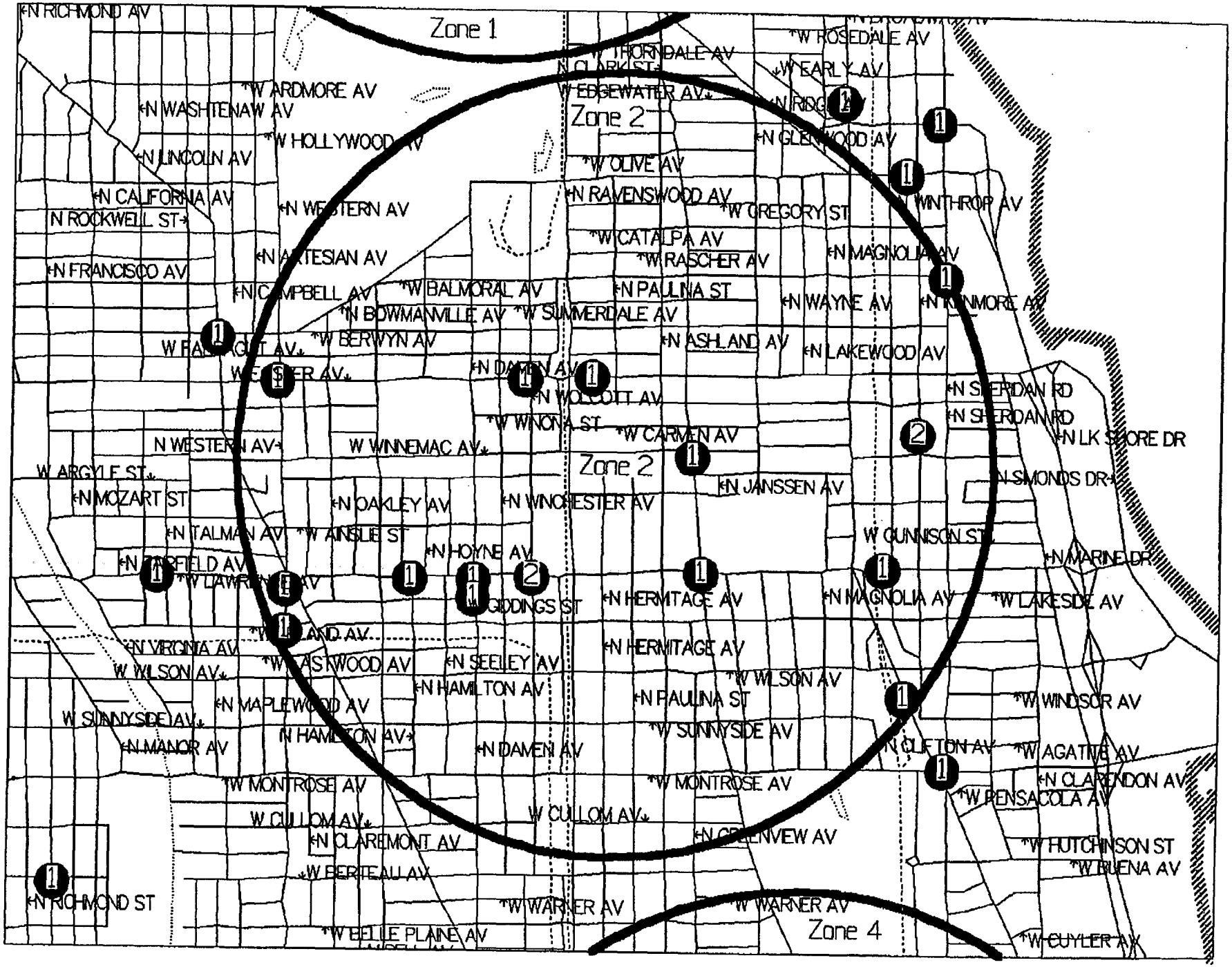
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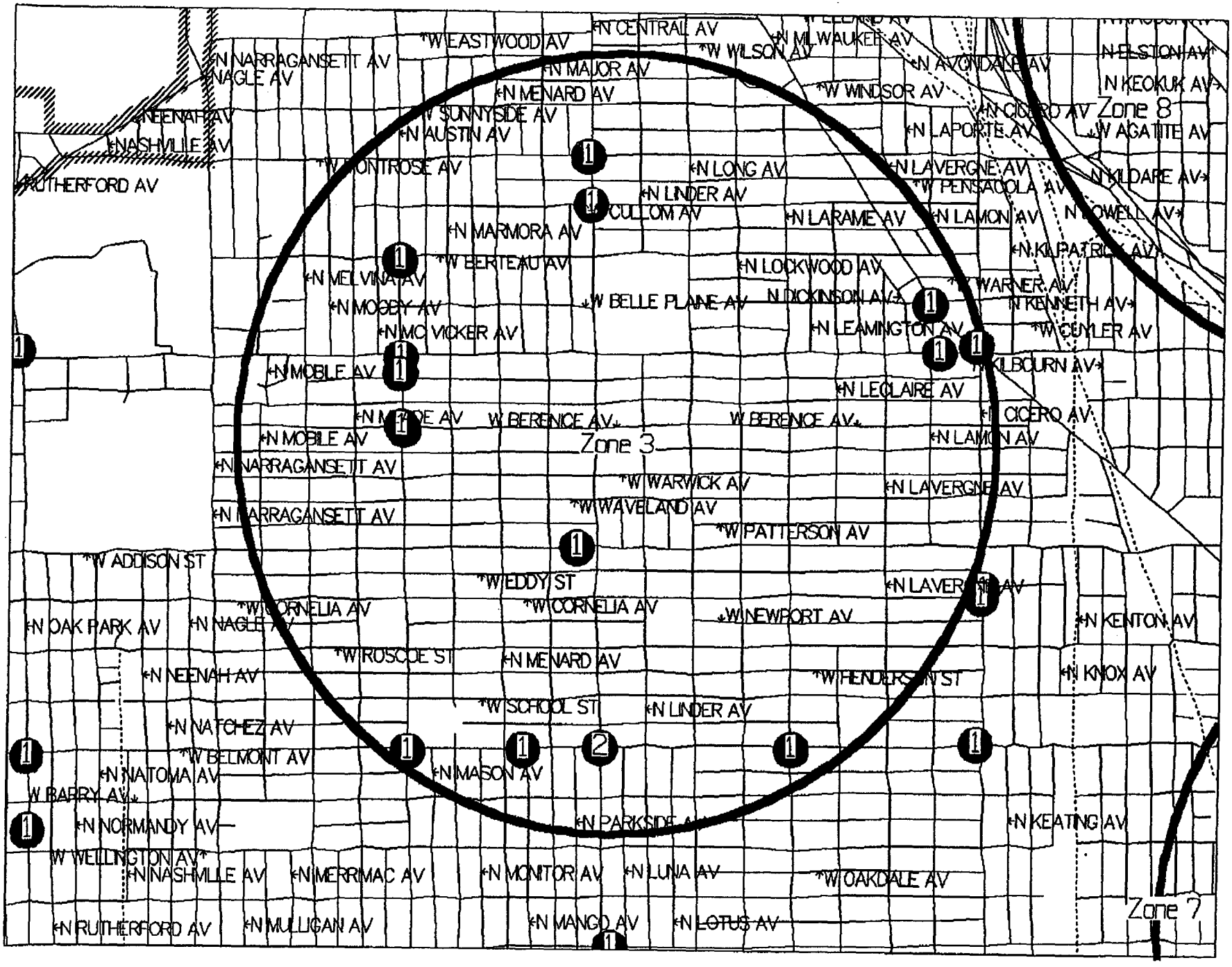
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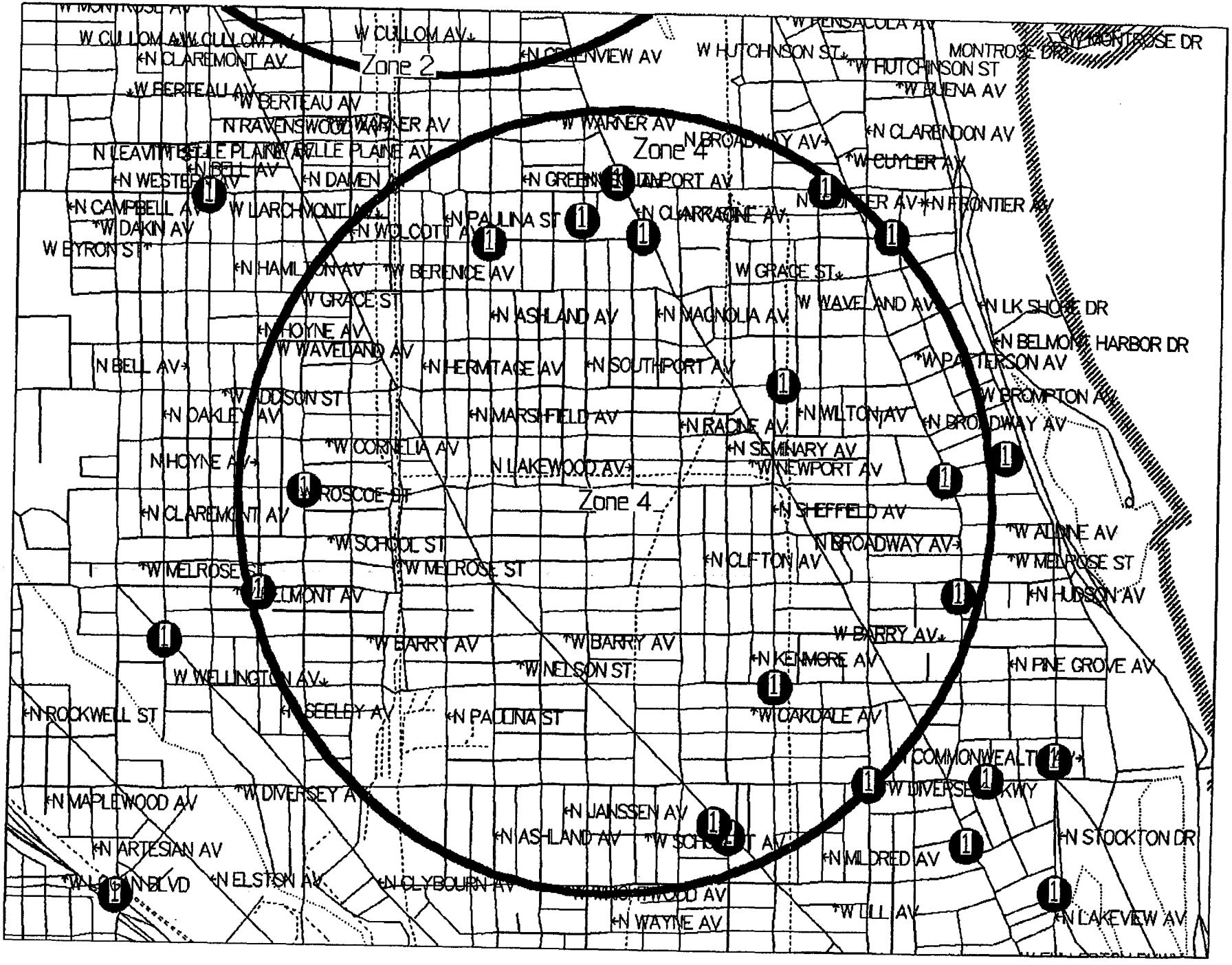
Zone 2
Zone 4
Zone 4
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W BERTEAU AV
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W WARNER AV
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W BELLE PLAINE AV
N WESTERN AV
N CAMPBELL AV
W LARCHMONT AV
W DAKIN AV
W BYRON ST
N GREENVIEW AV
N PAULINA ST
N WOLCOTT AV
N HAMILTON AV
W BERENICE AV
W GRACE ST
N HOYNE AV
W WAVELAND AV
N BELL AV
N HERMITAGE AV
N ASHLAND AV
N MAGNOLIA AV
N SOUTHPORT AV
W ADDISON ST
N OAKLEY AV
N MARSHFIELD AV
N HOYNE AV
W CORNELIA AV
N LAKEWOOD AV
W ROSCOE ST
N CLAREMONT AV
W SCHOOL ST
W MELROSE ST
W BARRY AV
W WELLINGTON AV
N SEELEY AV
N PAULINA ST
N ROCKWELL ST
W DIVERSEY AV
N MAPLEWOOD AV
N ARTESIAN AV
N ELSTON AV
N CLYBOURN AV
N WAYNE AV
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W BUENA AV
N CLARENDON AV
W CUYLER AV
N FRONTIER AV
N CLARIDGE AV
N BROADWAY AV
W WAVELAND AV
N LK SHORE DR
N BELMONT HARBOR DR
W PATTERSON AV
W BROMPTON AV
N WILTON AV
N RACINE AV
N SEMINARY AV
W NEWPORT AV
N SHEFFIELD AV
N BROADWAY AV
N CLIFTON AV
W ALDINE AV
W MELROSE ST
N HUDSON AV
W BARRY AV
N KENMORE AV
W NELSON ST
W OAKDALE AV
N PINE GROVE AV
W DIVERSEY PKWY
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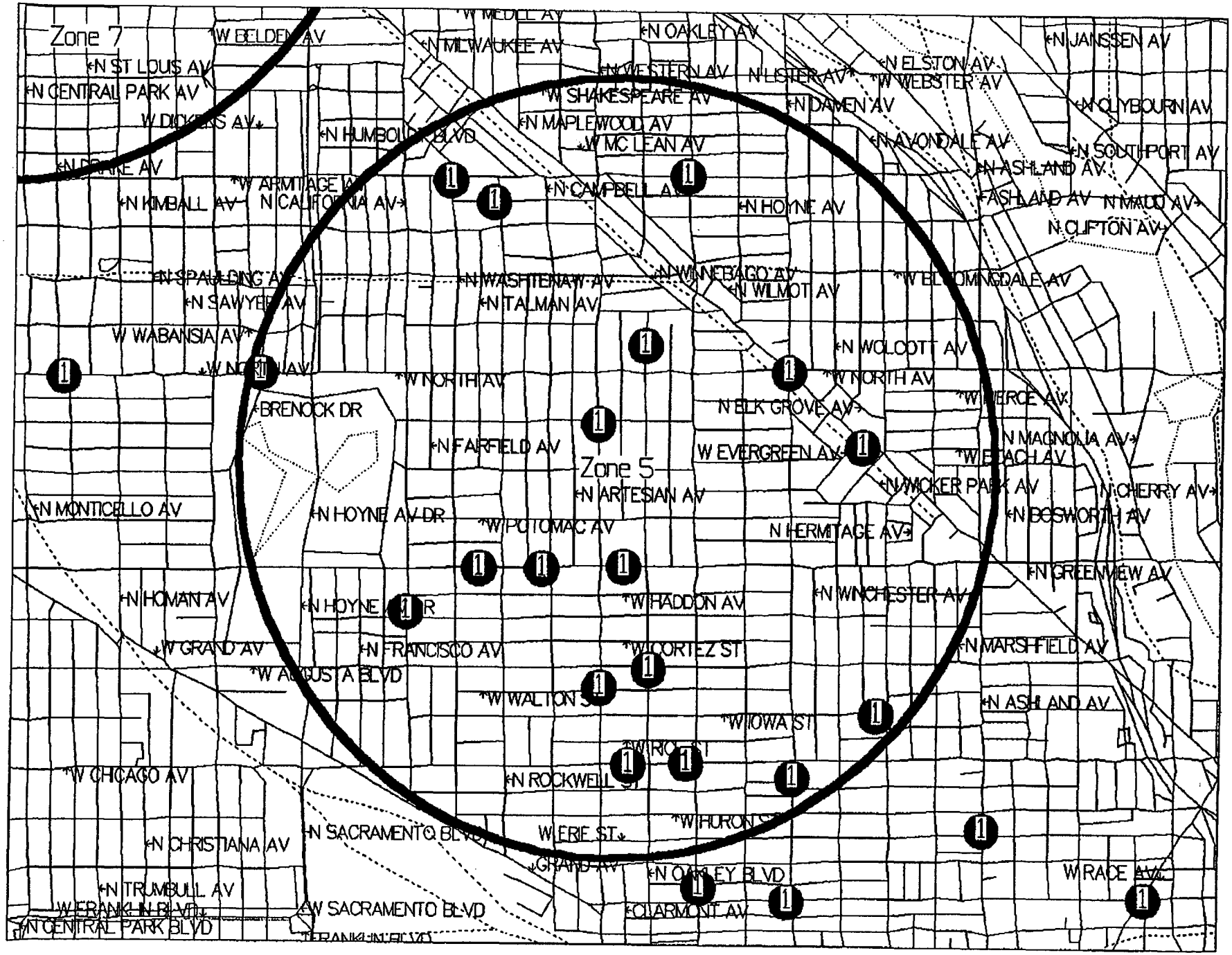
N STOCKTON DR
W LILL AV
N LAKEVIEW AV
W MONTROSE DR
MONTROSE DR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Zone 5
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W DICKENS AV
N DRAKE AV
N KIMBALL AV
W ARMITAGE AV
N CALIFORNIA AV
N SPAULDING AV
N SAWYER AV
W WABANSIA AV
W NORTH AV
BRENOCK DR
N MONTICELLO AV
N HOYNE AV DR
N HOMAN AV
W GRAND AV
W AUGUSTA BLVD
W CHICAGO AV
N CHRISTIANA AV
N TRUMBULL AV
W FRANKLIN BLVD
N CENTRAL PARK BLVD
W MEDILL AV
N MILWAUKEE AV
N OAKLEY AV
N WESTERN AV
W SHAKESPEARE AV
N MAPLEWOOD AV
W MC LEAN AV
N HUMBOLDT BLVD
N CAMPBELL AV
N HOYNE AV
N WASHTENAW AV
N TALMAN AV
N FAIRFIELD AV
W POTOMAC AV
N FRANCISCO AV
W WALTON ST
N ROCKWELL ST
W ERIE ST
GRAND AV
W SACRAMENTO BLVD
N LISTER AV
N DAMEN AV
N WINNEBAGO AV
N WILMOT AV
N WOLCOTT AV
N ELK GROVE AV
W EVERGREEN AV
N ARTESIAN AV
W PADDOCK AV
W CORTEZ ST
W IOWA ST
W HURON ST
N OAKLEY BLVD
CLARMONT AV
N ELSTON AV
W WEBSTER AV
N JANSSEN AV
N OLYBOURN AV
N AVONDALE AV
N SOUTHPORT AV
N ASHLAND AV
FASHLAND AV
N MADD AV
N CLIFTON AV
W BLOOMINGDALE AV
N MAGNOLIA AV
W WICKER PARK AV
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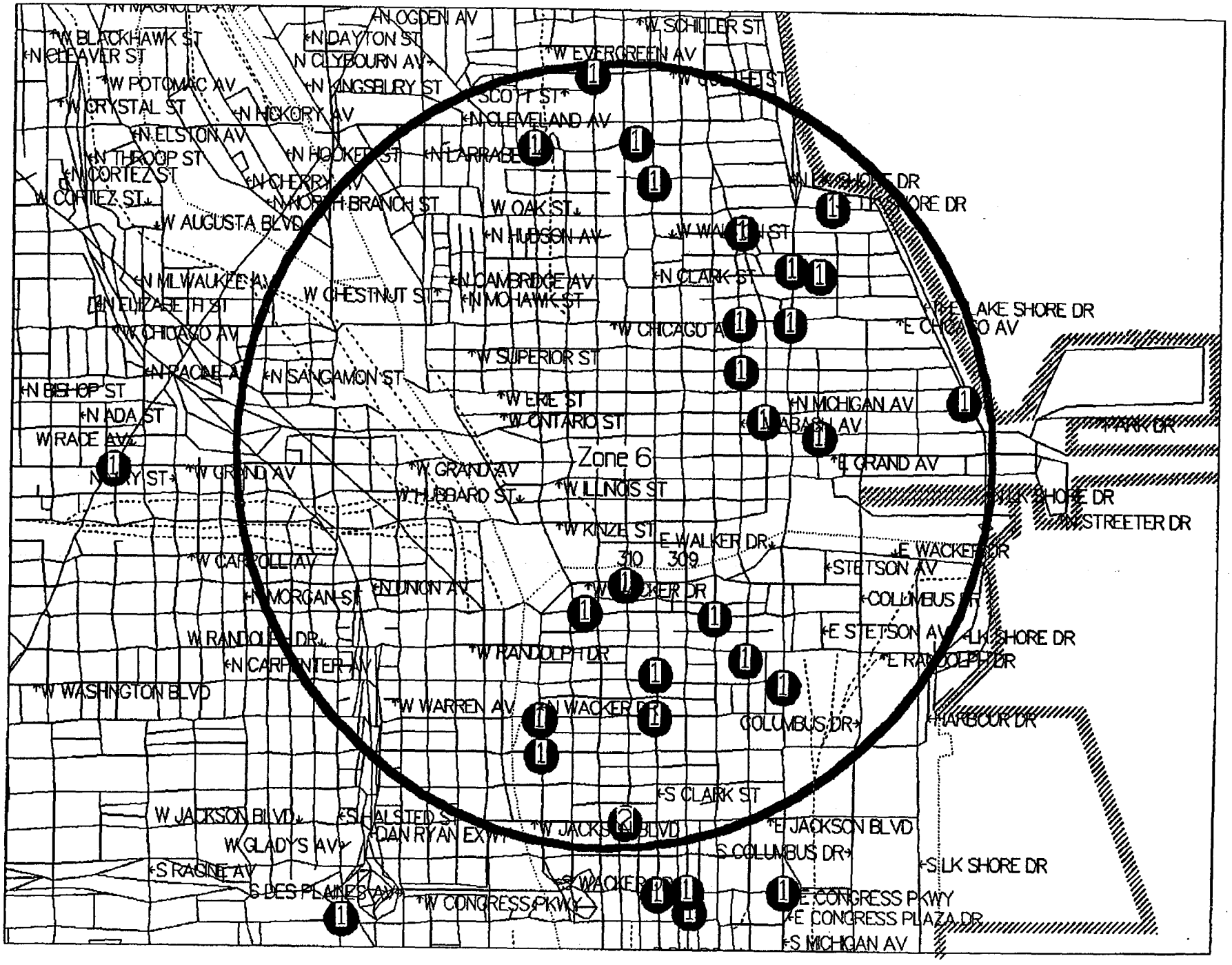
N MARSHFIELD AV
N ASHLAND AV
W RACE AV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N KINGSBURY ST
W CRYSTAL ST
N HICKORY AV
SCOTT ST
N CLEVELAND AV
N ELSTON AV
N THROOP ST
N HOOKER ST
N LARRABEE
N CORTEZ ST
N CHERRY AV
W CORTEZ ST
NORTH BRANCH ST
W OAK ST
N LAKE SHORE DR
W AUGUSTA BLVD
N HUDSON AV
W WALTON ST
N MILWAUKEE AV
N LOOMBRIDGE AV
N CLARK ST
W CHESTNUT ST
N MOHAWK ST
N ELIZABETH ST
N LAKE SHORE DR
W CHICAGO AV
W CHICAGO AV
E CHICAGO AV
W SUPERIOR ST
N RACINE AV
N SANGAMON ST
N BISHOP ST
W ERIE ST
N MICHIGAN AV
N ADA ST
W ONTARIO ST
N WABASH AV
W RACE AV
N PARK DR
N HALSTED ST
W GRAND AV
E GRAND AV
W GRAND AV
W HUBBARD ST
W ILLINOIS ST
N LAKE SHORE DR
N STREETER DR
W KINZIE ST
E WALKER DR
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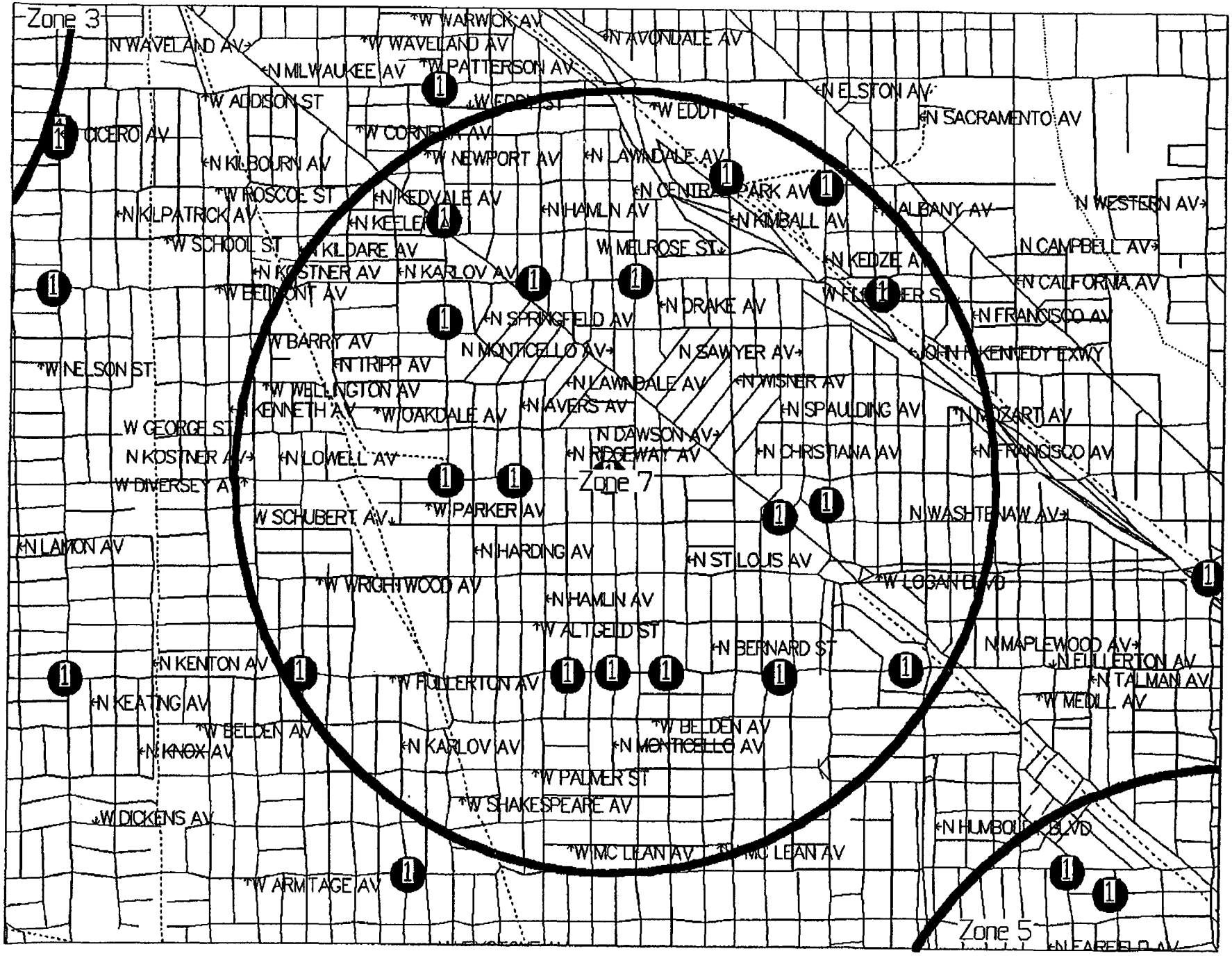
310
309
W CARROLL AV
STETSON AV
N MORGAN ST
N UNION AV
W WACKER DR
COLUMBUS DR
W RANDOLPH ST
E STETSON AV
N LAKE SHORE DR
N CARPENTER AV
W RANDOLPH ST
E RANDOLPH DR
W WASHINGTON BLVD
W WARREN AV
N WACKER DR
COLUMBUS DR
HARBOUR DR
S CLARK ST
W JACKSON BLVD
S HALSTED ST
W JACKSON BLVD
E JACKSON BLVD
DAN RYAN EXWY
W GLADYS AV
S COLUMBUS DR
S RACINE AV
S LK SHORE DR
S WACKER DR
S DES PLAINES AV
W CONGRESS PKWY
E CONGRESS PKWY
E CONGRESS PLAZA DR
S MICHIGAN AV


Zone 3
Zone 7
Zone 5
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N MILWAUKEE AV
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N ELSTON AV
W ADDISON ST
W EDDY ST
N SACRAMENTO AV
N CICERO AV
W CORNELIA AV
N KILBOURN AV
W NEWPORT AV
N LAWNDALE AV
W ROSCOE ST
N KEDVALE AV
N CENTRAL PARK AV
N WESTERN AV
N KILPATRICK AV
N KEELER AV
N HAMLIN AV
N KIMBALL AV
N ALBANY AV
W SCHOOL ST
N KILDARE AV
W MELROSE ST
N CAMPBELL AV
N KOSTNER AV
N KARLOV AV
N KEDZIE AV
W BELMONT AV
N CALIFORNIA AV
N DRAKE AV
N SPRINGFIELD AV
N FRANCISCO AV
W BARRY AV
N MONTICELLO AV
N SAWYER AV
JOHN F KENNEDY EXWY
W NELSON ST
N TRIPP AV
N LAWNDALE AV
N WISNER AV
W WELLINGTON AV
KENNETH AV
W OAKDALE AV
N AVERS AV
N SPAULDING AV
N MOZART AV
W GEORGE ST
N DAWSON AV
N KOSTNER AV
N LOWELL AV
N RIDGEWAY AV
N CHRISTIANA AV
N FRANCISCO AV
W DIVERSEY AV
W PARKER AV
N WASHTENAW AV
W SCHUBERT AV
N LAWLER AV
N HARDING AV
N ST LOUIS AV
W LOGAN BLVD
W WRIGHTWOOD AV
N HAMLIN AV
W ALTGELD ST
N BERNARD ST
N MAPLEWOOD AV
N KENTON AV
W FULLERTON AV
N ELLERTON AV
N TALMAN AV
N KEATING AV
W MEDILL AV
W BELDEN AV
N KNOX AV
N KARLOV AV
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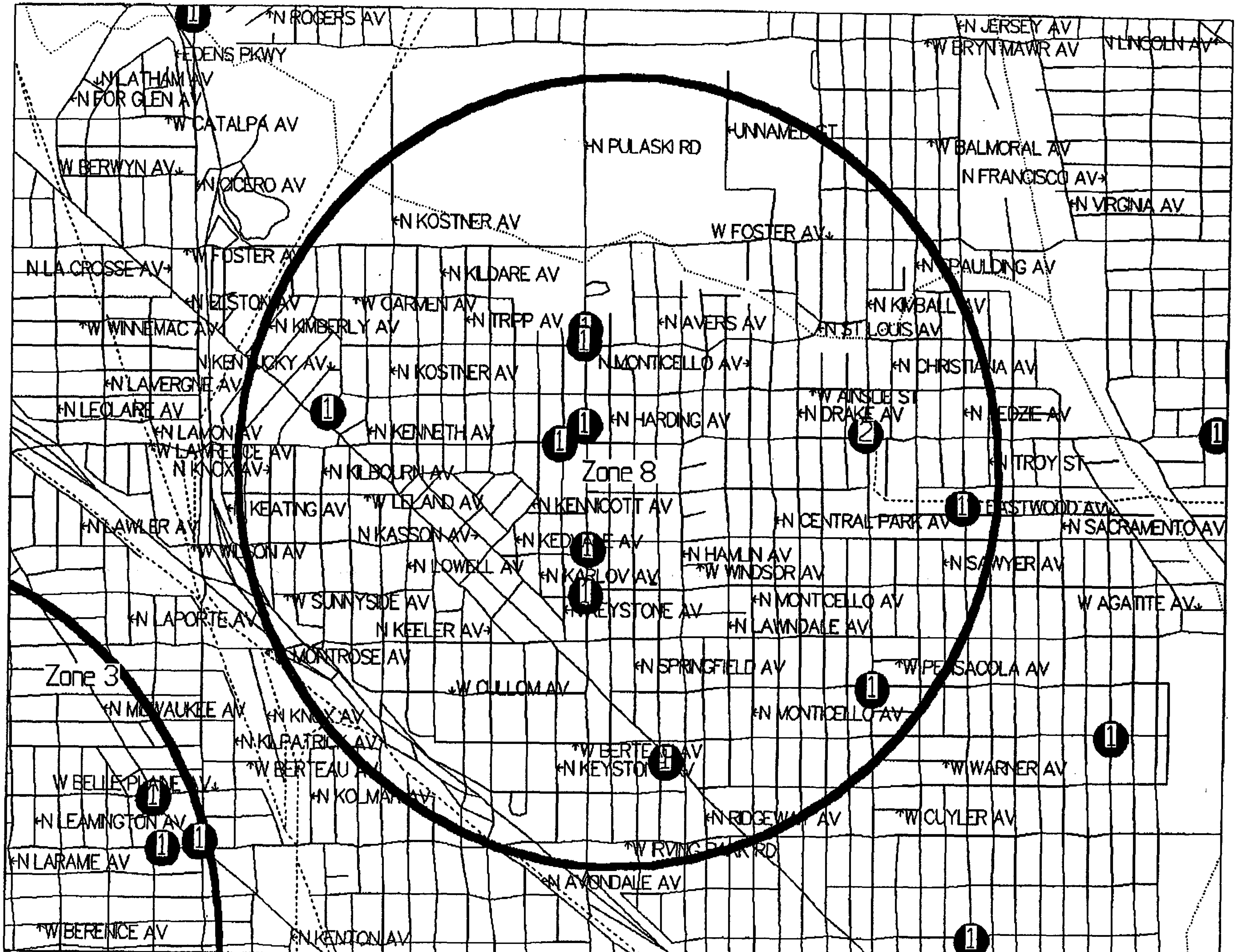
W MC LEAN AV
W ARMITAGE AV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W FOSTER AV
N LA CROSSE AV
N KILDARE AV
W CARMEN AV
N KIMBERLY AV
N TRIPP AV
N AVERS AV
N MONTICELLO AV
N KOSTNER AV
N LAVERGNE AV
N LECLARE AV
N HARDING AV
N DRAKE AV
N KENNETH AV
N KILBOURN AV
Zone 8
N KEATING AV
W LELAND AV
N KENNICOTT AV
N CENTRAL PARK AV
N KASSON AV
N LOWELL AV
N HAMLIN AV
W WINDSOR AV
W WILSON AV
W SUNNYSIDE AV
N LAPORTE AV
N KEELER AV
N MONTICELLO AV
N LAWNDALE AV
N SPRINGFIELD AV
W CULLOM AV
Zone 3
N MILWAUKEE AV
N MONTICELLO AV
W WARNER AV
N KEYSTONE AV
N RIDGEWAY AV
W CUYLER AV
N LEAMINGTON AV
N LARAME AV
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N AVONDALE AV
W BERENICE AV
N KENTON AV
N JERSEY AV
W BRYN MAWR AV
N LINCOLN AV
W BALMORAL AV
N FRANCISCO AV
N VIRGINIA AV
N SPAULDING AV
N KIMBALL AV
N ST LOUIS AV
N CHRISTIANA AV
W AINSLIE ST
N KEDZIE AV
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W BELLE PLAINE AV
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N KOLMAR AV
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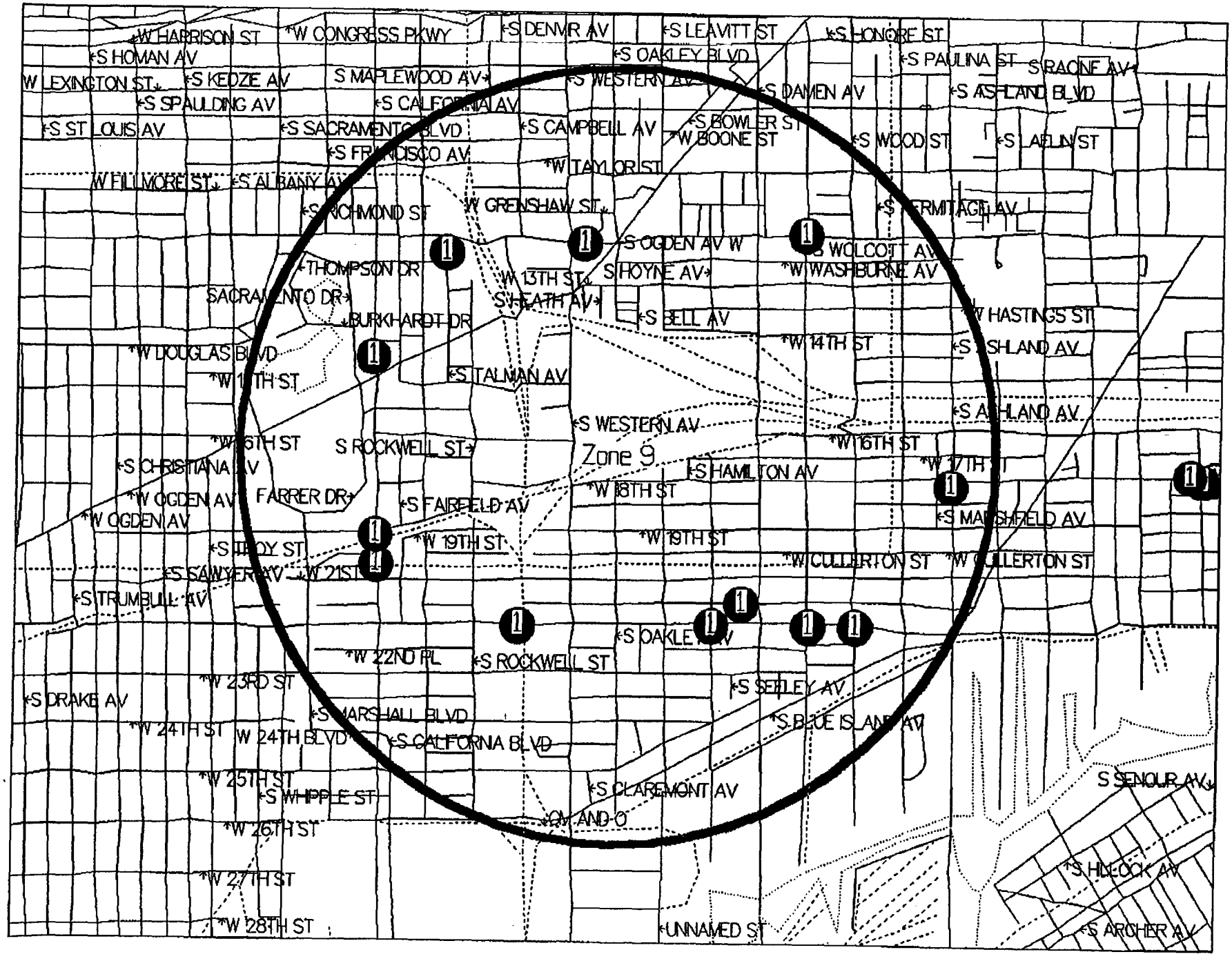
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S HONORE ST
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S RACINE AV
W LEXINGTON ST
S KEDZIE AV
S MAPLEWOOD AV
S WESTERN AV
S DAMEN AV
S ASHLAND BLVD
S SPAULDING AV
S CALIFORNIA AV
S ST LOUIS AV
S SACRAMENTO BLVD
S CAMPBELL AV
S BOWLER ST
W BOONE ST
S WOOD ST
S AELIN ST
S FRANCISCO AV
W TAYLOR ST
W FILLMORE ST
S ALBANY AV
S RICHMOND ST
W GRENSHAW ST
S HERMITAGE AV
S OGDEN AV W
S WOLCOTT AV
THOMPSON DR
W 13TH ST
S HOYNE AV
W WASHBURNE AV
SACRAMENTO DR
S HEATH AV
BURKHARDT DR
S BELL AV
W HASTINGS ST
W DOUGLAS BLVD
W 14TH ST
S ASHLAND AV
W 15TH ST
S TALMAN AV
S WESTERN AV
S ASHLAND AV
W 16TH ST
S ROCKWELL ST
Zone 9
S CHRISTIANA AV
S HAMILTON AV
W 17TH ST
W OGDEN AV
FARRER DR
W 18TH ST
S FAIRFIELD AV
S MARSHFIELD AV
W OGDEN AV
W 19TH ST
W 19TH ST
S LOOMIS ST
W CULLERTON ST
W CULLERTON ST
S SAWYER AV
W 21ST
S TRUMBULL AV
S OAKLEY AV
W 22ND PL
S ROCKWELL ST
W 23RD ST
S SEELEY AV
S DRAKE AV
S MARSHALL BLVD
W 24TH ST
W 24TH BLVD
S CALIFORNIA BLVD
S BLUE ISLAND AV
W 25TH ST
S CLAREMONT AV
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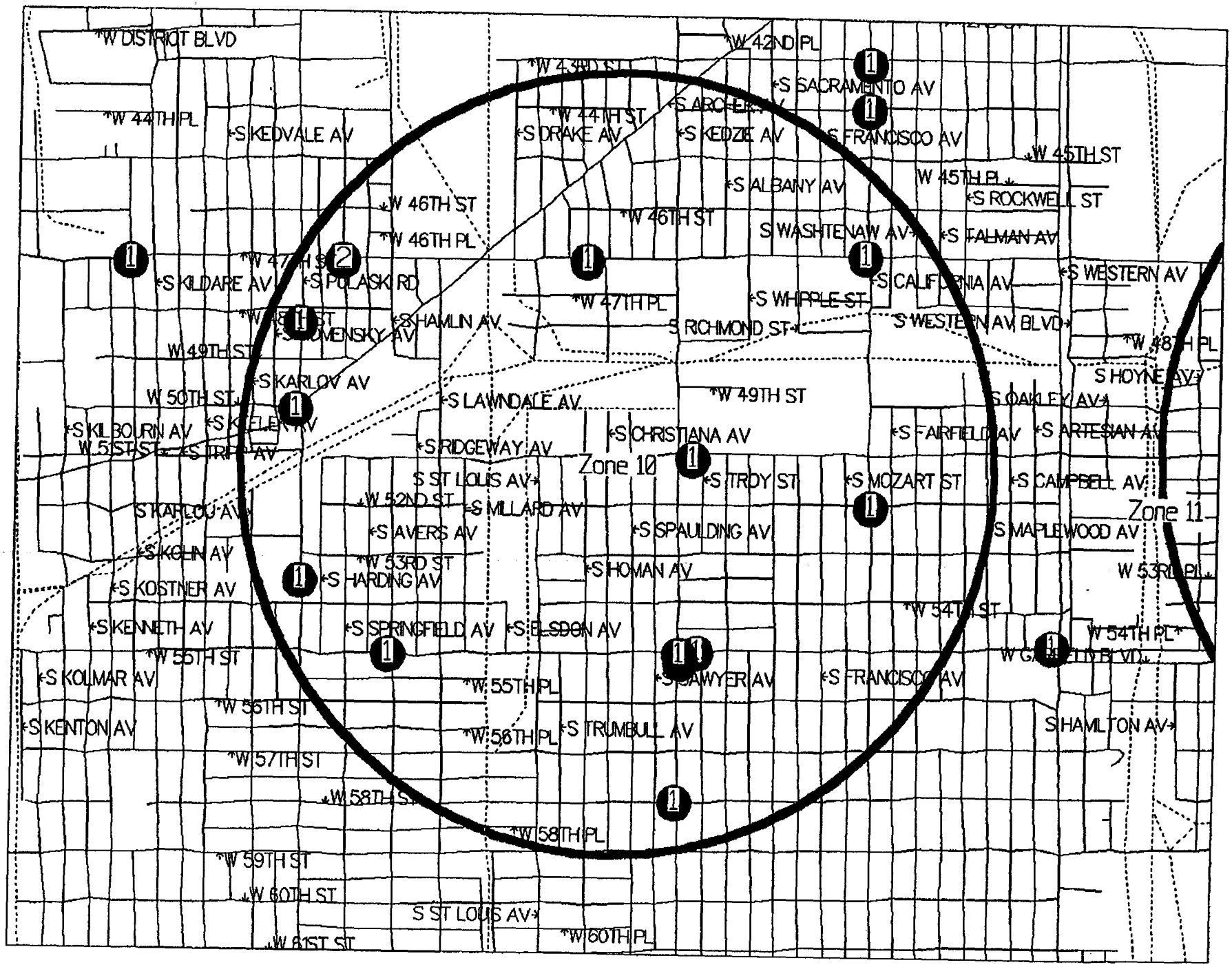
S ARCHER AV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S FRANCISCO AV
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W 45TH PL
S ALBANY AV
S ROCKWELL ST
W 46TH ST
W 46TH PL
S WASHTENAW AV
S TALMAN AV
S KILDARE AV
S POLASKI RD
W 47TH PL
S WHIPPLE ST
S CALIFORNIA AV
S WESTERN AV
S HAMLIN AV
S RICHMOND ST
S WESTERN AV BLVD
W 49TH ST
S KARLOV AV
W 50TH ST
S LAWNDALE AV
W 49TH ST
S OAKLEY AV
S KILBOURN AV
S CHRISTIANA AV
S FAIRFIELD AV
S ARTESIAN AV
W 51ST ST
S RIDGEWAY AV
Zone 10
S ST LOUIS AV
S TROY ST
S MOZART ST
S CAMPBELL AV
W 52ND ST
S MILLARD AV
Zone 11
S KARLOV AV
S AVERS AV
S SPAULDING AV
S MAPLEWOOD AV
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S HOMAN AV
W 53RD PL
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S SPRINGFIELD AV
S ELSDON AV
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S KOLMAR AV
W 55TH PL
S SAWYER AV
S FRANCISCO AV
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S KENTON AV
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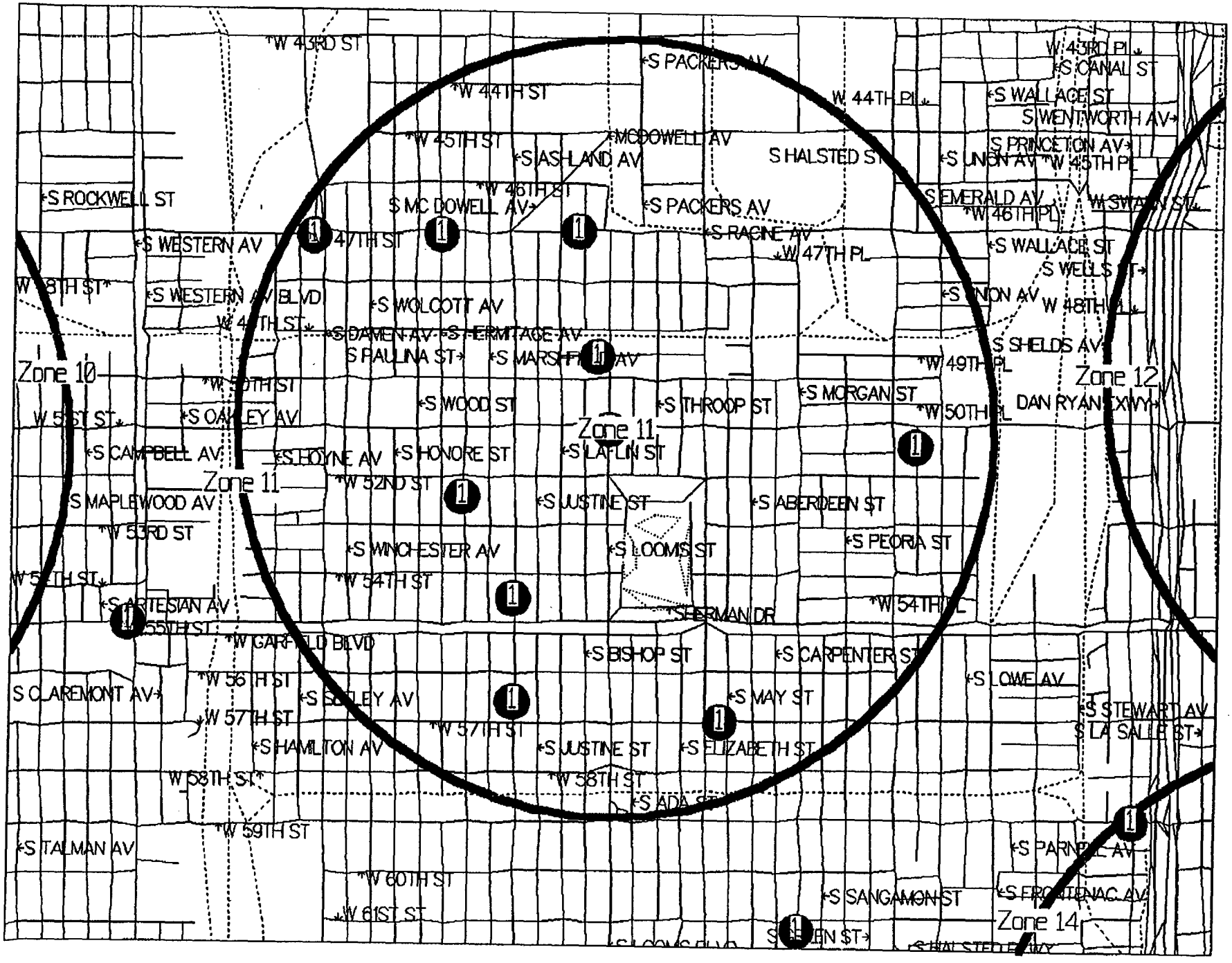
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S HALSTED ST
S PRINCETON AV
S UNION AV
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S PACKERS AV
S EMERALD AV
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S WESTERN AV
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S RACINE AV
W 47TH PL
S WALLACE ST
S WELLS ST
W 48TH ST
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S WOLCOTT AV
S UNION AV
W 48TH PL
S DAMEN AV
S HERMITAGE AV
S PAULINA ST
S MARSHFIELD AV
S SHIELDS AV
W 49TH PL
Zone 10
Zone 12
W 50TH ST
S WOOD ST
S THROOP ST
S MORGAN ST
W 50TH PL
DAN RYAN EXWY
W 51ST ST
S OAKLEY AV
Zone 11
S CAMPBELL AV
S HOYNE AV
S HONORE ST
S LAFLIN ST
Zone 11
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S BISHOP ST
S CARPENTER ST
W 56TH ST
S LOWE AV
S CLAREMONT AV
S OAKLEY AV
S MAY ST
S STEWART AV
W 57TH ST
W 57TH ST
S LA SALLE ST
S HAMILTON AV
S JUSTINE ST
S ELIZABETH ST
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S ADA ST
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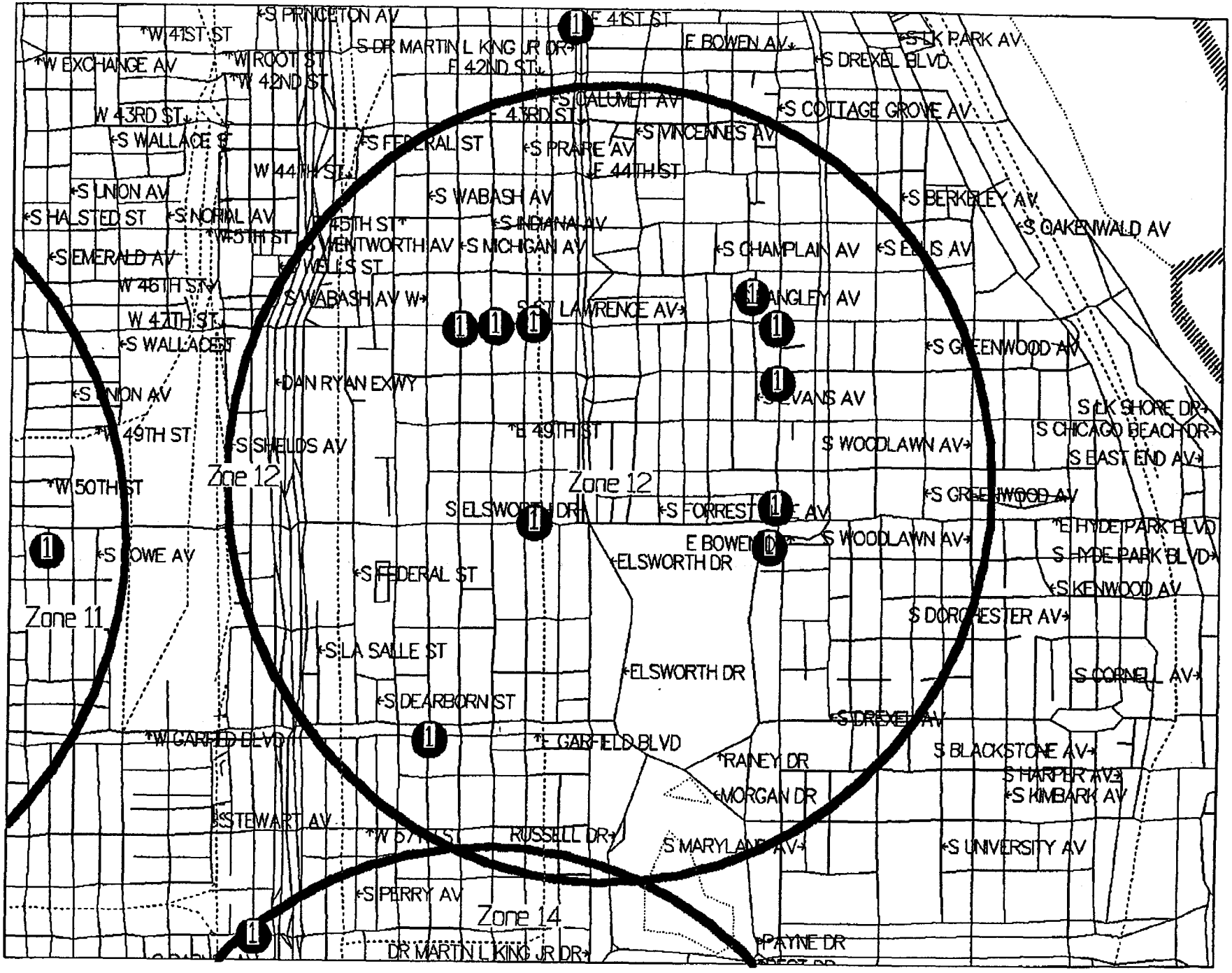
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Zone 12
Zone 12
Zone 14
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W EXCHANGE AV
W ROOT ST
E 42ND ST
S DREXEL BLVD
W 42ND ST
S CALUMET AV
S COTTAGE GROVE AV
W 43RD ST
E 43RD ST
S WALLACE ST
S FEDERAL ST
S PRAIRIE AV
S VINCENNES AV
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E 44TH ST
S UNION AV
S WABASH AV
S BERKELEY AV
S HALSTED ST
S NORMAL AV
W 45TH ST
S INDIANA AV
S OAKENWALD AV
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S WENTWORTH AV
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S LANGLEY AV
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S WALLACE ST
S GREENWOOD AV
DAN RYAN EXWY
S UNION AV
S EVANS AV
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S CHICAGO BEACH DR
S SHIELDS AV
S WOODLAWN AV
S EAST END AV
W 50TH ST
S ELSWORTH DR
S FORRESTER AV
S GREENWOOD AV
E HYDE PARK BLVD
E BOWEN
S WOODLAWN AV
S HYDE PARK BLVD
S LOWE AV
ELSWORTH DR
S FEDERAL ST
S KENWOOD AV
S DORCHESTER AV
S LA SALLE ST
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S CORNELL AV
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S HARPER AV
MORGAN DR
S KIMBARK AV
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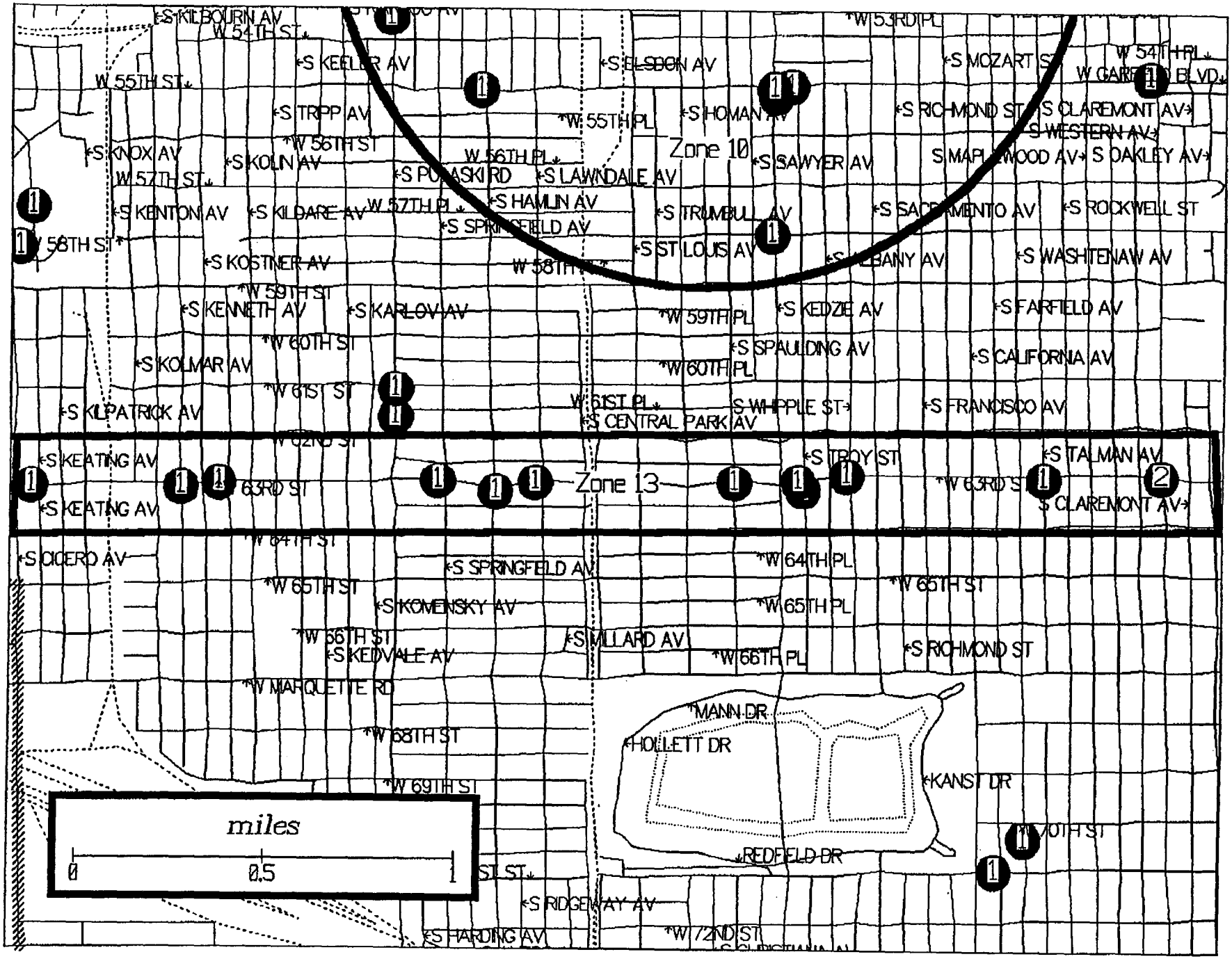
S PERRY AV
PAYNE DR
DR MARTIN L KING JR DR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S TRIPP AV
W 55TH PL
S HOMAN AV
S RICHMOND ST
S CLAREMONT AV
S WESTERN AV
W 56TH ST
S KNOX AV
S KOLIN AV
W 56TH PL
Zone 10
S SAWYER AV
S MAPLEWOOD AV
S OAKLEY AV
W 57TH ST
S PULASKI RD
S LAWNDALE AV
S KENTON AV
S KILDARE AV
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S SACRAMENTO AV
S ROCKWELL ST
W 58TH ST
S ST LOUIS AV
S ALBANY AV
S WASHTENAW AV
S KOSTNER AV
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W 59TH ST
S KENNETH AV
S KARLOV AV
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S FAIRFIELD AV
W 60TH ST
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S KOLMAR AV
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W 66TH PL
S RICHMOND ST
W MARQUETTE RD
MANN DR
W 68TH ST
HOLLETT DR
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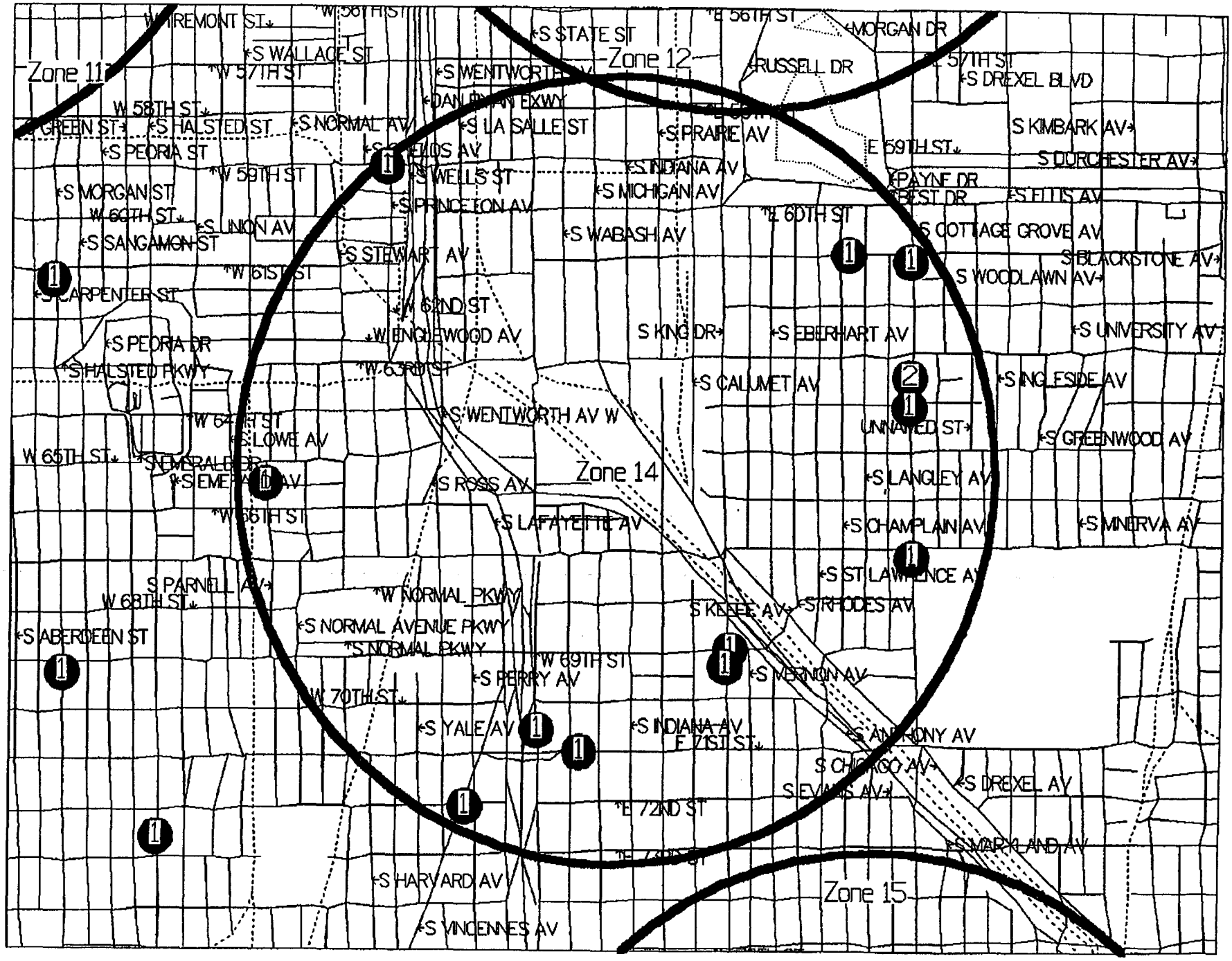
Zone 11
Zone 12
Zone 14
Zone 15
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W 56TH ST
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S STATE ST
MORGAN DR
S WALLACE ST
W 57TH ST
S WENTWORTH AV
RUSSELL DR
E 57TH ST
S DREXEL BLVD
DAN RYAN EXWY
W 58TH ST
S GREEN ST
S HALSTED ST
S NORMAL AV
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S PRAIRIE AV
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S PEORIA ST
E 59TH ST
S DORCHESTER AV
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S INDIANA AV
PAYNE DR
S MORGAN ST
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BEST DR
S ELLIS AV
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S PRINCETON AV
E 60TH ST
S UNION AV
S WABASH AV
S COTTAGE GROVE AV
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S STEWART AV
S BLACKSTONE AV
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S WOODLAWN AV
S CARPENTER ST
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W ENGLEWOOD AV
S KING DR
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S PEORIA DR
S HALSTED PKWY
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UNNAMED ST
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S CHAMPLAIN AV
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W NORMAL PKWY
S KEELER AV
S RHODES AV
S NORMAL AVENUE PKWY
S ABERDEEN ST
S NORMAL PKWY
W 69TH ST
S VERNON AV
S PERRY AV
W 70TH ST
S YALE AV
S INDIANA AV
E 71ST ST
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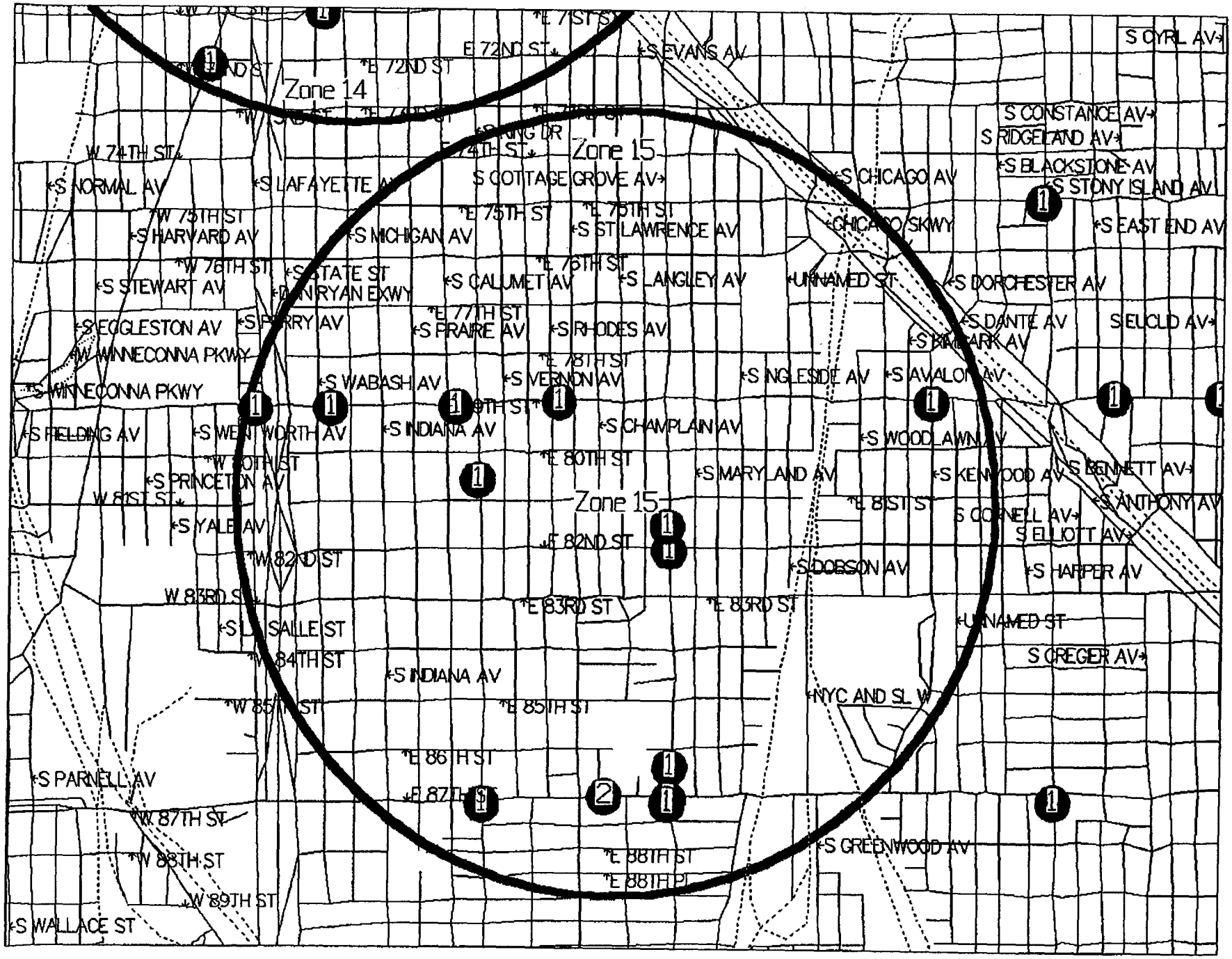
S VINCENNES AV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S LAFAYETTE AV
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S DANTE AV
S EUCLID AV
W WINNECONNA PKWY
E 78TH ST
S WABASH AV
S VERNON AV
S INGLESIDE AV
S AVALON AV
S WINNECONNA PKWY
S FIELDING AV
S WENTWORTH AV
S INDIANA AV
S CHAMPLAIN AV
S WOODLAWN AV
W 80TH ST
E 80TH ST
S BENNETT AV
S PRINCETON AV
S MARYLAND AV
S KENWOOD AV
W 81ST ST
E 81ST ST
S ANTHONY AV
S CORNELL AV
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S GREENWOOD AV
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W 89TH ST
S WALLACE ST

AVAILABLE PI&E MATERIALS

A variety of print and audiovisual materials were prepared for the older adult as part of the field test of the study. Included are brochures, envelope stuffers (or door hangers), posters, bus cards, print advertisements, bumper stickers, radio and television public service announcements (PSA's), a slide set and presenter's guide, and a video and discussion guide. These materials are coordinated through the use of the campaign title: ***Walking Through the Years***. Most of the materials are targeted for the pedestrian; a few are directed to the driver. Some of the materials cover the entire spectrum of pedestrian safety advice considered important for the older adult; others are devoted to specific pedestrian risks and associated correct behaviors.

Each of the materials is an outgrowth of a rigorous research process. First, crash data were analyzed to determine the causes of the various types of pedestrian crashes. Effort was focused on those behavioral errors which played a major role and were considered amenable to change. Then, remedial behaviors were developed and expressed in a manner appropriate for the particular media form. Often, preliminary versions of the messages were tested with members of the target audiences in focus groups or small scale pretests. After any indicated revisions were made, the materials were produced in polished form. Finally, most of them were field tested in various cities to determine their effectiveness.

A listing of the program materials is provided in Table 1 on the next three pages. The table lists first the general-purpose materials. These are followed by the materials devoted to the following specific pedestrian risks:

- Turning cars
- Multiple threat/visual screens
- Looking first before entering the street
- Backing cars
- Parking lots
- Conspicuity
- The fresh green light
- Driveways and alleys
- The flashing DON'T WALK signal.

The availability of each item and the form in which it is available are included in the table.

Descriptions of all the PI&E materials are provided in the following paragraphs. Audiovisual materials are described first. They are followed by descriptions of brochures and other print materials.

Table 1
***Walking Through the Years* PI&E Materials**

BROAD PROGRAM MATERIALS	
• Basic brochure--pedestrian (8-1/2 x 11)	Glossy available
• Envelope stuffers--pedestrian	
- 12-page brochure	Glossy available
- 8-page brochure	Available from AAA
- 1-page stuffer	Available from AAA
• Slides--pedestrian	
- Slide set and presenter's guide	Available from AAA/project
• Video--pedestrian (12:52)	
- Video	Available from AAA/project
- Discussion guide (2 pages)	Available from project
TURNING CARS	
• Envelope stuffer--pedestrian	
- Turning cars (1-page)	2-color negative available
• Envelope stuffer--motorist	
- Making turns (1-page)	2-color negative available
• Poster--motorist	
- Don't turn on a pedestrian	2-color negative available
• Print ads (1, 2, 3 col)--motorist	
- Don't turn on a pedestrian	2-color negative available
• Bumper sticker--motorist	
- Don't turn on a pedestrian	2-color negative available
• Small brochure--pedestrian/motorist	
- Turning vehicles	2-color negatives available
• Radio PSA's--motorist	
- Turning vehicles (30-sec)	Available from project
- Turning vehicles (60-sec)	Available from project
• TV PSA's--pedestrian	
- Turning vehicles	Available from project
- Right turn on red	Available from project

Table 1 (Continued)

MULTIPLE THREAT/VISUAL SCREENS	
• Envelope stuffer--pedestrian	
- Visual "screens"	2-color negative available
• Envelope stuffer--motorist	
- Stopped cars	2-color negative available
• Radio PSA's--motorist	
- Multiple threat (30-sec)	Available from project
- Multiple threat (60-sec)	Available from project
• Poster--motorist	
- Stopped car may hide a pedestrian	2-color negative available
• Bus poster--pedestrian	
- Crossing in front of a bus	2-color negative available
• Bus cards--pedestrian	
- Crossing in front of a bus	2-color negative available
- Crossing in front of stopped vehicle	2-color negative available
• Print ads (1, 2, 3 col)--motorist	
- Stopped car may hide a pedestrian	2-color negative available
• Bumper Sticker--motorist	
- Stopped car may hide a pedestrian	2-color negative available
• Small brochure--pedestrian/motorist	
- Stopped vehicles	2-color negative available
LOOKING FIRST	
• Envelope stuffer--pedestrian	
- First stepping off the curb	2-color negative available
- Understanding traffic signals	2-color negative available

Table 1 (Continued)

BACKING CARS	
• Envelope stuffer--pedestrian	
- Backing cars	2-color negative available
• Envelope stuffer--motorist	
- Backing	2-color negative available
PARKING LOTS	
• Envelope stuffer--pedestrian	
- Parking lots	2-color negative available
• TV PSA--pedestrian	
- Parking lots	Available from project
CONSPICUITY	
• Envelope stuffer--pedestrian	
- Being seen	2-color negative available
• TV PSA--pedestrian	
- Conspicuity	Available from project
THE FRESH GREEN LIGHT	
• Envelope stuffer--pedestrian	
- The "fresh" green light	2-color negative available
• TV PSA--pedestrian	
- Wait for the fresh signal	Available from project
DRIVEWAYS AND ALLEYS	
• Envelope stuffer--pedestrian	
- Driveways and alleys	2-color negative available
THE FLASHING DON'T WALK SIGNAL	
• Envelope stuffer--pedestrian	
- The flashing "DON'T WALK" signal	2-color negative available

Audiovisual Materials

Audiovisual materials include a video (with discussion guide), a slide set and presenter's guide, and television and radio PSA's. Each of these is described below.

Video and Discussion Guide. The video, entitled ***Walking Through the Years***, has a running time of 12:52 minutes. It provides pedestrian safety advice on the following:

- The basics of stopping at the curb and looking left, right, and then left again before entering the street.
- Procedures for checking for turning vehicles and the importance of looking in *all* directions including *behind* the pedestrian.
- The importance of checking for traffic even when the light is green or the signal says WALK.
- Providing the most time to cross the street by waiting for a fresh green light or WALK signal.
- The meaning of the flashing DON'T WALK signal.
- Checking for cars when there is another vehicle or object blocking the pedestrian's and driver's view of each other.
- Being alert to the signs that a car might back up.
- Treating a parking lot like an intersection.
- Making sure that the pedestrian is conspicuous to the driver.

The video was prepared to be shown in group settings of older adults or for presentation on television. Therefore, it is available in standard VHS (½ inch) format as well as in ¾ inch, 1 inch and digital tape formats. A two page discussion guide describes the video and recommends procedures for presenting the video to groups of older adults.

Slide Set and Presenter's Guide. Twenty-five 35 mm slides summarize research on the problem of older adult pedestrian safety and provide advice on the same topics covered in the video. An accompanying document was prepared to aid in presenting the slides. Called a *Presenter's Guide*, it describes the slide contents and provides certain background information that the presenter may wish to use to amplify the contents of selected slides as appropriate. The slide set (or subsets of it) is designed to be shown to police, traffic engineering and other community groups who are concerned with older adult pedestrian safety as well as to audiences of the older adult themselves. The slides provide the advantage of easy customization to a given community or audience. The presenter can add slides that show specific problems in the community or specific areas where problems have

been resolved. The slides are available from the AAA (stock number 3006) or directly from the project.

PSA's. PSA's (closed captioned) have been prepared for both television and radio.

Television PSA's (all 30 second length) are available for the following pedestrian risks:

- Turning vehicles
- Right-turn-on-red
- Parking lots
- Conspicuity
- Wait for the fresh signal

Radio PSA's (30 sec and 60 sec) are available for the following risks:

- Turning vehicles
- Multiple threat/visual screens

The turning vehicle PSAs are available in both English and Spanish.

Brochures and Flyers (*Walking Through the Years* Theme)

Basic (16-Page) Brochure. This 8-1/2" x 11" brochure summarizes research on the problem of older adult pedestrian safety, describes the major risks facing older adults and recommends specific ways for them to improve their safety. It covers all items described previously for the program video and slide set. Originally prepared for individuals or organizations that would serve as "gatekeepers" to the elderly audience, it became apparent that it could be distributed directly to the target group or to the population at large. It is available in camera-ready format.

12-Page Flyer. This 4" x 9" flyer summarizes information provided in the basic brochure. The flyer could be distributed directly to the older adult or included with other materials in a standard business envelope. It is available in camera-ready format.

8-Page AAA Flyer. This two-color 4" x 9" flyer summarizes information presented in the basic brochure. Again, the flyer could be distributed directly to the older adult or included with other materials in a standard business envelope. The brochures are available from AAA (Stock # 3005).

2-Page AAA Flyer. This 4" by 9" flyer emphasizes the importance of seeing and being seen. Again, the flyer could be distributed directly to the older adult or included with other materials in a standard business envelope. The flyer is available from AAA (Stock # 3004).

Pedestrian and Motorist Brochures

Two four-page 3" by 6" brochures are available for distribution to both pedestrians and motorists. One, entitled ***You and You Should Never Meet Like This,*** describes the multiple threat risk. It advises the pedestrian who crosses in front of a stopped vehicle to stop at the edge of the vehicle and look around it for oncoming traffic before stepping into the next traffic lane. It advises the motorist who sees a stopped vehicle to anticipate that it may be hiding a pedestrian.

The second brochure is also called ***You and You Should Never Meet Like This.*** Directed toward the turning vehicle threat, it advises pedestrians to look at the driver of a turning vehicle to help determine what the driver is going to do. It advises motorists to take a last look for pedestrians before making a turn.

Both brochures could be distributed directly to drivers and older adults. They could also be included in small-envelope mailings. Two-color negatives are available for both brochures.

Bumper Stickers

Two bumper stickers are available for the program. Both are oriented toward the motorist. One is addressed to the multiple threat risk and advises the motorist as follows:

- ***My stopped car may be hiding a pedestrian.***

The second bumper sticker addresses the turning vehicle risk and presents the following advice:

- ***Don't turn on a pedestrian. Take that last look.***

Both bumper stickers could be distributed directly to drivers and older adults. Two-color negatives are available for both.

Posters/Print Advertisements

Two posters and accompanying print advertisements were prepared for the motorist. One is addressed to the multiple threat risk and advises drivers as follows:

- ***Drivers--A stopped car may be hiding a pedestrian.***

The second is addressed to the turning risk and advises drivers as follows:

- ***Don't turn on a pedestrian. Take that last look!***

Posters could be displayed in motor vehicle offices or other places where drivers assemble. Print advertisements are provided in three different sizes. They could be distributed to local newspapers as well as to companies that provide routine billings to the community for inclusion in their accompanying flyers. Two-color negatives are available for all these materials.

Bus Cards/Posters

Two bus cards and one bus poster are available for the project. All are directed to the pedestrian and address the multiple threat risk. The bus cards provide the following advice:

- ***When stopping in front of any stopped vehicle, stop and look around it!***

- ***When crossing in front of a bus, stop and look around it!***

The bus poster, intended for bus shelters and waiting rooms repeats the second of the two above-listed pieces of advice.

Two-color negatives are available for all bus materials.

Envelope Stuffers/Door Hangers

A set of 4 x 9 inch flyers provides advice for motorists and pedestrians. Three flyers are addressed to motorists and provide advice on the following:

- Watching for pedestrians while making turns.

- Being alert to the possibility that a stopped car may be hiding a pedestrian.

- Checking carefully for pedestrians before backing a vehicle.

Ten flyers are addressed to pedestrians and provide advice on the following:

- Looking carefully for cars before stepping off the curb because that is when the pedestrian is at the greatest risk.
- Looking in all traffic directions for turning cars before stepping off the curb.
- Stopping at the outside edge of a stopped vehicle and searching around it for oncoming traffic.
- Recognizing that a green light or WALK signal doesn't mean Go; it means Look First to make sure it's safe.
- Treating a driveway or alley like a roadway and checking for traffic before crossing.
- Being alert to the signs that a car may back up.
- Treating parking lots like roadways.
- Understanding the DON'T WALK signal.
- Waiting for a "fresh" green light or WALK signal to obtain the most time to cross.
- Making oneself conspicuous to the driver both during the day and at night.

These flyers can be distributed as handouts or can be designed as door hangers. Two-color negatives are available for all flyers.

The total PI&E package covers virtually all pedestrian crash situations and media forms relevant to the older adult. Some media types not covered explicitly such as billboards, could easily be addressed by an adaptation of one or more of the materials described above. It is important to note that all materials, including the audiovisuals, were designed with space for local sponsorship. Thus, it is simple for a City department or cooperating private organization to add their logo to any materials prior to duplication.

COOPERATIVE TASKS

A prime objective of the NHTSA/FHWA project is to develop a model zone definition and utilization system which can be applied in other cities using a manual as guidance. NHTSA and FHWA have funded Dunlap for the development of countermeasure materials, providing technical consulting to the two test cities and conducting a thorough evaluation. It is up to the cooperating cities to produce and distribute the countermeasures with whatever localization they think would be beneficial. Dunlap will provide contract funds to each city as "seed" money to move the process along more quickly to facilitate the evaluation.

The specific tasks needed to implement the zone concept are shown in Table 2. As shown, these will be shared among the *sponsors* (NHTSA/FHWA), the *project* (Dunlap and HSRC), *DPW* (the Department of Public Works, Bureau of Traffic Engineering and Operations) and various *volunteer* groups in Chicago. The shaded boxes are for the tasks which are most dependent on broad volunteer groups from the public and private sectors for their ultimate success.

Table 2

List of Cooperative Tasks

Task	Lead	Assistance	Comments
Define Zones	Project	DPW	Already completed
Analyze zones	DPW	Project	Will involve on-street surveys and specific countermeasure selection
Develop PI&E materials	Project	Volunteers	Localization and tailoring may be needed to enhance the effectiveness of the materials
Identify zone resources	DPW	Volunteers, Project	The availability of resources within the zone for countermeasure application, e.g., senior centers, bus shelters, will help determine which materials will be reproduced and distributed

Table 2 (continued)

Task	Lead	Assistance	Comments
Select PI&E materials	DPW, Volunteers	Project	Given limited resources, specific targets are needed before materials are duplicated
Reproduce PI&E materials	DPW, Volunteers	Project, Sponsors	Some Sponsor/Project funding is available. The objective is to maximize its effectiveness by combining with local resources
Distribute PI&E materials	DPW, Volunteers	Project	The "personal touch" helps ensure maximum exposure for public information materials
Identify sites for engineering changes	DPW	Volunteers, Project	Engineering resources are limited and must be applied where they are most needed. DPW can use help in identifying "hot spots"
Select engineering targets	DPW	Project	Engineering needs will have to be prioritized with respect to available resources and potential benefits from possible changes
Follow-up on progress	DPW	Volunteers, Project	DPW will serve as a clearinghouse for comments and suggestions about the program. Project will conduct detailed follow-up as necessary
Document process	Project	DPW, Volunteers	This is a model program which will be captured for use by other communities
Prepare Zone Manual	Project	DPW, Volunteers, Sponsors	The final product will be a manual (perhaps with a video) on how to apply the concept

It is clear from Table 2 that the success of this effort involves input and assistance from a variety of sources with knowledge of Chicago and its older adult population. Whether in the identification of unique problems or in the adaptation of solutions, local experience is vitally needed. If the process proves as efficient as hoped, a new method for maximizing the benefits of the limited countermeasure resource funds will have been developed. This will extend the benefits possible through appropriate countermeasure targeting with a resulting decrease in crashes and their tragic consequences.

APPENDIX C

PROGRAM FLYERS AND BROCHURES

This appendix contains copies of the 13 flyers that were developed for this study and the two small NHTSA brochures that were adapted for use by the study. These materials were delivered as door hangers to each residence in the Phoenix zones as part of the PI&E countermeasure program. Included are the following materials:

- A flyer indicating that the materials were being provided by the City of Phoenix. It was reproduced in black on red.

- The 13 flyers giving advice to pedestrians and motorists. They were reproduced in black copy on a white background. The border stripes were red with white lettering. The words "Problem" and "Advice" were also reproduced in red.

- The back of the flyers. It was identical for all 13 flyers and the color scheme was identical to that used on the front of the flyers.

- Two small NHTSA brochures. They were reproduced with black copy on a white background. Certain words were reproduced in red as was the program logo. When folded, they measured 3" x 6". They have been reduced slightly here in order to show both sides of each brochure on a separate page.

The City of Phoenix cares about your safety and wants to make *WALKING* as safe as possible for you.

We are pleased to pass the enclosed information on to you. We hope that you will read it carefully and follow the advice.

If you have any questions, or would like additional information, please call:

262-6284

City of Phoenix
STREET TRANSPORTATION DEPARTMENT

Winner of the
Carl Bertelsmann
Prize

PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

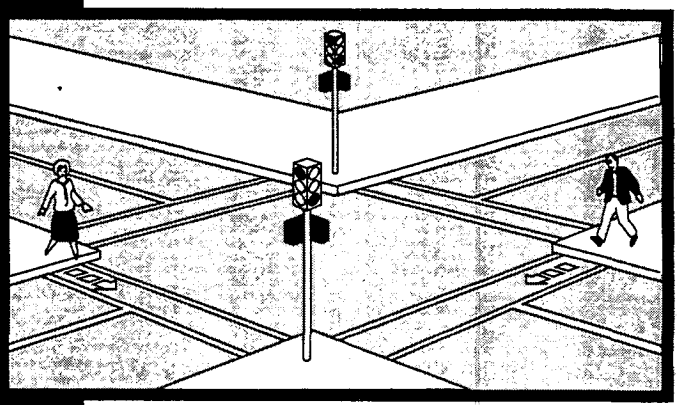
FIRST STEPPING OFF THE CURB

PROBLEM:

You are at risk of an accident when you first step off the curb because drivers may not see you until you are right in front of them and it's too late to stop.

ADVICE:

- Be sure to **LOOK LEFT-RIGHT-LEFT** *before* stepping off the curb.
- **LOOK LEFT-RIGHT-LEFT** even when the light is green or the signal says *WALK*.
- **LOOK LEFT-RIGHT-LEFT** even when you're in a marked crosswalk.
- **LOOK LEFT** *last* since that is the direction that cars will come from *first*.



PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

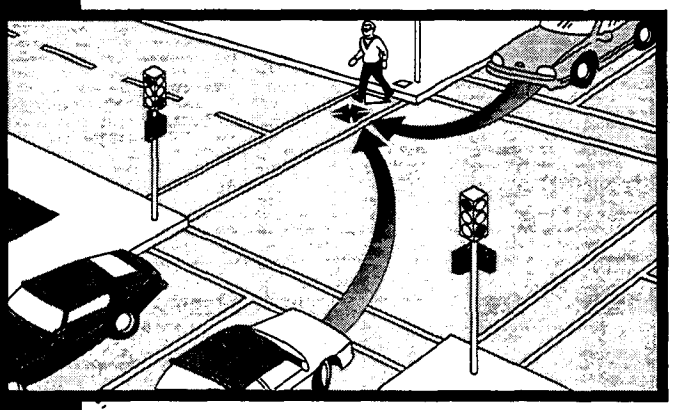
TURNING CARS

PROBLEM:

Turning cars are especially dangerous because drivers are concentrating on making their turns and may not notice you.

ADVICE:

- Always check for turning cars *before* you step into the street.
- **LOOK** in *all* traffic directions including *behind* you.
- **LOOK** for left-turning cars coming toward you.
- **LOOK** for cars making right turns, including right-turns-on-red.
- If you're not sure the driver sees you, just let the car go by.



PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

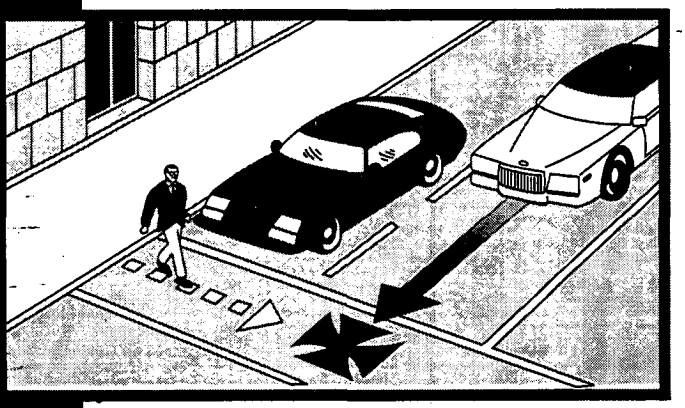
VISUAL "SCREENS"

PROBLEM:

You may be "screened" from the driver's view by another car, a bus, or even a bush or a mailbox.

ADVICE:

- Make sure all cars have stopped *before* you step off the curb.
- If a car has stopped, don't assume that an overtaking car will also stop. That driver may not even know that you're there.
- Always **STOP** at the outside edge of any "screen" and **LOOK** around it for cars that might be coming.
- Be especially alert if you step in front of a stopped bus because, due to its size, it's even harder for an overtaking driver to see you.



PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

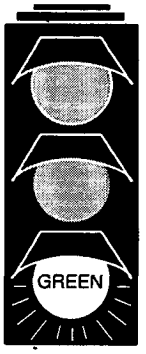
THE "FRESH" GREEN LIGHT

PROBLEM:

Sometimes people don't have enough time to get across the street before the light changes.

ADVICE:

- Wait for a "fresh" green light. It will give you the most time to cross.
- If there is a ***WALK*** signal, wait for a "fresh" one.
- Remember, even with a "fresh" signal, always **LOOK LEFT-RIGHT-LEFT** to make sure it's safe before you enter the street.



PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

THE FLASHING "DON'T WALK" SIGNAL

PROBLEM:

Many people think they should return to the curb when the *DON'T WALK* signal flashes.

ADVICE:

- The flashing signal means **DON'T START** to cross the street.
- If you are in the middle of the street when the ***DON'T WALK*** signal flashes, continue to the other side at your normal pace.
- A signal that's working right will give you enough time to cross the street.
- Don't stop in the middle of the street or return to the curb. Always continue to the other side.

WALKING THROUGH THE YEARS

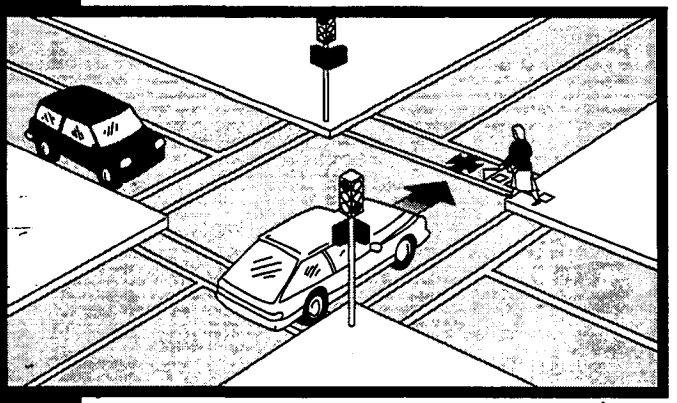
PEDESTRIAN SAFETY TIP

PROBLEM:

If you start to cross the street without looking as soon as the light turns green or the signal says *WALK*, you may be hit by a car that is still in the intersection.

ADVICE:

- Don't rely totally on signals. Always **LOOK** first.
- Green doesn't mean GO. Green means **LOOK FIRST,** then GO if it's safe.
- The *WALK* signal doesn't mean that it is safe to start crossing. It means **LOOK FIRST** to make sure it is safe.
- Always **STOP** and **LOOK LEFT-RIGHT-LEFT** for cars from *all* directions *before* you step off the curb.



PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

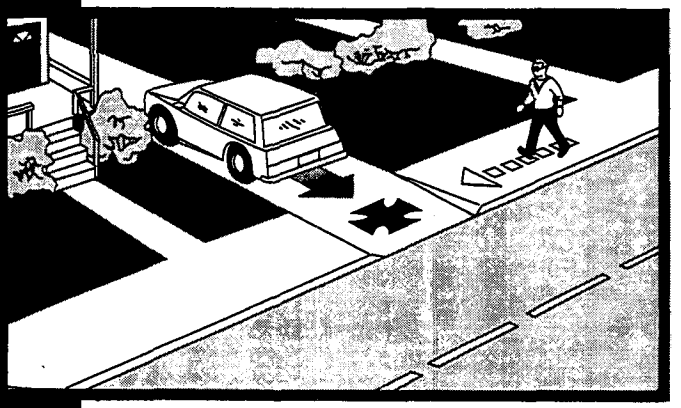
DRIVEWAYS AND ALLEYS

PROBLEM:

Driveways and alleys are dangerous because cars can be entering or leaving at any time.

ADVICE:

- Treat a driveway or alley as if it were a road. **STOP** and **LOOK** both ways to make sure it is safe before you cross.
- Be alert to the signs that a car might back up:
  - **LOOK** for backup lights.
  - **LISTEN** for engine noise.
  - **LOOK** for drivers in cars.



PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

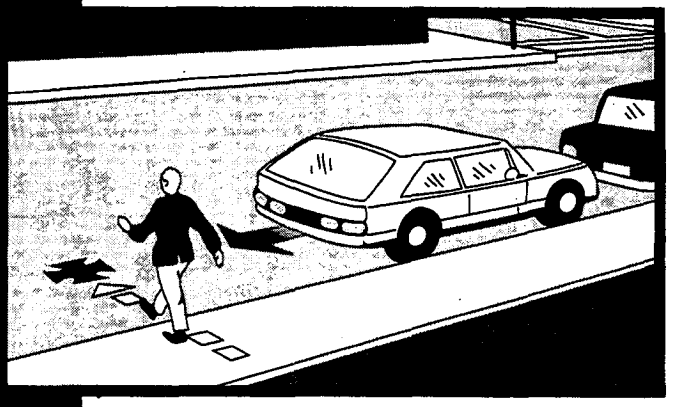
BACKING CARS

PROBLEM:

It can be very dangerous to enter the street behind a parked car since the car may back up.

ADVICE:

- Be alert to the signs that a car might back up:
  - **LOOK** for backup lights.
  - **LISTEN** for engine noise.
  - **LOOK** for drivers in vehicles.
- Never enter the roadway behind a parked car if there is *any* chance that the car will back up.



WALKING THROUGH THE YEARS

PEDESTRIAN SAFETY TIP

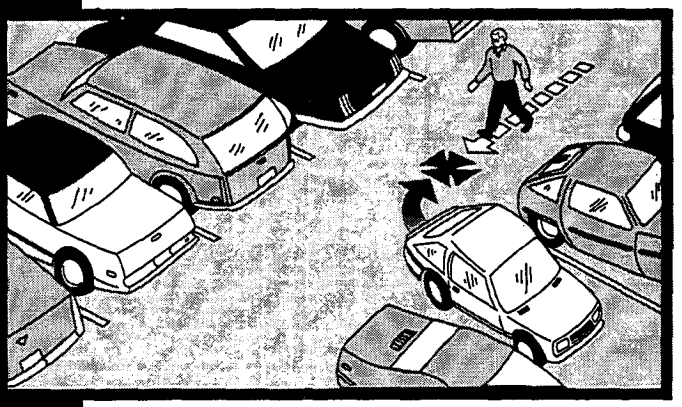
PARKING LOTS

PROBLEM:

Parking lots can be just as dangerous as roadways.

ADVICE:

- Do not assume that you have the right-of-way.
- Keep to walkways if they are available.
- Walk in *front* of parked cars whenever possible.
- Remember to check for backing cars:
  - **LOOK** for backup lights.
  - **LISTEN** for engine noise.
  - **LOOK** for drivers in cars.



PEDESTRIAN SAFETY TIP

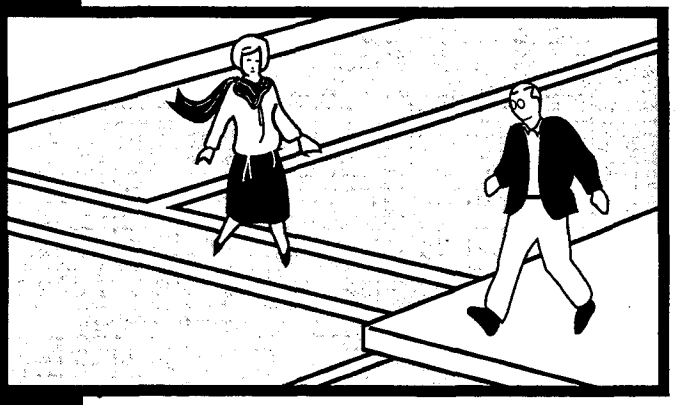
BEING SEEN

PROBLEM:

If your clothing blends with the background, it can be difficult for drivers to see you, even in the daytime.

ADVICE:

- Always wear something bright or contrasting (like a scarf) to increase the chance that a driver will see you.
- During the daytime, attach something bright or fluorescent to your clothing.
- At nighttime, attach something retroreflective to your clothing.
- Wave your arms to make sure the driver of a turning vehicle sees you.
- If you're not sure that the driver sees you, let the car go by.



MOTORIST/PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

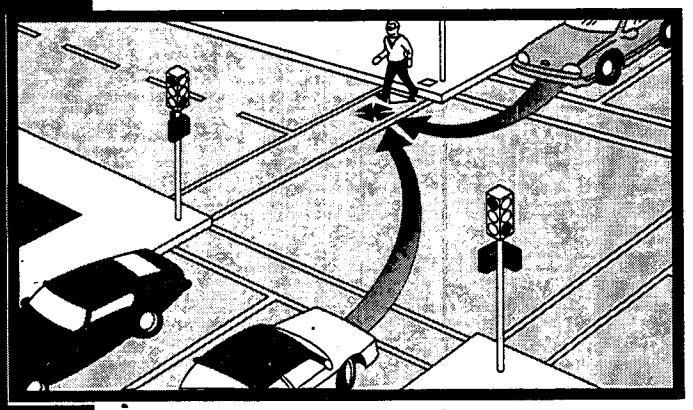
MAKING TURNS

PROBLEM:

When drivers concentrate on making turns, they sometimes fail to notice people in the street.

ADVICE:

- When you are making a turn, don't concentrate only on traffic. **LOOK** for *both* traffic *and* pedestrians.
- When you have a gap in traffic, **LOOK** *both* to your right *and* to your left to make sure there are no pedestrians in your path. What was an empty crosswalk when you first looked may now have a pedestrian in it. Continue to **LOOK** for pedestrians as you make your turn.
- Since car door posts are wide enough to screen a pedestrian from your view as you turn, always **LOOK** around the posts to make sure there is no one in your path.
- Remember that cars are much bigger and much easier to see than pedestrians. Always **LOOK** for pedestrians (and bicyclists too) and yield to them in the roadway.



MOTORIST/PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

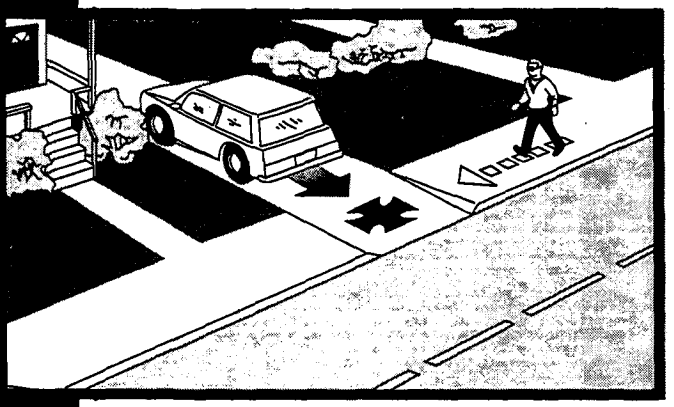
BACKING

PROBLEM:

Drivers often fail to check carefully behind them when they back up. And pedestrians fail to check for signs that a car might move backwards.

ADVICE:

- Always turn and **LOOK** over *both* shoulders to check for traffic *and* pedestrians before you back your car. And continue to **LOOK** while you are backing.
- Always turn and **LOOK** for *both* traffic and pedestrians when you are backing up in *roadways, driveways* and *parking lots.*
- Since your vehicle frame can prevent a good view to the rear, always turn and **LOOK** several times to check for pedestrians and traffic *before* you back up and continue to **LOOK** while you are backing.
- Remember that cars are much bigger and much easier to see than pedestrians. Always **LOOK** for pedestrians (and bicyclists too) and yield to them in the roadway.



MOTORIST/PEDESTRIAN SAFETY TIP

WALKING THROUGH THE YEARS

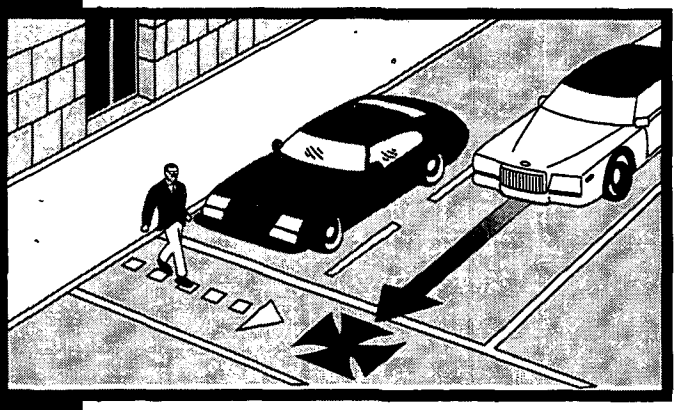
STOPPED CARS

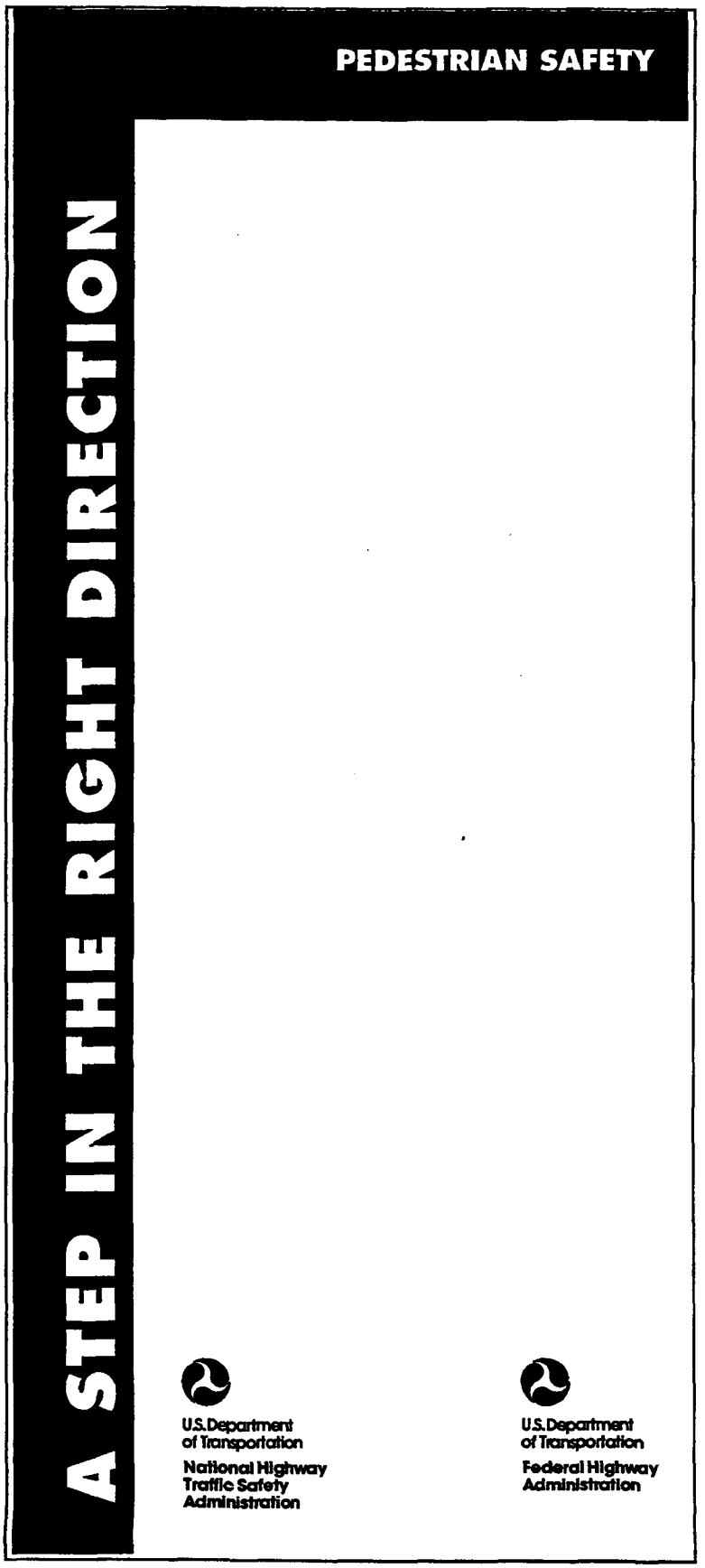
PROBLEM:

If a motorist stops to let someone cross the street, that person may be "screened" from the view of overtaking traffic and may not be seen until the pedestrian suddenly appears in the traffic lane.

ADVICE:

- If a car is stopped in traffic, slow down and approach it cautiously. Ask yourself why the car has stopped and assume that the car is hiding a pedestrian.
- **Never** pass a car that has stopped to permit a pedestrian to cross the street.
- Be especially alert if the stopped vehicle is a bus because, due to its size, it will be even harder for you to notice a pedestrian until the pedestrian appears in your traffic lane.
- Remember that cars are much bigger and much easier to see than pedestrians. Always **LOOK** for pedestrians (and bicyclists too) and yield to them in the roadway.




PEDESTRIAN SAFETY
A STEP IN THE RIGHT DIRECTION
U.S.Department
of Transportation
National Highway
Traffic Safety
Administration
U.S.Department
of Transportation
Federal Highway
Administration

How do you avoid hitting a hidden pedestrian? When you see a car, truck or bus slow, stop or remain stopped, ask yourself, "Why is that vehicle slowing or stopping?" Be ready for a hidden pedestrian (or bicyclist) by slowing your vehicle and looking carefully. **Slow down, be prepared to stop** and **look** for what's in front of any vehicle you are about to pass. It's one good way to avoid accidents, and...

YOU MAKE IT WORK

YOU AND YOU SHOULD NEVER MEET

LIKE THIS!

WALK NG THROUGH THE YEARS

YOU THE PEDESTRIAN

When crossing in front of a stopped vehicle, look around it to see if a car is coming.

You'd never knowingly walk right out into the path of an oncoming vehicle whose driver couldn't see you. But sometimes you forget that a driver overtaking a stopped car, truck or bus can't see people crossing in front of it. Sure it seems safe when cars stop for you at a crosswalk or when cars stay stopped at a light to let you cross. The problem is that these vehicles hide you from overtaking motorists. What's the answer?

Simple. Whenever you cross in front of or between stopped vehicles, stop at their outside edge and **LOOK AROUND THEM.** Look around them to be sure there are no cars coming that could hit you as you walk past the vehicle that's hiding you. Remember, when you cross in front of a stopped vehicle, look around it. It's one good way to keep walking safely through the years, and ***you make it work.***

YOU THE DRIVER

When approaching a stopped vehicle, slow down. It may be hiding a crossing pedestrian.

You have to avoid hitting pedestrians, even the ones you can't see. Like those crossing in front of a stopped bus. Or a pedestrian crossing in front of cars stopped at a light. Or someone crossing in front of a slowing vehicle. In each of these situations you may not see or expect a pedestrian, but one could be there ready to step right out into your path.

Fortunately, there is a simple way for drivers to avoid hitting a pedestrian at an intersection. **Before** turning, take a good look. Keep looking until you find a safe opportunity to turn and then **take one last look** in the direction of your turn. Be particularly careful to look for pedestrians (and bicyclists too). They're sometimes hard to see.

Your eyes hold the key to a safe turn. **Take a last look** for pedestrians before you turn. It takes almost no time at all.

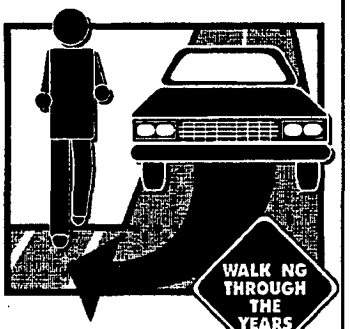
It's one good way to avoid accidents and...

YOU MAKE IT WORK

U.S. Department of Transportation
National Highway Traffic Safety Administration

U.S. Department of Transportation
Federal Highway Administration

YOU AND YOU SHOULD NEVER MEET



LIKE THIS

YOU THE PEDESTRIAN

Even when you're crossing in a crosswalk with a green light or "WALK" signal, you can be hit by a car making a turn. Drivers making left and right turns at intersections have a lot to look for and may forget to look for you. The car won't stop unless the driver sees you. So, try to **look at the driver,** not just the car, to help you figure out what a turning vehicle is about to do. If you take a careful look **before** you enter the street, you will be ready to get out of the way of a vehicle turning across your path.

Don't take a chance. It's really no trouble at all to make sure the driver sees you. Try to look at the driver's eyes to help decide if you've been noticed. When in doubt, wait a second and let the car go by. That way, you are sure to avoid an accident with a driver who may not know you are there. Also, cars at intersections can come at you from all directions. They can even turn right on a red signal at most corners. So, keep looking all around. It's one good way to keep walking safely through the years, and ***you make it work.***

YOU THE DRIVER

You never want to hit a pedestrian crossing at an intersection. Of course not. But, turning at an intersection can be confusing and frustrating. You have to look for a gap in traffic while avoiding pedestrians. Sometimes things get so hectic that you might forget to **take a last look for pedestrians.** For example, you may be making a right turn on a red light and worrying about finding a safe opening in traffic from your left. Or, you may be in the middle of a busy intersection trying to make a left turn through a line of oncoming traffic. All turns are difficult for you, the driver.

APPENDIX D

SECTION OF PHOENIX ZONE WORKBOOK

The Phoenix zone workbook was prepared as an aid in conducting the on-site analysis of each zone. It was accompanied by a document containing police accident reports for each zone crash as well as citizen complaints regarding zone locations. The workbook contained a section for each of the Phoenix zones. Included on the following pages is the section of the workbook that was provided for Zone 1. It contains the following information and materials:

- A brief description of the zone including its boundaries, the crashes contained in the zone and within 1/2 mile of the zone (if any), and selected land use features.
- A form for capturing diagrams and descriptions of areas that would benefit from engineering improvements. Multiple copies of this form were included in the workbook for each zone.
- A form for noting traffic and pedestrian flows at intersections. This form was printed on the back of the engineering improvement diagram described above.
- A form for capturing information on PI&E opportunities in the zone. Multiple copies of this form were included in the workbook for each zone.
- A summary of the crash sites in the zone. This summary appeared on a page facing the zone map, and the crash numbers were keyed to the numbers in the accompanying map.
- A zone map containing locations of each crash in the zone and within an additional 1/2 mile of the zone. The zones were outlined in yellow and crash locations indicated in red on a portion of a standard city map.

ZONE 1 DESCRIPTION

Boundaries:

	West-East	13 Avenue to 13 Street
	North-South	Becker Lane to Loma Lane

Accidents (see zone map):

Total accidents = 11 (all within zone)
Total pedestrians = 12 (8 zone residents, 4 lived within 1/6 mile of zone)

1.	N Cave Creek 30 ft S of E Mountain View	Veh making LT on Mountain View to go SB on Cave Creek struck ped walking EB in crosswalk (SW corner) (ped lived within 1/8 mile of zone)
2.	N 7 St 38 ft N of E Vogel	Veh SB in inside lane struck ped walking WB in crosswalk (NW corner) (zone resident)
3.	W Hatcher 104 ft E of N 11 Av	EB veh in curb lane struck ped running SB across Hatcher (E of SE corner) (ped lived within 1/6 mile of zone)
4.	W Hatcher 32 ft W of N 6 Av	Veh WB on Hatcher struck ped crossing Hatcher NB in unmarked crosswalk on W side of 6 Av (NW corner) (ped lived within 1/6 mile of zone)
5.	E Hatcher 280 ft W of N 3 St	Veh EB on Hatcher struck ped crossing Hatcher midblock (W of SW corner) (zone resident)
6.	E Dunlap at N 2 St	Veh WB on Dunlap struck ped crossing Dunlap SB (NE corner?) (zone resident)
7.	E Dunlap at N 3 St	Veh SB on 3 St making LT onto Dunlap struck two peds (both 65+) crossing Dunlap NB in marked crosswalk (SE corner) (two zone residents)
8.	E Dunlap 304 ft E of N 3 St	Veh leaving private drive struck ped WB on sidewalk (E of SE corner) (zone resident)

9.	Central 34 ft S of Ruth	Veh making LT WB to SB (Ruth to Central) struck ped in crosswalk (ped direction unknown) (SW side) (zone resident)
10.	N 7 St at Townley	Veh NB on 7 St struck ped WB in crosswalk (corner unknown) (ped lived within 1/6 mile of zone)
11.	N 7 St at E Griswold	Veh SB on 7 St struck ped crossing 7 St WB (NW corner) (zone resident)

Selected Land Use Features:

Sunnyslope Senior Center
John C. Lincoln Hospital
Sunnyslope High School

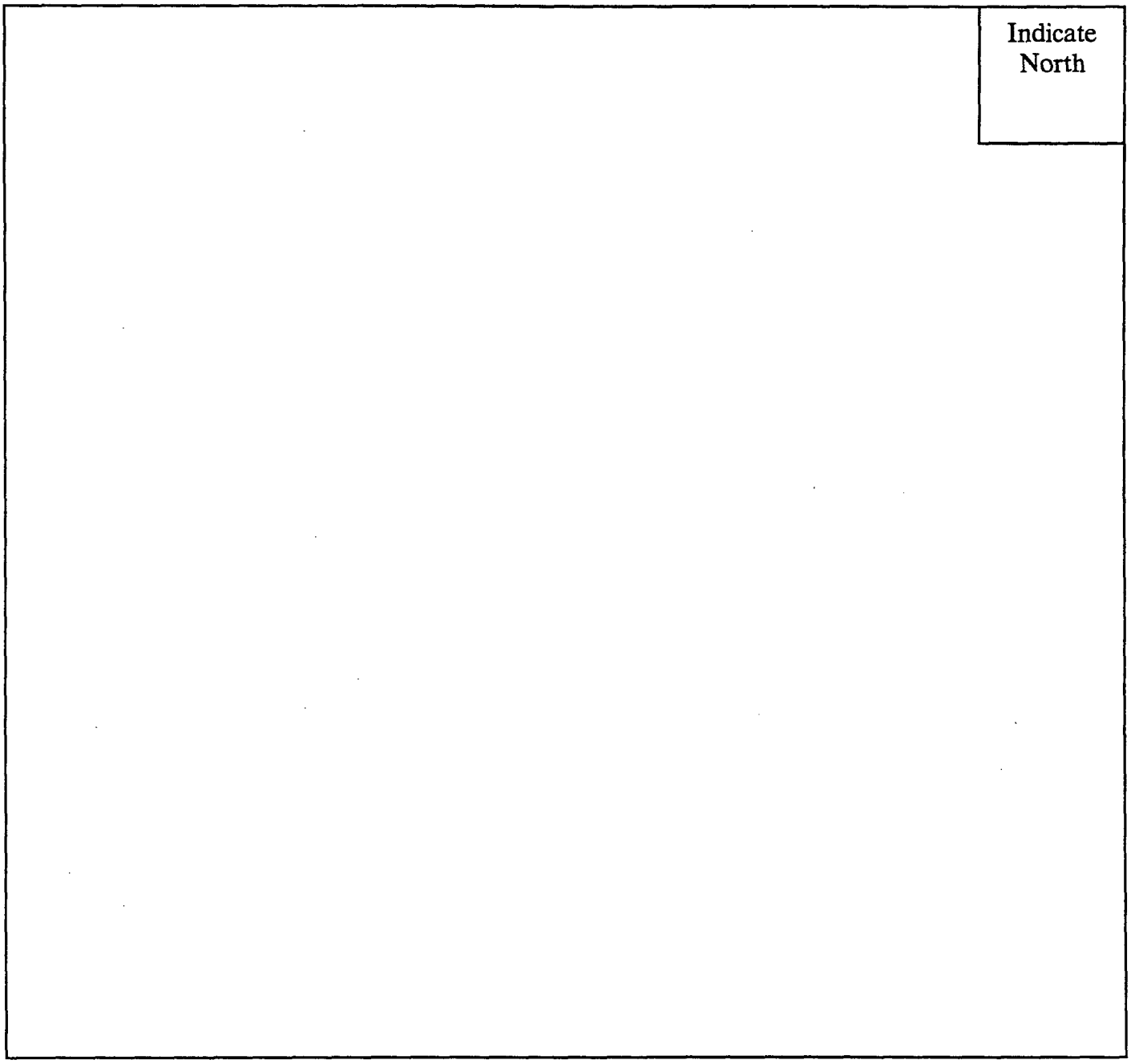
Zone No.:_____ (___inside zone or ___outside zone) (___Accident site or ___non-accident site) Date:_____

Location:_____

___at_____

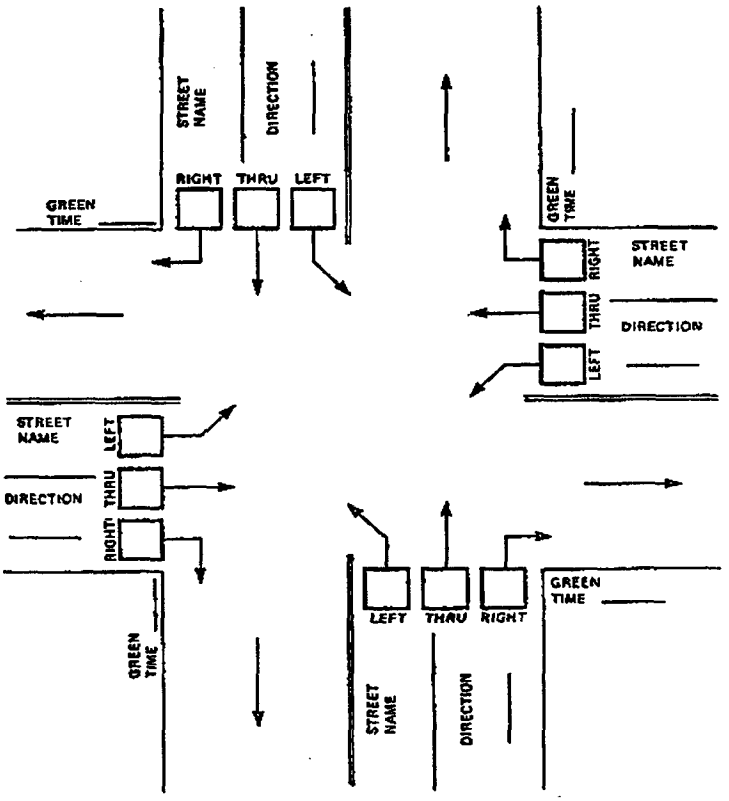
___or between_____and_____

Engineering Improvement Diagram



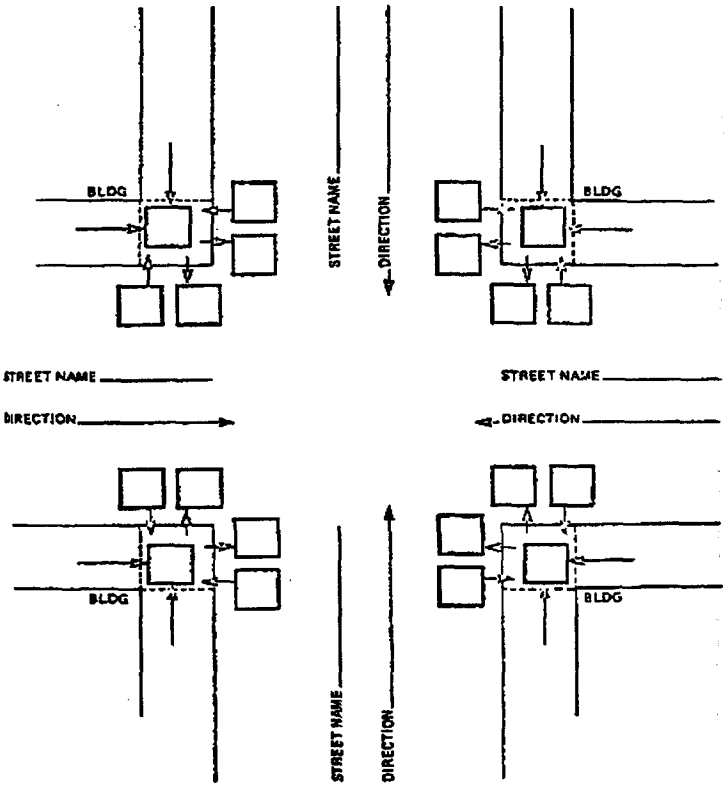
Make sketch, indicating locations of:

Traffic lights	Vehicle signs (note words)	Obvious screens
Ped lights (words/figures)	Ped signs (note words)	No. of traffic lanes
Left/right turn arrows	Sidewalks	Turning lanes
Stop signs	Curb cuts	Parking spaces
Stop bars	Road lights (indicate lumens)	Marked crosswalks
Speed limit signs	Bus stops	One-way streets



TRAFFIC FLOW TALLIES

DATE _____ START TIME _____



PEDESTRIAN FLOW TALLIES

DATE _____ START TIME _____

Zone No.:_____ · (___inside zone or ___outside zone) Date:_____

PI&E Opportunities

Resource Type:

___Senior center	___Church	___"Y"
___Senior housing	___Synagogue	___Hospital/clinic
___Senior apartment	___Radio station	___School
___Billboard	___Other(specify): _____	

Name and Address: _____

_____

_____

Contact(s): _____ Phone:_____

_____ Phone:_____

_____ Phone:_____

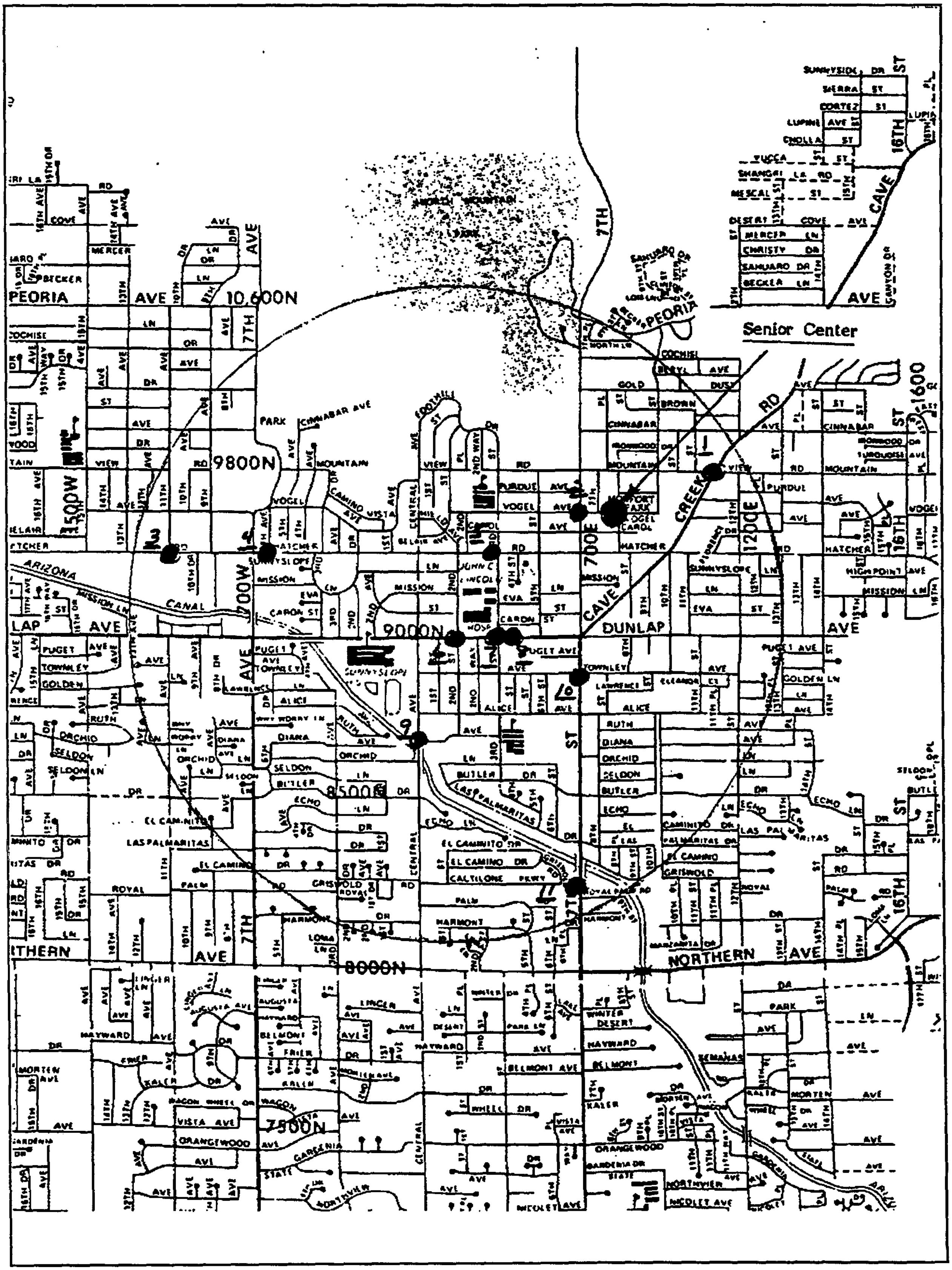
Comments:

ZONE 1

Boundaries; West-East 13 Avenue to 13 Street
North-South Becker Lane to Loma Lane

Accidents (see zone map):

1.	N Cave Creek	30 ft S of E Mountain View	(SW corner)
2.	N 7 St	38 ft N of E Vogel	(NW corner)
3.	W Hatcher	104 ft E of N 11 Av	(E of SE corner)
4.	W Hatcher	32 ft W of N 6 Av	(NW corner)
5.	E Hatcher	280 ft W of N 3 St	(W of SW corner)
6.	E Dunlap	at N 2 St	(NE corner?)
7.	E Dunlap	at N 3 St	(SE corner)
8.	E Dunlap	304 ft E of N 3 St	(E of SE corner)
9.	Central	34 ft S of Ruth	(SW side)
10.	N 7 St	at Townley	(corner unknown)
11.	N 7 St	at E Griswold	(NW corner)


Senior Center
PEORIA
AVE
10,600N
9800N
9000N
8500N
8000N
7500N
DUNLAP
NORTHERN
AVE
CAVE
CREEK
RD
7TH
1500W
700E
1200E
16TH
ST
SUNNYSLOPE
ARIZONA
CANAL

Zone 1

APPENDIX E

PEDESTRIAN SAFETY ZONE FIELD SURVEY CHECKLIST

Background

The pedestrian safety zone concept involves identifying zones on the basis of previous accident experience. It is then necessary for trained safety personnel to visit the zones and determine what remedial actions are warranted. The site visit is an important part of both the effectiveness and efficiency of the pedestrian safety zone program. Countermeasures must be selected and applied based on the specific crash types and problem situations encountered at each location.

In order to assist the process of site surveys, a checklist of things to look for has been prepared. This list is not intended to be exhaustive nor is it designed to acquire statistical samples of the various factors. Rather, it captures many of the key factors known to contribute to accident causation as a reminder to the safety professional who is using his or her judgement during field surveys. The list is divided into four main areas:

- ***Search Limitations*** - The failure of the pedestrian and driver to see each other is by far the largest cause of pedestrian crashes. Therefore, emphasis is placed on factors which can limit the search of pedestrians and drivers for each other.

- ***Conflicts*** - Vehicle/pedestrian conflicts are often good predictors of safety problems and typically occur more frequently than crashes.

- ***Negative Behavioral Indicators*** - Even when conflicts between drivers and pedestrians do not occur with great frequency, problems may still be detected by assessing the occurrence of certain behaviors by drivers and pedestrians which are indicative of unsafe situations.

- ***Predisposing Factors*** - These are aspects in the environment which increase the likelihood that a driver or pedestrian will commit an error leading to a crash.

These areas are not necessarily independent. For example, parked cars are a frequent factor limiting search. This limitation will often lead to poor pedestrian search behavior.

The ***Pedestrian Safety Zone Field Survey Checklist*** can be used in several ways:

- A "memory jogger" for writing or dictating notes
- A data collection form for sites visited
- A reference and training aid.

The important thing is to consider each of these classes and types of factors and then relate them to an appropriate countermeasure selection.

Pedestrian Safety Zone Field Survey Checklist

Location: _____

Accident History: Frequency: _____ **Types:** _____

Date of Review: _____ **Reviewer:** _____

SEARCH LIMITATIONS

Search Limitation	Driver	Ped
Parked cars		
Unusual amount of moving traffic to obscure vision during crossing		
Roadway curvature		
Terrain		
Vegetation		
Unusual sun glare		
Insufficient building setback		
Moveable roadside items, e.g., street furniture		
Fixed roadside items, e.g., signal control boxes, signs		
Inadequate roadway lighting		

POTENTIAL OR OBSERVED CONFLICTS

Conflict Type	Observed	Potential
Pedestrian walks too close to a vehicle - NEAR SIDE		
Pedestrian walks too close to a vehicle - FAR SIDE		
RIGHT TURN vehicle (on green) too close to pedestrian		
LEFT TURN vehicle too close to pedestrian		
RIGHT TURN ON RED vehicle too close to pedestrian		

NEGATIVE BEHAVIORAL INDICATORS

INADEQUATE PED SEARCH (peds enter roadway without searching) ❑

INADEQUATE DRIVER SEARCH (drivers proceed without searching) ❑

ABORTED CROSSING (return to curb after both feet in roadway) ❑

CROSSING AGAINST LIGHT (entry and exit from roadway against signal) ❑

SMALL GAPS (accepting gaps which require rapid crossings) ❑

LEAVING CROSSWALK (crossing starts or ends outside of an available crosswalk) ❑

CROSSING IN FRONT OF A BUS ❑

VEHICLE OVERTAKING (ped crosses in front of stopped traffic - Multiple Threat) ❑

RUNNING (entry or crossing while running or obviously moving faster than normal) ❑

SHORT TIME EXPOSURE (e.g., appearance from behind parked cars) ❑

RETREAT (momentary reversal in pedestrian direction of travel) ❑

HIGH RISK FACTORS

Travel Conditions:

HIGH VEHICLE SPEEDS ❑ HIGH PED VOLUME ❑

HIGH VEHICLE VOLUME ❑ POOR SURFACE (danger of falls) ❑

Signal Conditions:

TIMING TOO SHORT ❑ TIMING TOO LONG ❑

BAD SIGNAL DESIGN ❑ BAD SIGNAL INSTALLATION ❑

PED CAN'T SEE SIGNAL ❑ DRIVER CAN'T SEE SIGNAL ❑

Land Use/Characteristics:

BARS/PACKAGE STORES ❑ OLD AGE FACILITIES ❑

PERSONAL DANGER ❑

APPENDIX F

PHOENIX SURVEY PROCEDURES, FORM AND INSTRUCTIONS

Survey Procedures

Data were collected in each of the six circular study zones and in one non-zone location--selected to be at least two miles from any of the study zones. In each zone, two survey sites were selected that were expected to provide a reasonable volume of senior citizen pedestrian traffic. All zone sites were actually located within the zone except one--the supermarket for zone 5 was located just outside the zone since no suitable in-zone site was available. All interviews were conducted outdoors--in front of the chosen site. The sites initially chosen and used throughout collection of the baseline data were:

Zone 1	-	Drug store and post office
Zone 2	-	Small mall and supermarket
Zone 3	-	Drug store and supermarket
Zone 4	-	Two supermarkets
Zone 5	-	Supermarket and grocery store
Zone 6	-	Post office and grocery store
Non-zone	-	Drug store and supermarket

The grocery stores in both zones 5 and 6 were eventually dropped as data collection sites. Both were small neighborhood stores with very little traffic and much of that non-English speaking. Since the PI&E program had been directed essentially toward English-speaking persons (with the exception of two radio PSAs in Spanish) and since the initially-trained Spanish-speaking interviewer left the program early in the data collection effort, it was decided that collection of data at these two sites was not productive. In zone 5, the grocery store was dropped as a site starting with study wave 4; all subsequent data in that zone were collected at the supermarket located just outside the zone. In zone 6, the grocery store was replaced by a senior residence near the post office starting with the first post-PI&E wave (wave 4).

Approximately one day was spent in each zone for each wave. All days of the week were included in the study, with days of the week and zones being varied more or less randomly from wave to wave.

Although four interviewers were originally trained to collect data, only one stayed with the program throughout the data collection period (three years). Since there were some inconsistencies in one of the interviewer's data, it was decided to use only the data provided by the one interviewer who collected data throughout the study effort.

The interviewer approached individuals who appeared to be 65 years old or older and asked them to participate in a study on safe walking being conducted for the City of

Phoenix. Visitors to the city and individuals who refused to give their age (or to indicate whether or not they were 65 years or older) were excused from the study.

The distribution of interviews by zone (excluding interviews from individuals who were less than 65 years old) is shown in the following table. These data show that zone 4 (with two supermarkets) was the most productive in terms of number of interviews conducted. Zones 5 and 6 were the least productive because of the previously-mentioned two small grocery stores that were eventually dropped as interview sites.

Zone	Baseline N = 2133	Post-PI&E N = 2751	Total N = 4884
Zone 1	15.2%	13.8%	14.4%
Zone 2	14.8	14.7	14.7
Zone 3	16.0	15.5	15.7
Zone 4	17.0	19.4	18.3
Zone 5	13.2	11.6	12.3
Zone 6	8.9	10.6	9.8
Non-zone	15.0	14.4	14.7

Survey Form and Instructions

The instructions that were provided to each interviewer are given on the following pages. They are followed by a copy of the survey form.

INSTRUCTIONS FOR CONDUCTING THE PHOENIX SURVEY

Data will be collected at two sites in each of six study zones and in one non-zone location.

General Procedures

- Collect data for 8 hours in each zone and in the one non-zone location.
- Divide the time equally between each site in each location.
- Collect data between the hours of 7 am and 5 pm. Make sure the store (post office, etc.) is open before you decide to start at 7:00 am.
- Collect all data outdoors unless you have been given specific permission to collect data indoors (for example, in bad weather).
- Do not show the interviewee any part of the interview form.
- If the individual has been surveyed before in a previous wave (for example, last year), complete the survey again if the individual is willing. Do not interview anyone who has previously been interviewed in this wave.
- Do not complete the form when:
  - The person refuses to give you any information on age.
  - The person lives outside the metropolitan Phoenix area for 11 months or more each year. The person is eligible if a resident of metropolitan Phoenix for 1 month or more every year.
- Take the following materials with you:
  - Survey forms (an adequate supply)
  - Clipboard
  - Pen and/or pencil
  - Zone map for the zone in which you are interviewing (not required for interviews conducted in the non-zone location)
  - A sample of program flyers (for the last three waves only)

Completing the Interview Form

- **Identifying Data** (on top of form)

  - Complete this portion of the interview form as you go along--either at the beginning or end of the interview.

  - Interviewer: The name of the interviewer is included in the appropriate place on the form.

  - Location: Indicate the code number and letter for the site where the interviews are being conducted, for example, for zone 1, site A, write "1A." For the non-zone location, site A, write "NZ-A."

  - Date: Indicate date of the interview.

- **Completing Each Question**

  - If the interviewee refuses to answer any question, place an "R" in the column next to the question.

  - Be sure to ask each question.

  - Question 1: Sex: Self-explanatory.

  - Question 2: Age: Ask the person's age. If refused, ask if the person is 65 or older. *If both questions are refused, terminate the interview.*

  - Question 3: Time in Phoenix: In this question, we are trying to find out if the person is a full-time resident of the Phoenix metropolitan area or *routinely* spends 1 or more months a year in the Phoenix metropolitan area. Anyone who lives *outside* the Phoenix metropolitan area or doesn't spend at least 1 month *each year* in the area should be classified as a visitor. *Terminate the interview for all visitors.*

  - Question 4: Living distance from site: Ask how far the interviewee lives from the interview site. If the person reports living within 2 miles of the site, show the zone map for that site and ask if the person lives within the circular area shown on the map. The circle has a diameter of 2 miles. You will need to become familiar with the boundaries of each circle so that you can help the person determine whether or not the residence is within the circle. For interviews conducted at the non-zone location, this part of the question should be omitted.

  - Question 5: Walking habits: This question is self-explanatory. Use the category "never walk on city streets" if the person restricts walking to such places as malls, backyards, etc. *Check only one answer.*

  - Question 6: Daytime visibility: Self-explanatory.

- Question 7: Flashing Don't Walk signal: Record *one answer only* for this question. If the interviewee gives more than one response, record the *first* response only or indicate "1" for the first response, "2" for the second response, etc.

- Question 8: Seen/heard publicity: If the person has seen or heard anything on walking safely, be sure to complete the two sub-parts of this question. On the second sub-part, write down *exactly* what the person says.

- Question 9: Phoenix pedestrian signs: The response categories for this question include both signs and signals, as follows:

  . Walk/don't walk signals: Use this category when the respondent refers to the signals themselves either by words or figures (e.g., hand).

  . Walk/don't walk advice: Use this category when the respondent refers to anything or everything that is listed on the advice sign. A copy of the sign is attached for your use--but don't show it to the interviewee.

  . Press button to walk: Use this category when the respondent says anything about pressing the button.

  . Use caution when entering street: Use this category for any response that refers to "Use caution" or "Be careful."

  . Traffic signals: Use this category if that's all the respondent says or the respondent refers to red, green or yellow signal lights.

  . Don't cross here, use crosswalk: Self-explanatory.

  . School zone: Self-explanatory.

  Note: Check as many categories as necessary to cover what the respondent says. If the respondent talks about driver signs (e.g., "Watch for pedestrians in crosswalk"), write that in the space for Other responses. Don't worry about trying to make the respondent give a pedestrian sign. Just read the question as is and accept whatever the respondent says.

- Question 10: Program flyers: This question will be asked in the last three study waves only. Display the flyers and ask if the person has seen them and, if so, where they were seen.

Interviewer_____ Location_____

PHOENIX PEDESTRIAN SURVEY

Date_____

Introduction: I am conducting a survey on safe walking for the City of Phoenix. May I ask you a few questions?

1. Sex (note: do not ask) ☐ male ☐ female

2. May I ask your age? ___ ___ years
   If *refused*, ask: Are you 65 or older? ☐ yes ☐ no
   If *refused*, excuse from remainder of interview.

3. How much time do you spend in the Phoenix area?
   ☐ all year ☐ part year: no of months ___ ___ ☐ visitor only
   If *visitor*, excuse from remainder of interview.

4. How far do you live from here? ___ miles ___ blocks ___ other:_____
   If *2 miles or less, show map* and ask: Do you live in this circular area? ☐ yes ☐ no

5. How often do you go for walks outdoors?
   ☐ 3 to 7 days a week ☐ 1 to 3 days a month ☐ never walk on city streets
   ☐ 1 or 2 days a week ☐ a few times a year ☐ never walk

6. Do you think drivers have a problem seeing walkers in the daytime? ☐ yes ☐ no ☐ don't know
   If *yes*, what can walkers do to help drivers see them in the daytime?
   ☐ wear something light/bright/contrasting/fluorescent ☐ don't know/no opinion
   ☐ move something (arms, body, scarf, cane) ☐ other:_____

7. If you are part way across the street and the Don't Walk signal flashes, what should you do?
   ☐ continue crossing ☐ wait in middle of street ☐ don't know/no opinion
   ☐ hurry/run across ☐ return to the curb ☐ other:_____

8. Have you seen, heard or read anything recently in Phoenix about how to walk safely? ☐ yes ☐ no
   If *yes*, where did you see or hear it?
   ☐ TV ☐ radio ☐ newspaper ☐ door hanger ☐ pamphlet
   ☐ video ☐ poster ☐ billboard ☐ other:_____
   If *yes*, what did it say?

9. Have you seen any signs on Phoenix streets that give information or advice to walkers? ☐ yes ☐ no
   If *yes*, what did you see?
   ☐ walk/don't walk signals ☐ traffic signals
   ☐ walk/don't walk advice ☐ don't cross here, use crosswalk
   ☐ press button for walk ☐ school zone
   ☐ use caution when entering street ☐ other:_____

10. Have you seen these flyers? ☐ yes ☐ no If *yes*, where?_____