Village of Sh[redacted]d, Wisconsin

Pedestrian/Bicycle Safety Intersection Review

December 2005

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Village of Shorewood, Wisconsin
Pedestrian/Bicycle Safety Intersection Review

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Executive Summary

The Village of Shorewood commissioned Baxter & Woodman, Inc. to perform a comprehensive study of all eleven signalized intersections and mid-block crossings along Capitol Drive and Oakland Avenue and to make recommendations that would improve the safety of those intersections and mid-block crossings for pedestrians and bicyclists, including re-timing of pedestrian signals, recommendations for signage and other safety mechanisms, and other more innovative measures that will improve safety for pedestrians and bicyclists.

After Baxter & Woodman performed the safety study, we then presented the recommendations to the Pedestrian Safety Committee. The committee, with Baxter & Woodman's guidance, then prioritized the recommended improvements into short term, mid term and long term improvements based on the cost and net safety benefit of the recommended improvements.

The following is a list of short term improvements that that the Committee believes should be implemented in the near future, listed in the order of importance.

1. ***Adjust traffic and pedestrian signal timing at six intersections that currently have inadequate pedestrian timing***
2. ***Install additional speed limit signs on Lake Drive and Oakland Avenue***
3. ***Install countdown timer pedestrian signals at the intersection of Oakland Avenue and Capitol Drive. Install countdown timers at the remaining 10 intersections as funds permit in the order shown on page 5***
4. ***Install pedestrian signal educational signs at all four legs of all intersections similar to the sign shown in Picture 3 on page 6***

The above recommended improvements are further detailed in the report, as well as the mid term and long term improvements. Note that improvements 3 and 4 may be eligible to receive a state grant through the WisDOT Traffic Signing and Marking Enhancement Program because they improve the visibility of traffic control devices for elderly drivers and pedestrians. Other mid term and long term recommended improvements that may be eligible for the state grant, such as signs and pavement markings, are indicated by an asterisk in the report.

The following report details the means and methods and other supporting information used to determine the above listed recommendations as well as other safety improvements that are recommended to be implemented over time as the budget permits. All of the recommendations contained in this report are consistent with the Village of Shorewood long range plan.

This report will serve as both a short term and long term planning tool that can be used to improve pedestrian and bicycle safety and promote walking and biking as a way to enhance the quality of life in the Village of Shorewood for many years to come.

Introduction

The goals of the Pedestrian Safety Committee are to educate the entire community on the requirements of pedestrian, bicycle, and traffic safety laws and to promote walking as a way to enhance the quality of life in Shorewood. The Pedestrian Safety Committee has made tremendous strides in improving pedestrian and bicycle safety throughout the Village over the past several years by taking an active role in recommending changes to sidewalks and streets within the Village of Shorewood, as part of an overall "Walkable Community Initiative Project".

Through the hard work of the Village of Shorewood and the Pedestrian Safety Committee, the following improvements have recently been made that have improved pedestrian and bicycle safety:

1) *Repainted the crosswalk pavement markings*
2) *Installed pedestrian crosswalk signs at many of the intersections and mid-block crossings*
3) *Installed Light Emitting Diode (LED) traffic signals at all intersections to provide better visibility for motorists (the first community in Wisconsin to do so)*
4) *Implemented "foot patrols" by police officers*
5) *Upgraded pedestrian traffic signals from "Walk" and "Don't Walk" signals to the current standard of the "walking man" and "flashing hand" symbols*
6) *Installed "No turn while pedestrians are present" signs*
7) *Distributed "I STOP for Pedestrians" bumper stickers*
8) *Created and distributed brochures entitled "Making Shorewood a Walkable Community is Everyone's Responsibility"*
9) *Created & administered an intersection safety survey for River Park Residents.*
10) *Worked with the City of Milwaukee to get the pedestrian signal timing lengthened at the intersection of Edgewood and Oakland.*
11) *Distributed Wisconsin Bike Law Cards & Share the Road Brochures at "National Night Out"*

In an effort to build upon these improvements, the Village of Shorewood commissioned Baxter & Woodman, Inc. to perform a comprehensive study of all eleven signalized intersections and mid-block crossings along Capitol Drive and Oakland Avenue and to make recommendations that would improve the safety of those intersections and mid-block crossing for pedestrians and bicyclists, including re-timing of pedestrian signals, recommendations for signage and other safety mechanisms, as well as more innovative measures that will improve safety for pedestrians and bicyclists.

The following report details the short term, mid term and long term safety improvements that are recommended to be implemented as the budget permits as well as the means and methods and other supporting information used to determine the improvements.

Data Collection

Weekday peak hour pedestrian and vehicular traffic counts were collected at all eleven Village signalized intersections, and weekend peak hour pedestrian and vehicular traffic counts were collected at nine of the busiest signalized intersections, at times determined by the Pedestrian Safety Committee. A map of the Village showing the signalized intersections that were studied is included in the Appendix as Exhibit 1.

The results of the weekday and weekend pedestrian and vehicular traffic counts are shown in graphical form as Exhibits 2 and 3, respectively. Exhibit 4 shows the results of the one-hour PM peak count that was done at North Oakland Avenue and East Capitol Drive pro bono for the Village prior to this study.

Traffic signal and pedestrian signal timings and crosswalk lengths at all signalized intersections were measured. The pedestrian and vehicular counts, existing signal timings, and existing intersection geometry were input into capacity analysis software, which measures vehicular movement efficiency (not pedestrian movement efficiency, but the amount of pedestrian traffic does have an effect on the vehicular movement efficiency). The results of the capacity analyses for the weekday counts are shown in Exhibit 5. Exhibit 6 shows the results of the capacity analysis performed for North Oakland Avenue and East Capitol Drive pro bono for the Village prior to the study. One of the most important outputs of the capacity analysis is the "Level of Service" or LOS of an intersection. The LOS is a measure of the average vehicular delay for each movement as well as the overall delay at an intersection. LOS "A" represents the least amount of delay and LOS "F" represents the most amount of delay. All intersections performed at a LOS "D" or better (the lowest acceptable LOS), during the hours of the counts; with the exception of Oakland and Capitol which performed at LOS "E". LOS classifications are further explained in Exhibit 5.

Baxter & Woodman, Inc. observed all signalized intersections and mid-block crossings to identify any apparent safety issues. In addition, we performed a "by-foot" survey along East Capitol Drive and North Oakland Avenue to identify any apparent safety concerns along the sidewalks, to study the feasibility of constructing a bike path along these roads, to determine the feasibility of more innovative safety enhancements at the intersections, and to perform an informal pedestrian survey regarding pedestrian safety (the results of the pedestrian survey are shown in Exhibit 7).

Repair Recommendations

As part of the "by foot" field study, Baxter & Woodman, Inc. took a comprehensive look at apparent pedestrian and vehicular safety concerns along North Oakland Avenue and East Capitol Drive. Many of the noted safety hazards and recommended improvements are applicable to several locations, while some are more site-specific. Some improvements will have a direct improvement on pedestrian safety while other improvements focus on increased vehicle safety, which has an indirect effect on pedestrian and bicycle safety.

The Wisconsin Department of Transportation offers a grant program for enhancing the visibility of signs, pavement markings, and other traffic control items for the benefit of elderly drivers and pedestrians called, "Traffic Signing and Marking Enhancement Grant Program". Any of the following recommended improvements that may be eligible for this type of funding, which requires a 25% local match, is identified by an asterisk.

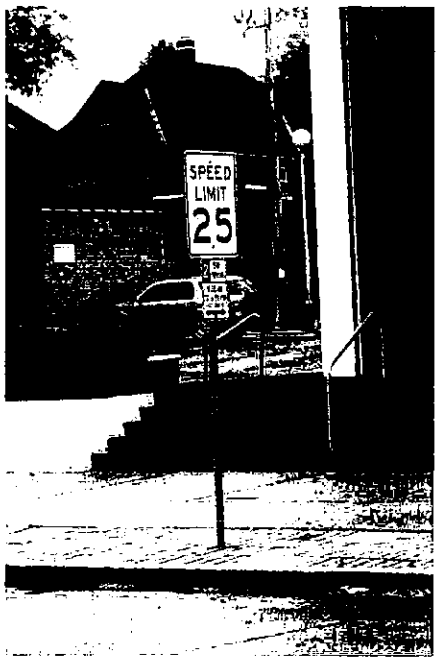
Short Term Improvements

The following is a list of improvements that the Committee believes should be implemented in the near future.

*1) Excessive Speed. Many vehicles drive over the posted speed limit of 25 mph on North Oakland Avenue and there are too few speed limit signs on North Lake Drive.

Solution: Install additional speed limit signs on North Oakland Avenue and North Lake Drive. There are currently only 2 to 3 speed limit signs in each direction along Oakland, one of which is shown in Picture 1.

Traffic calming is another possible solution. Two possible traffic calming measures would be either 1) install a solid yellow 4-foot wide flush center median with pavement markings, or 2) install a solid white pavement marking 10-feet from the face of curb to widen the parking stalls from 8-feet to 10-feet (measured from the face of curb). Either of these traffic calming measures would effectively reduce the lane widths on North Oakland Avenue from 16-feet in each direction (measured from the center line to the edge of the parking lane) to 14-feet, which would likely slow traffic. Also consider additional police enforcement, or other traffic calming measures.



Picture 1 – 25 mph Speed Limit on Oakland

2) Pedestrian Signal Timing. Pedestrian signal timing is inadequate at six of the eleven intersections.

Solution: Revise the pedestrian and vehicular signal timing as recommended in Exhibit 8. Also, consider a "leading walk" phase of 4 seconds for all intersections along Oakland Avenue. A leading walk phase provides pedestrians with a 4 second "head start" to cross the road while vehicles have a red signal, making pedestrians more visible to drivers. One drawback to the leading walk phase is that vehicle delay increases because less green time is available for vehicles. For this reason, a leading walk phase may not be appropriate for intersections along Capitol Drive due to the existing traffic congestion at those intersections and also because Capitol Drive is under State jurisdiction. The vehicle delay for the intersections along Oakland Avenue will still operate at an acceptable level with the leading walk phase.

3) Countdown Timer Pedestrian Signals. Countdown timer pedestrian signals are designed to assist pedestrians with the amount of time available to cross the street, as well as educate them regarding the meaning of the "Walk" and "Don't Walk" symbols. The countdown timers begin to countdown during the "Walk" phase, and continue to count down through the "Don't Walk" phase, to inform pedestrians how long they have to cross the street.

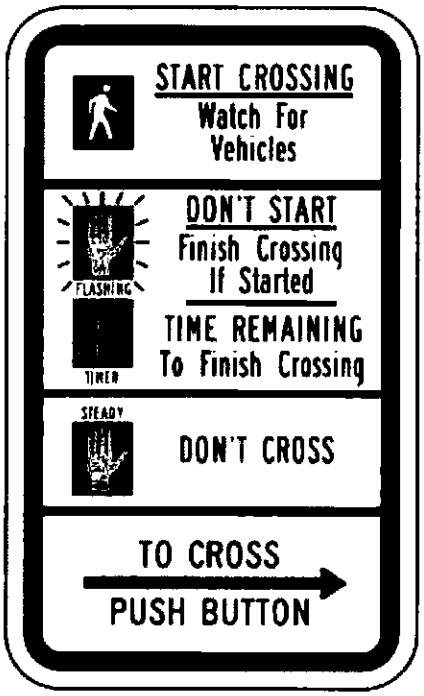
Solution: Install countdown timers at the intersection of North Oakland Avenue and East Capitol Drive in the near future, and at the remaining intersections as the budget permits, in the order listed below:

1) Oakland/Capitol
2) Capitol/Morris
3) Capitol/Maryland
4) Oakland/Shorewood
5) Oakland/Lake Bluff
6) Oakland/Kenmore
7) Oakland/Edgewood
8) Oakland/Menlo
9) Capitol/Lake Drive
10) Capitol/Downer
11) Capitol/Wilson

Picture 2 – Countdown Timers

The cost to remove the existing pedestrian signal heads and replace them with new countdown timers like the one shown in Picture 2, is approximately $600 each or $5000 per intersection. Engineering plans may be required to install the countdown timers along Capitol Drive because Capitol Drive is under the State's jurisdiction, which will increase the cost by approximately $2000 per intersection. Product information is included in Exhibit 9.

*4) Pedestrian Crosswalk Signs. "Walk" vs. "Don't Walk" pedestrian symbols are commonly misunderstood. The walk symbol (an upright pedestrian) on a properly designed pedestrian signal, at a minimum, provides time for pedestrians to react to the signal and begin crossing a crosswalk. This amount of time is typically 6 or 7 seconds minimum and can be much longer if the concurrent green traffic signal stays on for a long time. The don't walk symbol (flashing hand) on a properly designed pedestrian signal provides enough time for a pedestrian, traveling at a speed of 4 feet per second to cross a road from one side of the road to the other side of the road. For example, if a crosswalk is 80-feet wide, the flashing hand should be 20 seconds long. This provides a pedestrian, who is just about to step into the crosswalk when the walk symbol changes to the flashing hand, with enough time to finish crossing to the other side of the road. Pedestrians commonly mistake the flashing hand to mean that he/she must either run to get to the other side or run back to the corner they came from and wait for the next walk signal.



Picture 3 – Crosswalk Sign

Solution: Install signs at all four corners of signalized intersections similar to that shown in Picture 3, which is meant to educate pedestrians regarding pedestrian signals. This in turn will decrease the potential for pedestrian / vehicle accidents at signalized intersections. Note that similar signs without the countdown timer indication are available for intersections the Village does not wish to install countdown pedestrian signals.

Mid Term Improvements

The following is a list of improvements recommended by Baxter & Woodman that the Committee believes should be implemented over the next several years either as the budget permits or as part of the yearly street improvement program.

1) Bike Path. A marked bike path, similar to the City of Milwaukee's bike path along North Oakland Avenue, is not feasible given the current geometry of North Oakland Avenue and East Capitol Drive. North Oakland Avenue is wide enough for a 5-foot wide marked bike path along much of its length through the Village. However, there are exceptions where the road is not wide enough as in the area south of "Pick-n-Save" where the road narrows, the intersection of Oakland and Capitol, and also at the intersection of Oakland and Menlo where the through lanes narrow as a result of the left turn lanes. Since there is not a logical end or a safe alternative route at any of these locations, it is not safe to install a marked bike path along North Oakland Avenue given its current geometry. Left turn lanes would need to be eliminated along North Oakland Avenue (Oakland does not have left turn lanes at any of the

intersections in Milwaukee in order to make the bike path fit) and the pavement would need to be widened in order to make a bike path feasible.

East Capitol Drive is not wide enough to install a marked bike path along much of its length. Besides its geometric limitations, we do not recommend installing a bike path on Capitol, west of Oakland, because of the heavy traffic on that section of road.

Picture 4– "Share the Road" Sign

Picture 5 – No bicycle rack

Measures can be taken, however to encourage bicycles to travel on the road and to improve safety for those bicyclists. Picture 4 shows a "Share the Road" sign that is meant to make drivers more aware of bicyclists that may be traveling on the road and to also encourage bicyclists to use the road rather than the sidewalk.

Police enforcement is necessary to teach drivers to respect bicyclists and to also teach bicyclists to obey the same "rules of the road" that vehicles must obey.

Bicycle racks along the sidewalk will encourage people to ride their bicycles to and from their destination in the downtown business area. Picture 5 shows a bicycle leaning against a tree because there is no place to secure the bicycle in the immediate area.

We recommend installing "share the road" signs at the north and south ends of Oakland Avenue for vehicles entering the Village. The signs will be especially helpful for northbound vehicles at the south end of town to remind drivers that even though Milwaukee's marked bike path ends, bicyclists are still present on Oakland Avenue and vehicles must drive with caution. Also, consider installing bicycle racks along Oakland and Capitol to provide bicycle riders with a secure place to leave their bicycles while patronizing local businesses.

*2) Pavement Markings. The pedestrian crosswalks throughout the Village have inconsistent cross marking widths and patterns and many are inconsistent with the Manual of Uniform Traffic Control Design (MUTCD) guidelines, a source for nationally recognized standards for traffic control devices. People recognize "universal" pavement markings. Inconsistencies in pavement markings can confuse vehicles and pedestrians or distract them

from paying attention to their surroundings. Picture 6 shows the crosswalk pavement markings at North Oakland Avenue and East Kenmore Place. The widths between the white markings are not consistent and the style of the pavement markings is not consistent with the MUTCD.

Picture 6 – Crosswalk at Oakland and Kenmore

Picture 7 is from the MUTCD and shows three nationally accepted pavement markings to delineate a crosswalk. Most crosswalks in the Village do not conform to the MUTCD.

Some parking spaces are painted too close to pedestrian crosswalks, driveways, and fire hydrants which limits driver's visibility of pedestrians and bicyclists. State law requires the parking stalls to be at least 15-feet from crosswalks, 10-feet from fire hydrants, and 4-feet from driveways and alleys.

Solution: Re-mark the substandard crosswalks in accordance with the MUTCD standard and re-mark the substandard parking lines in accordance with State laws throughout the Village. Replace the existing crosswalks, and parking markings with highly reflective pavement markings, such as paint or thermoplastic with glass beads to make all pavement markings more visible. When future maintenance is required on other pavement markings, replace them with highly reflective pavement markings.

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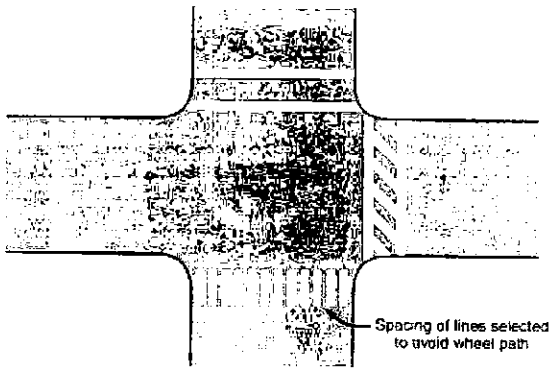
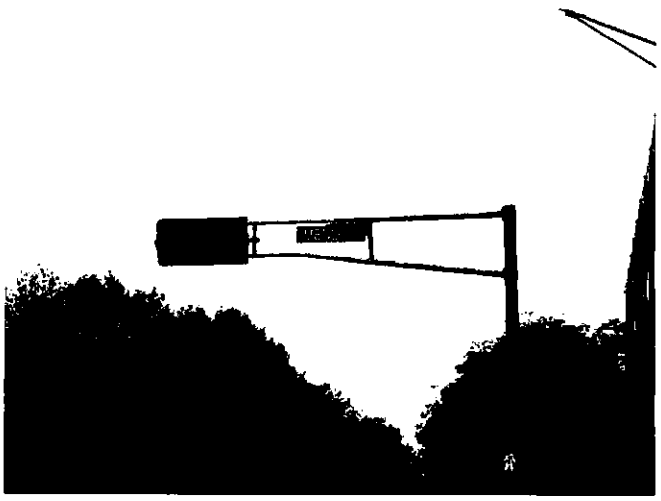
Figure 3B-16. Examples of Crosswalk Markings



Picture 7 – Various Pavement Marking Styles

*3) Street Name Signs. The street name signs along North Oakland Avenue and East Capitol Drive are very small as can be seen in Picture 8, which make them difficult for drivers to read as they approach an intersection. This takes drivers' attention away from the road and from pedestrians and bicyclists.

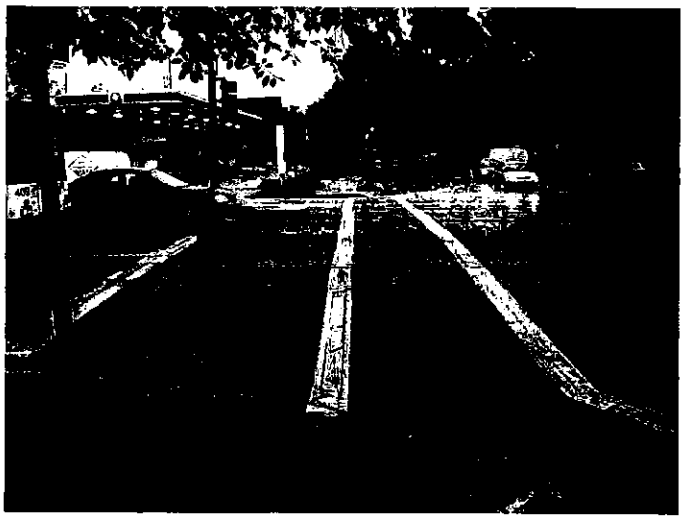


Picture 8– Hard to read overhead street sign

Solution: Replace the existing street signs with larger, more reflective signs. The Manual on Uniform Traffic Control Devices recommends a minimum letter height of 6-inch upper case and 4 ½" lower case letters for ground mounted signs, and 12-inch upper case and 9" lower case letters for overhead mounted street name signs (such as the one shown in Picture 8); and the signs shall be retro reflective or illuminated to show the same shape and similar color both day and night. Replacing the existing street signs would cost approximately $1000 - $1500 per intersection.

A more innovative solution is to install illuminated street signs, making the signs even more visible, while adding a decorative feature to the business district. Product information on illuminated street signs can be found in Exhibit 9. The approximate cost of the illuminated signs is $2000 each or $4000 per intersection, which includes installation.

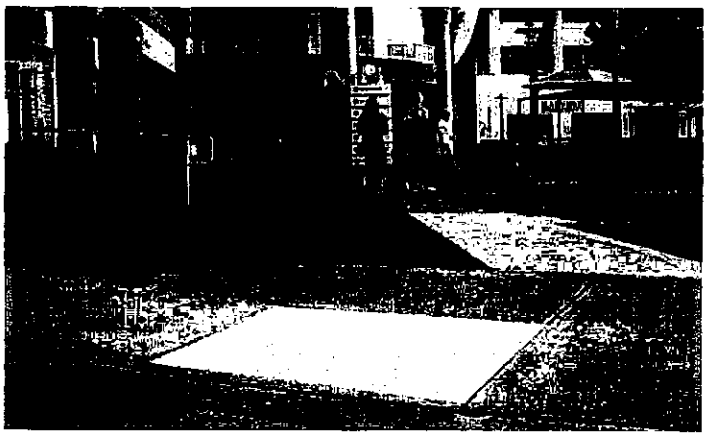
4) Depressed Curb Openings. Most depressed sidewalk ramps at intersections throughout the Village do not meet current ADA requirements. Many depressed curb openings are less than the required 36" minimum width, many depressed curb openings are not in alignment with the crosswalk and/or the adjacent sidewalk, and nearly all intersection corners only have one depressed curb opening that serves both directions of pedestrian travel, rather than the recommended two curb openings (one for each direction of travel). Picture 9 shows a crossing at Capitol and Morris with all of the above listed design deficiencies. These defects make it difficult for pedestrians and bicyclists to safely



Picture 9 – Crosswalk not in alignment w/sidewalk

cross the road, especially visually impaired pedestrians or pedestrians with adaptive equipment, whom may trip as they enter the crosswalk since it is not in alignment with the sidewalk; or those people may be directed into the intersection rather than the crosswalk because of the direction in which the curb opening is angled. Another Village-wide safety concern shown in Picture 9 which exists in several locations throughout the Village is that the crosswalk is located too close to the intersection, making the crosswalk longer than if the crosswalk were located further back from the intersection. In general, crosswalks should be placed as far from the intersection as possible, while still in alignment with the sidewalk, in order to minimize the crosswalk length.

Picture 10 – Properly Constructed Crosswalk



Picture 11 – ADA standard for depressed curbs

Picture 10 shows a properly constructed intersection crosswalk and depressed curb opening along East Capitol Drive. The curb depressions, crosswalk and sidewalk are all in alignment with one another, which directs pedestrians and bicyclists across the intersection in the safest way possible.

Solution: Reconstruct the handicap ramps similar to the ramps shown in Picture 10, as the budget permits. Keep in mind the Americans with Disabilities Act (ADA) requirements are raised, truncated domes with color contrast (usually yellow or red) to be constructed at depressed handicap ramps. An example of the new ADA raised truncated domes is shown in Picture 11. The ADA requires all communities to have a multi-year plan in place for replacing items such as handicap ramps to make them ADA compliant.

5) East Capitol Drive & North Wilson Drive

a) The driveway across "Baker's Square" exceeds the ADA maximum cross slope of 2% where the sidewalk intersects the driveway. A sidewalk should continue through a driveway at a maximum of 2% cross slope.

Solution: Reconstruct the driveway apron to ADA standards.

b) The sign shown in Picture 12 shows that the inside eastbound through lane is designated for both through and left turning traffic. However, there are no pavement markings for eastbound traffic that indicate this lane configuration, which causes confusion over whether vehicles are continuing straight through the intersection or turning left.

Picture 12 – Signage @ Capitol & Wilson

Solution: After reviewing the capacity analysis, one dedicated left turn lane is not sufficient to service the left turn demand alone. Therefore, the shared through/left lane should remain. Install pavement markings for eastbound East Capitol Drive that delineate the lane assignments as indicated on the existing signs.

6) East Capitol Drive & North Morris Boulevard. The BP gas station entrance on East Capitol Drive is located too close to the intersection (there is also a second entrance a little further east). After the light turns green, eastbound vehicles going to the gas station proceed though the intersection and turn quickly into the gas station's first driveway. There are many "near misses" as unsuspecting vehicles following closely behind nearly rear-end the turning vehicles.

Solution – Eliminate the two BP entrances closest to the intersection (one on Capitol and one on Morris). One entrance on East Capitol Drive and one on North Morris Boulevard would still remain, but they would be located further from the intersection making ingress and egress safer into the gas station.

7) East Capitol Drive & North Lake Drive. The left arrow for northbound traffic turns on when no vehicle is present in the left turn lane. Southbound vehicles on North Lake Drive expect a green signal when the northbound traffic starts and often get stuck in the middle of the intersection when they proceed without the expected green signal.

Solution – Install traffic detector loops or video detection in the northbound left turn lane so the northbound left turn arrow only activates when a vehicle is present (the traffic signal controller may need to be upgraded). This will not only improve the safety of the intersection but also improve the capacity of the intersection.

9) North Oakland Avenue & East Kenmore Place.

Picture 13 shows the intersection of Oakland and Elmdale, which is near the intersection of Oakland and Kenmore. The depressed curb opening is not in alignment with the painted crosswalk and the storm sewer inlet creates a trip hazard for wheelchairs and pedestrians with adaptive equipment.

Picture 13 – Crosswalk at Oakland & Elmdale

Solution: Reconstruct the depressed curb opening so that it is in alignment with the crosswalk and so pedestrians or wheelchairs do not have to cross over the storm sewer inlet in order to cross the street.

10) North Oakland Avenue & East Shorewood Boulevard.

a. When southbound traffic have a red light, some vehicles form a second queue on the right of the stopped through/left turning vehicles in order to pass those vehicles. The very wide approach lane encourages vehicles to form two stopped queues.

Solution – Install highly reflective pavement markings that delineate the through lane at the intersection. Then, either delineate a right turn lane or mark the area adjacent to the curb for no vehicles and install a "Do not drive on shoulder" sign.

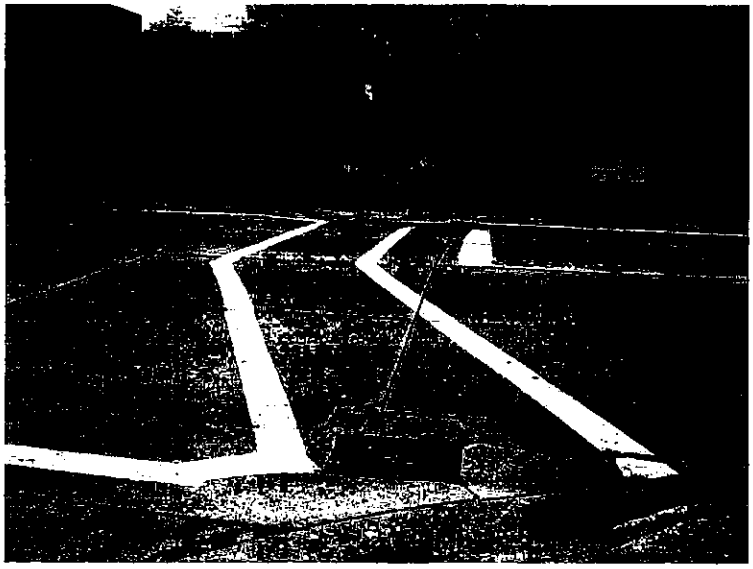
b. People stop in the yellow zone to unload students, which holds up traffic on both sides of the intersection.

Solution – Install a "No Stopping" sign in this location.

c. There is no sidewalk into the parking lot from the south side.

Solution – Extend the sidewalk into the parking lot.

d. The crosswalk across North Oakland Avenue has a "kink" as can be seen in Picture 14. This is a safety concern because visually impaired pedestrians may not realize the crosswalk does not continue in a straight line and may walk into opposing lanes of traffic on East Shorewood Boulevard. Additionally, the kinked sidewalk results in a longer crosswalk length which increases the potential for an accident because pedestrians may underestimate the time necessary to cross the road.



Picture 14– "Kinked" Crosswalk @ Oakland & Shorewood Elmdale

Solution: Repaint the crosswalk so that it is in a straight line. The stop bar may then need to be repainted so that it is a minimum of 4' behind the crosswalk.

Long Term Improvements

The following is a list of improvements recommended by Baxter & Woodman that the Committee believes should be considered in the long term as the budget permits.

1) Portable Speed Sign. Purchase a portable speed sign (not grant eligible) that displays an approaching vehicle's speed alongside the posted speed limit to slow down traffic. Product information for a solar powered portable speed sign, which would cost approximately $6000 per installation, is shown in Exhibit 9. Other traditional portable speed signs on wheels would be a less expensive option but they are larger and take up more space on the side of a road.

2) Traffic Signal Displays. Traffic signal heads are 8" in size at most intersections (with the exception of some red displays that have been upgraded to 12" like the one shown in Picture 15). All existing signals are Light Emitting Diode (LED), which is the MUTCD and Wisconsin Department of Transportation's (WisDOT) new standard for traffic signals, however the new standard for size is 12". Larger, LED traffic signals allow drivers to see the traffic signals further in advance of the intersection so drivers can be more cognizant of their surroundings, such as pedestrians, bicyclist, or other drivers, as they approach the intersection. The MUTCD and WisDOT's standard is currently traffic signals installed on

trombone arms like the one shown in picture. Traffic signals on trombone arms improve the visibility of traffic signal displays and also provide the best location for street name signs.

Solution: Consider upgrading all traffic signals to 12" LED traffic signals on trombone arms as the budget permits. The cost of replacing existing traffic signal heads with 12" LED signal heads is approximately $10,000 - $12,000 per intersection. Further engineering is required to determine the cost of replacing the existing signal posts with trombone arms but the range of cost is likely an additional $50,000 - $100,000 per intersection depending upon the amount of signal equipment that could be salvaged. WisDOT may upgrade the traffic signal equipment along Capitol Drive, as described above, when Capitol Drive is improved.

Picture 15 – 8" vs. 12" Signal Heads

7) Intersection #3: East Capitol Drive & North Oakland Avenue. The depressed curb opening shown in Picture 16 is too narrow. The minimum curb opening required by the Americans with Disabilities Act, ADA is 36". Also, the median in the roadway protrudes into the crosswalk which presents a safety hazard for pedestrians and especially pedestrians who are visually impaired.

Picture 16 – East leg of Capitol & Oakland

Solution: Remove a portion of the median that protrudes into the crosswalk retaining at least 2-feet between the face of curb and the existing post. It may be necessary to relocate the existing traffic signal post. Reconstruct the depressed curb opening to a width of 48" and align it with the crosswalk.

4) Mid-block Crossings. In-road warning lights, as shown in Picture 17, can reduce the potential for pedestrian accidents at mid-block crossings during the evening hours. Warning lights turn on when pedestrians approach the crossing to warn vehicles to slow down and yield to pedestrians. The Village should consider installing In-road warning lights at the mid-block crossings on East Capital Drive and North Oakland Avenue. The approximate installed cost is $13,000 - $15,000 per crossing. Product information can be found in Exhibit 9.

Picture 17 – In-road warning lights

A less costly alternative to in-road warning lights is pedestrian crossing signs with flashing lights around the border of the sign that are activated when pedestrians are present at the crossing. A picture of this flashing pedestrian sign is shown in Exhibit 9.

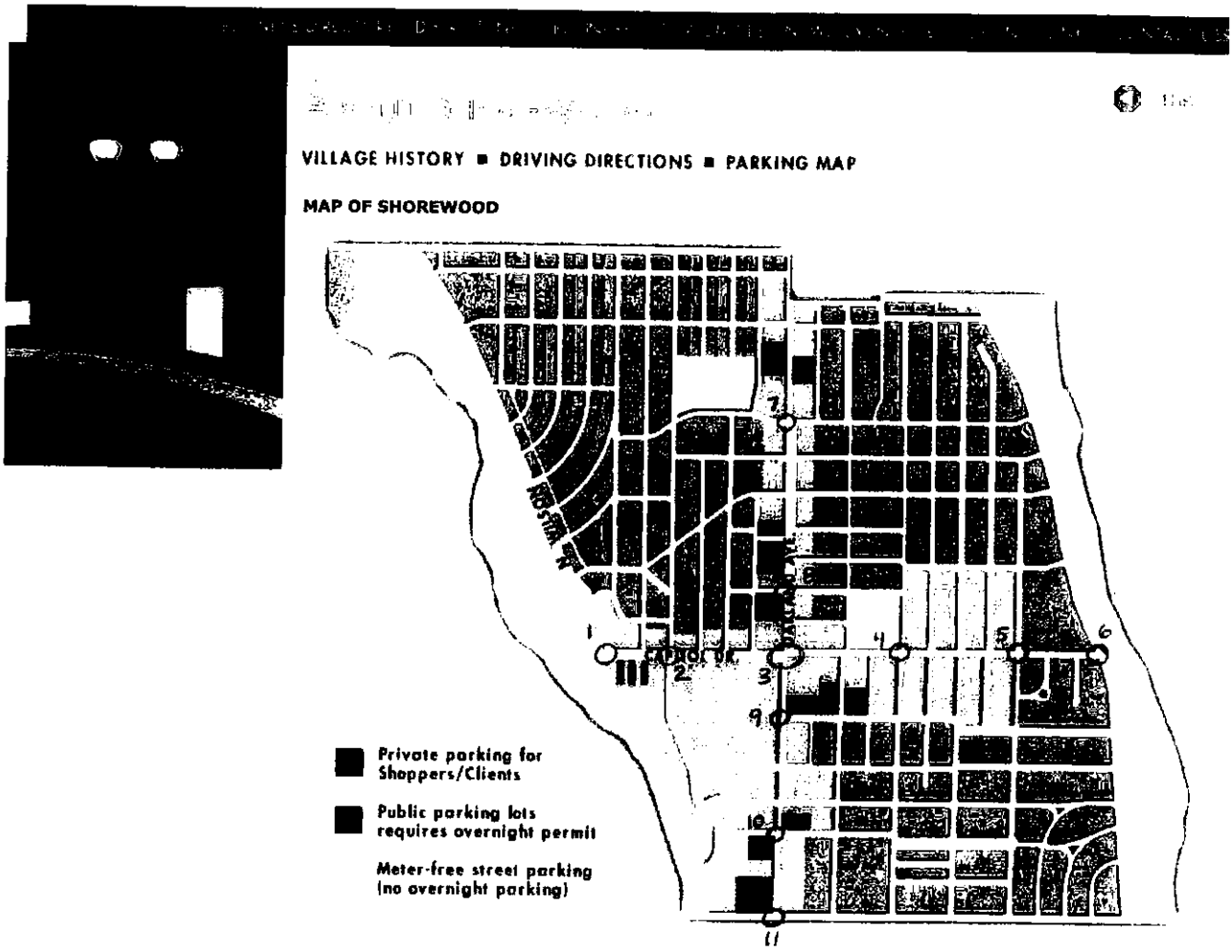
Picture 18– Curb bump-out

Curb bump-outs like those shown at the mid-block crossing on North Oakland Avenue in Picture 18 can also reduce the potential for pedestrian accidents. With curb bump-outs, the crosswalk length is reduced and pedestrians are in better view of a driver when they are standing at the curb waiting to cross. Curb bump-outs should be constructed at all mid-block crossings along North Oakland Avenue and East Capitol Drive if the existing conditions permit them to be constructed.

Conclusion

The goals of the pedestrian safety committee are to educate the entire community on the requirements of pedestrian, bicycle, and traffic safety laws and to promote walking as a way to enhance the quality of life in Shorewood. The recommendations in this report are based upon a comprehensive study of all the signalized intersections in the Village of Shorewood and measures that have proven to be successful pedestrian and bicycle safety enhancements in other communities. The goal of this report is to provide the Village with both relatively low cost improvements that should be implemented in the near future and innovative solutions that will enhance pedestrian and bicycle safety beyond the recommended minimum standards of safety. These recommendations have been prioritized by short-term, mid-term, and long-term classifications. The long-term improvements are more costly in some cases and as such should be implemented as the Village budget permits. The Wisconsin Department of Transportation offers a grant program for enhancing the visibility of signs, pavement markings, and other traffic control items called, "Traffic Signing and Marking Enhancement Grant Program". The Village should apply for this grant, which requires a 25% local match, to fund any proposed improvements relating to signage, pedestrian and traffic signals, and pavement markings. This report will serve as both a short term and long term planning tool that can be used to improve pedestrian and bicycle safety and promote walking and biking as a way to enhance the quality of life in the Village of Shorewood for many years to come.

EXHIBIT 1

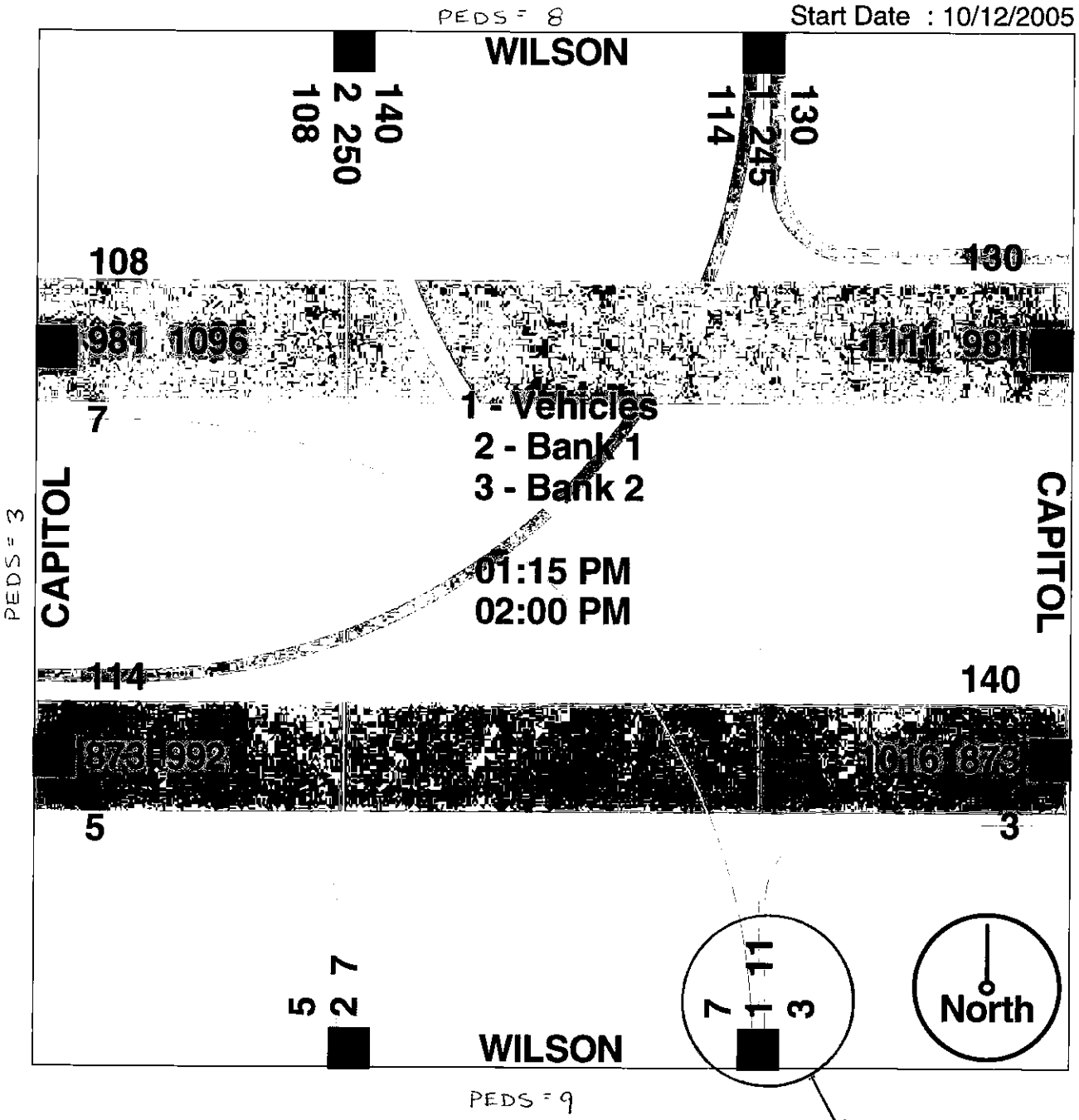


1. Intersection of East Capitol Drive and North Wilson Drive.
2. Intersection of East Capitol Drive and North Morris Boulevard.
3. Intersection of East Capitol Drive and North Oakland Drive.
4. Intersection of East Capitol Drive and North Maryland Avenue.
5. Intersection of East Capitol Drive and North Downer Avenue.
6. Intersection of East Capitol Drive and North Lake Drive
7. Intersection of North Oakland Drive and East Lake Bluff Boulevard.
8. Intersection of North Oakland Drive and East Kenmore Place
9. Intersection of North Oakland Drive and East Shorewood Boulevard.
10. Intersection of North Oakland Drive and East Menlo Boulevard.
11. Intersection of North Oakland Drive and East Edgewood Avenue.

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Capitol-Wilson
Site Code : 00000000
Start Date : 10/12/2005



HOW TO READ DIAGRAM

TOTAL VEHICLES @ INTERSECTION LEG

LEFT TURN | THRU | RIGHT TURN

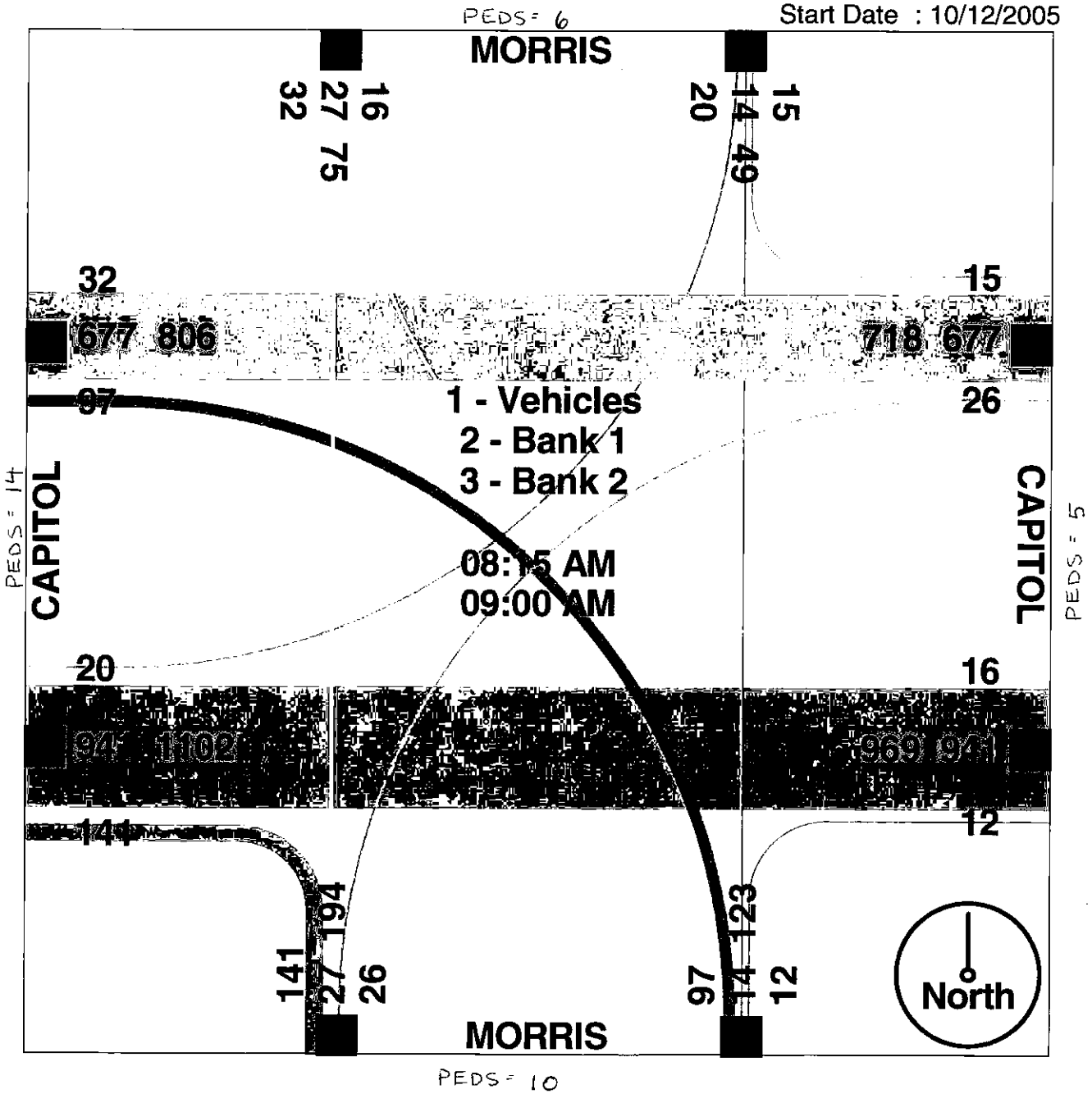
TOTAL PEDS = 22

NOTE: TIME REPRESENTED IS 1:15 PM – 2:15 PM
2:00 PM REPRESENTS THE LAST 15 MIN.
PERIOD WHICH ENDS AT 2:15 PM.

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Capitol-Morris
Site Code : 00000000
Start Date : 10/12/2005

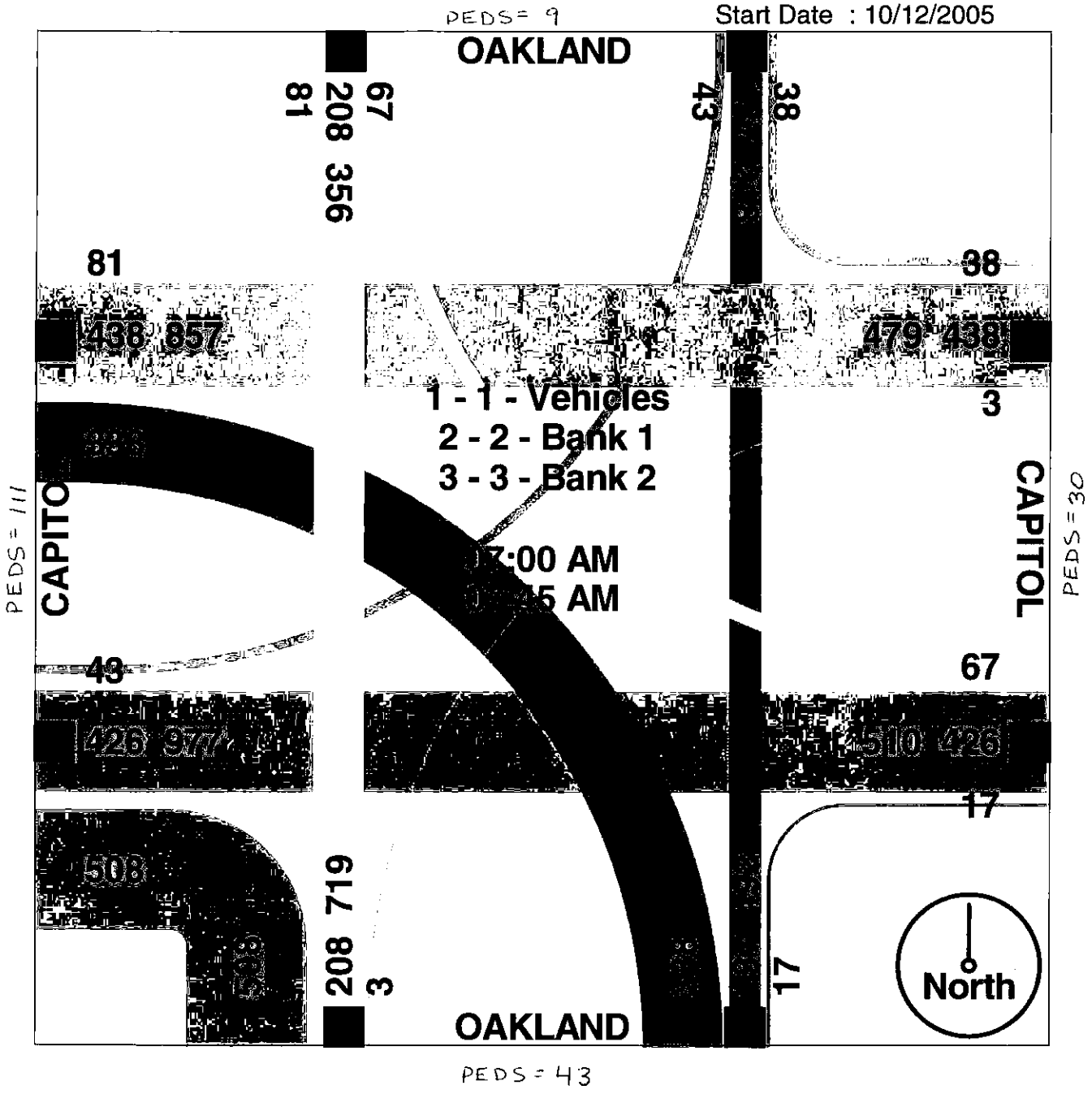


TOTAL PEDS = 35

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Oakland-CapitolAM
Site Code : 00000000
Start Date : 10/12/2005

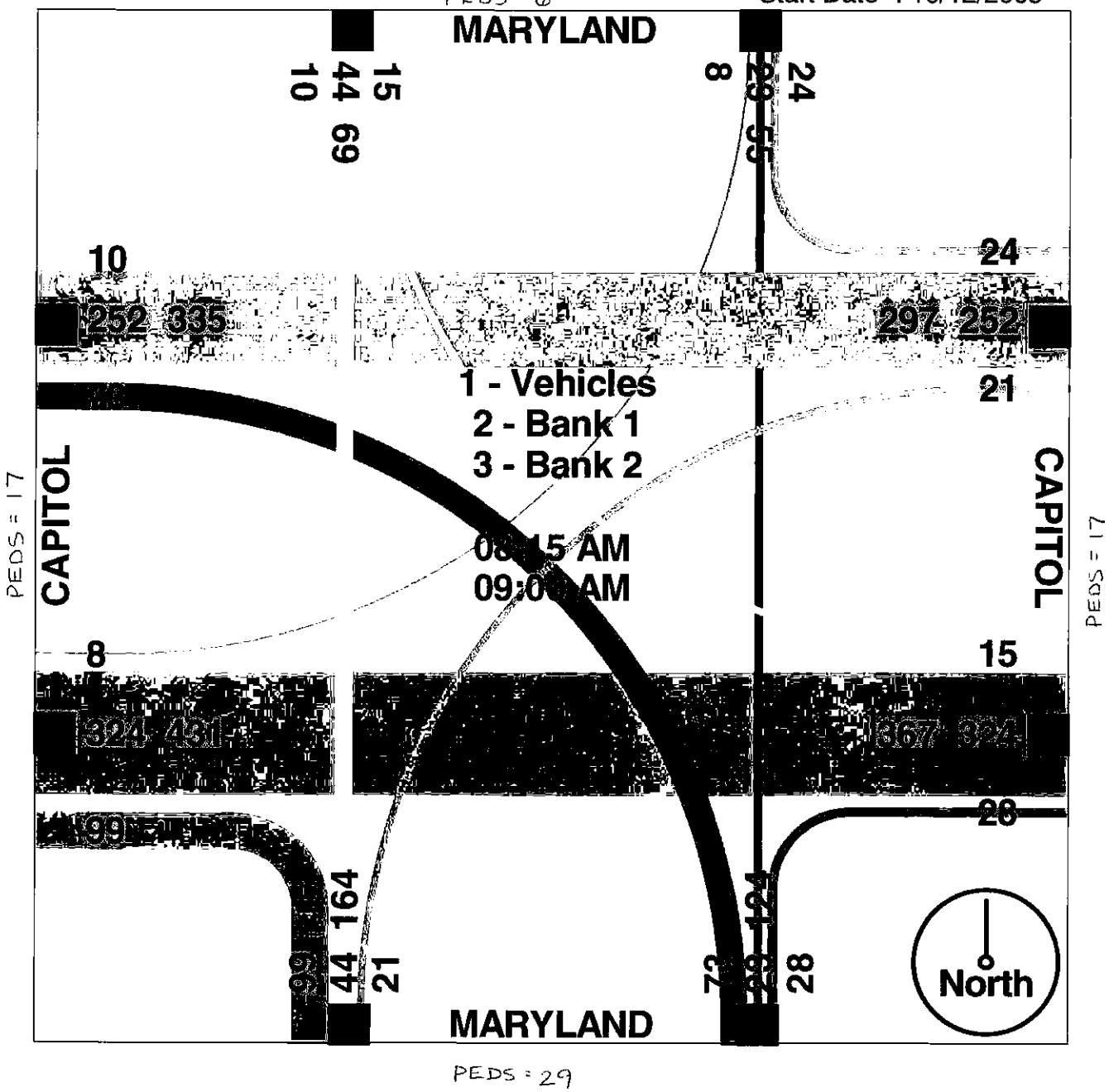


TOTAL PEDS = 193

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Maryland-Capitol
Site Code : 00000000
Start Date : 10/12/2005



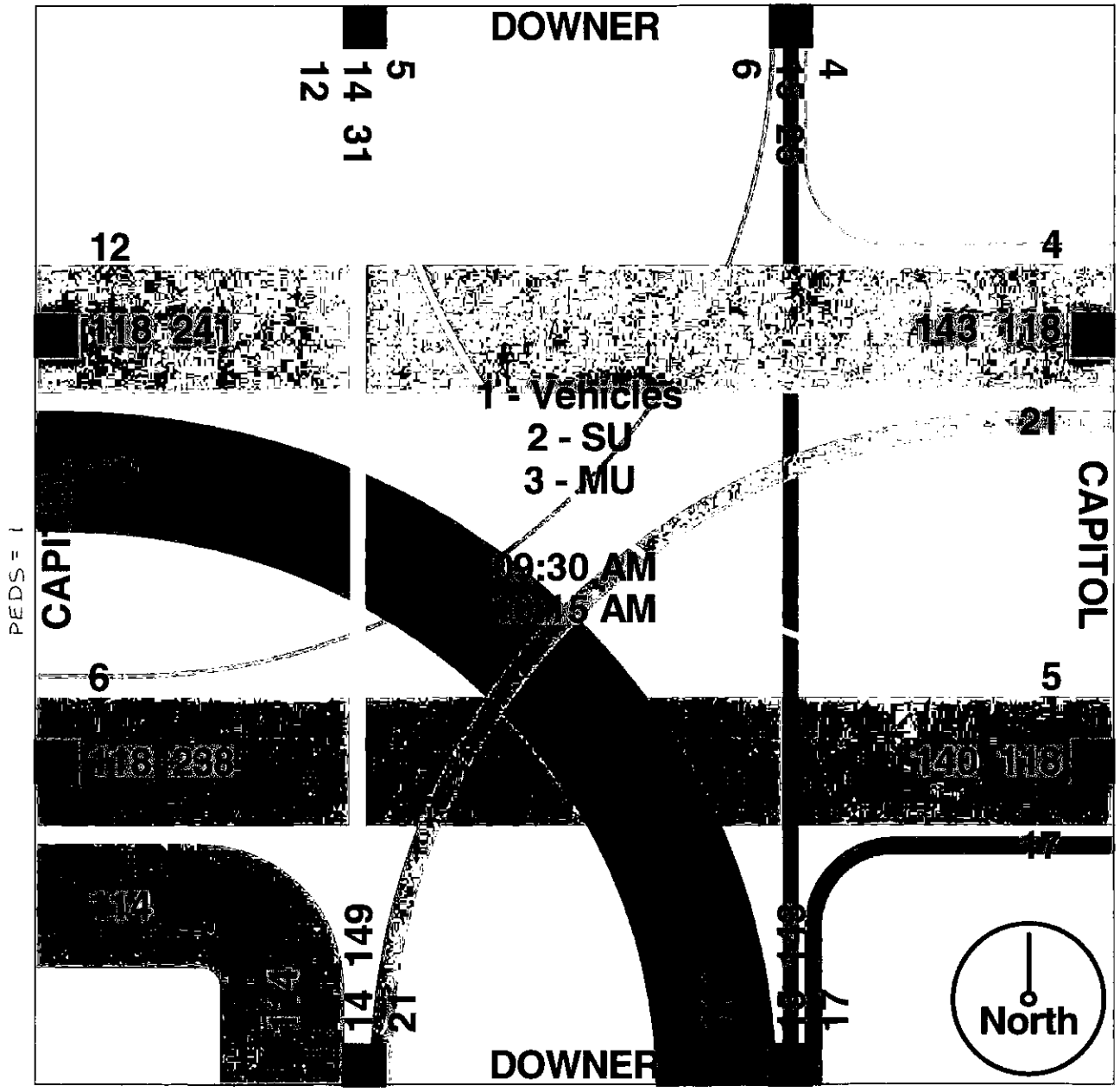
TOTAL PEDS = 69

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : CAPITO~1
Site Code : 00000005
Start Date : 10/12/2005

PEDS = 7



PEDS = 1

PEDS = 5

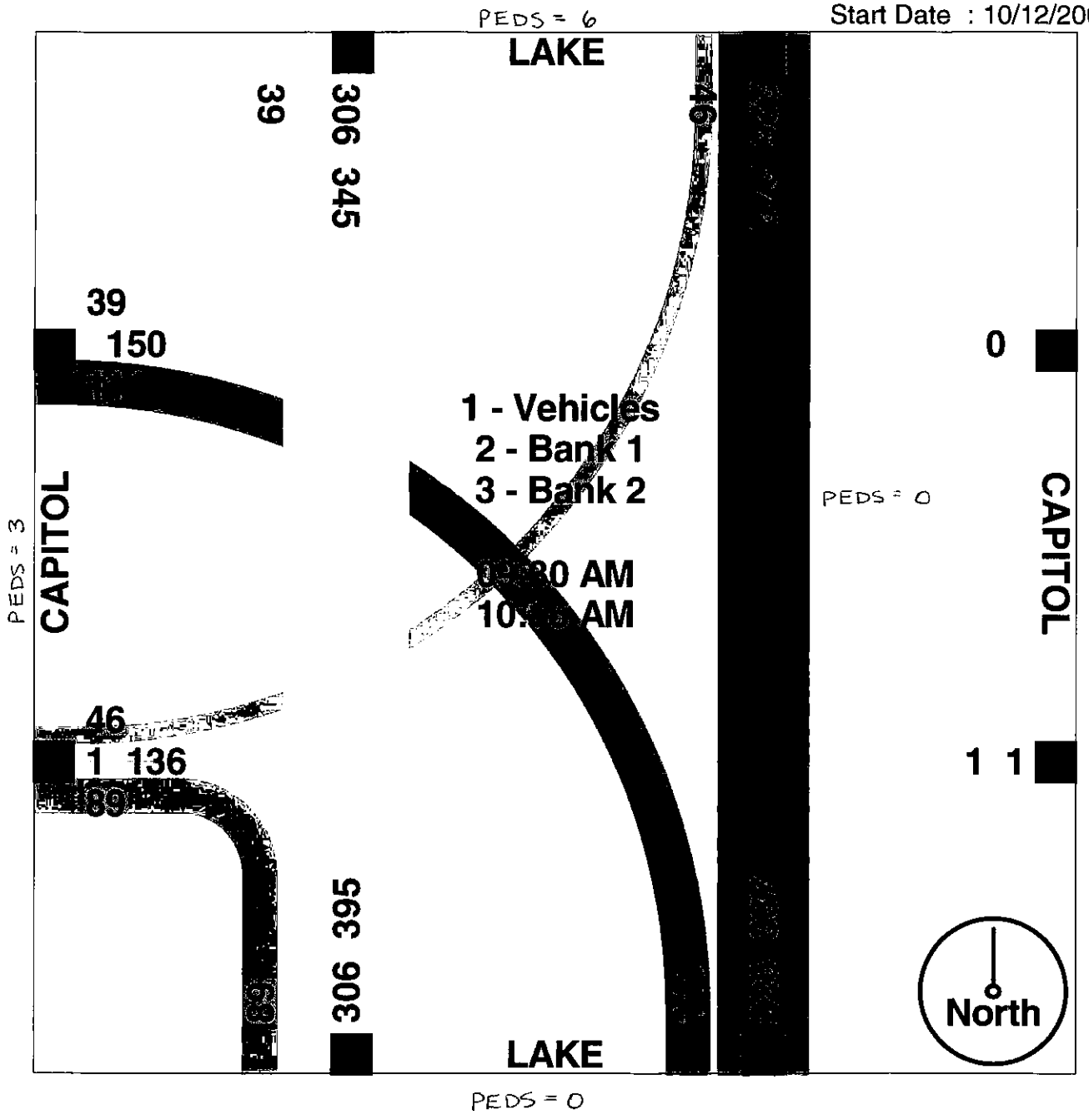
PEDS = 5

TOTAL PEDS = 18

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : CAPITO~2
Site Code : 00000000
Start Date : 10/12/2005



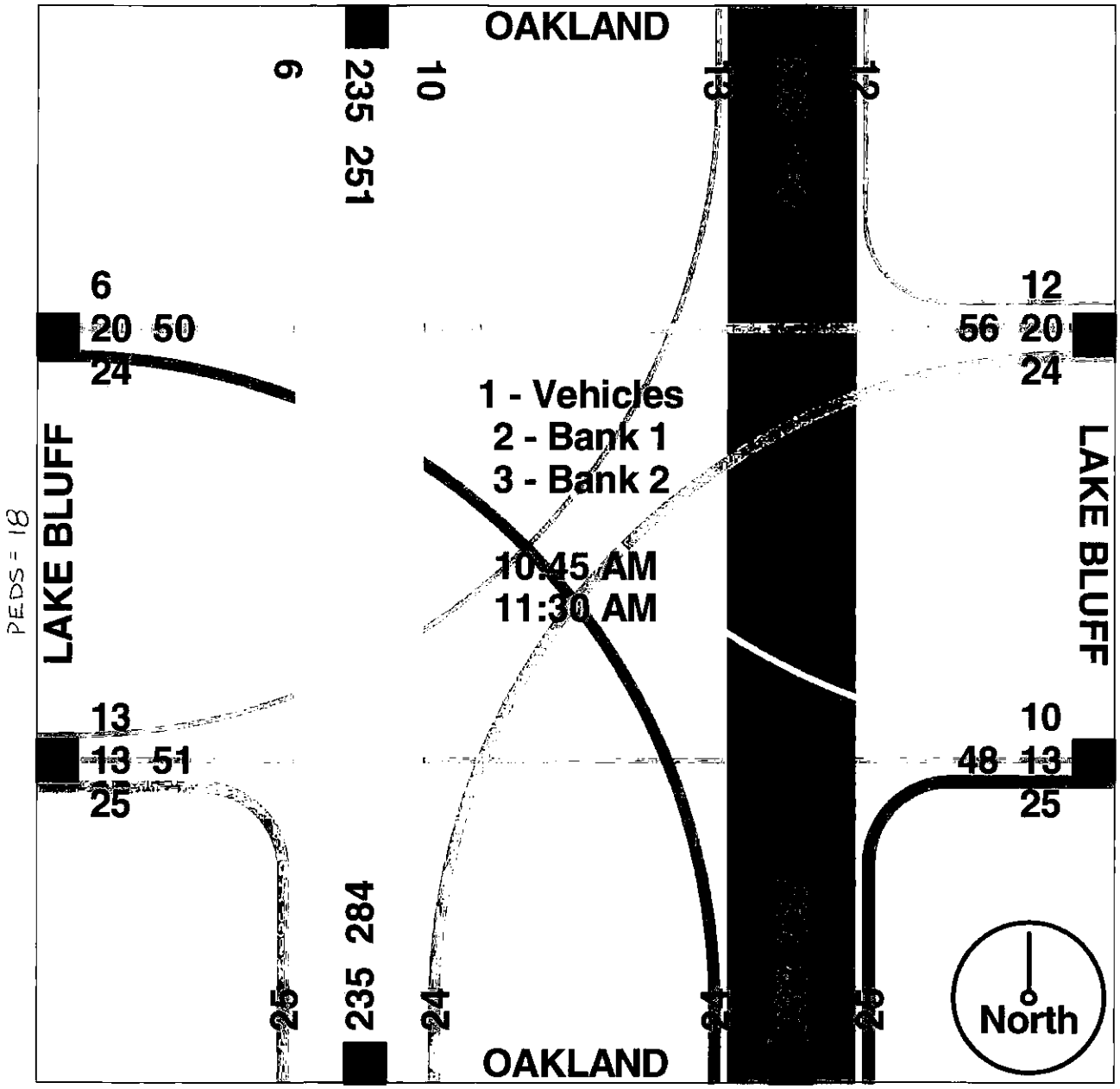
TOTAL PEDS = 9

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Oakland-LakeBluff
Site Code : 00000000
Start Date : 10/12/2005

PEDS = 4



PEDS = 18

PEDS = 9

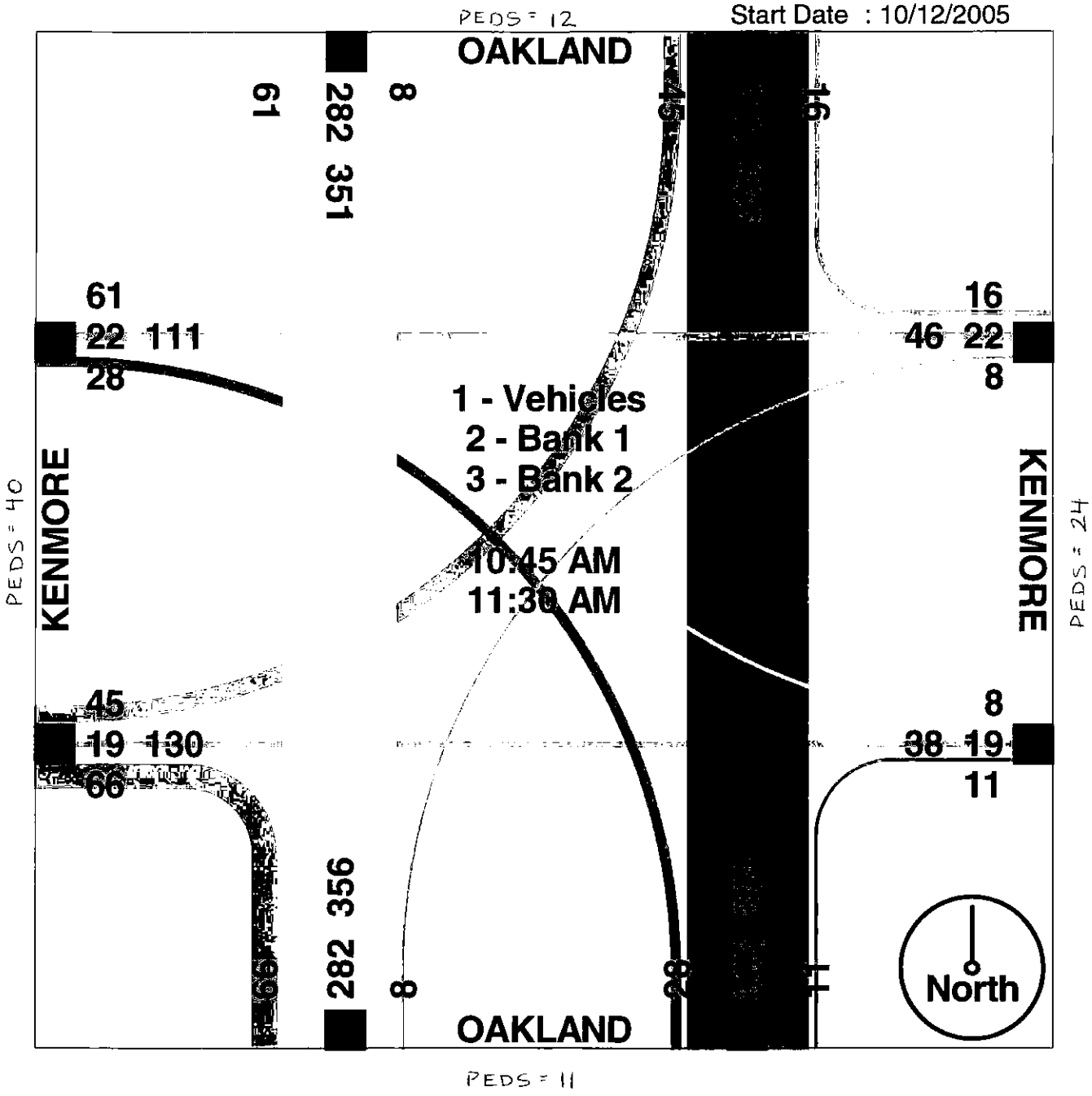
PEDS = 23

TOTAL PEDS = 54

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Oakland-Kenmore
Site Code : 00000000
Start Date : 10/12/2005



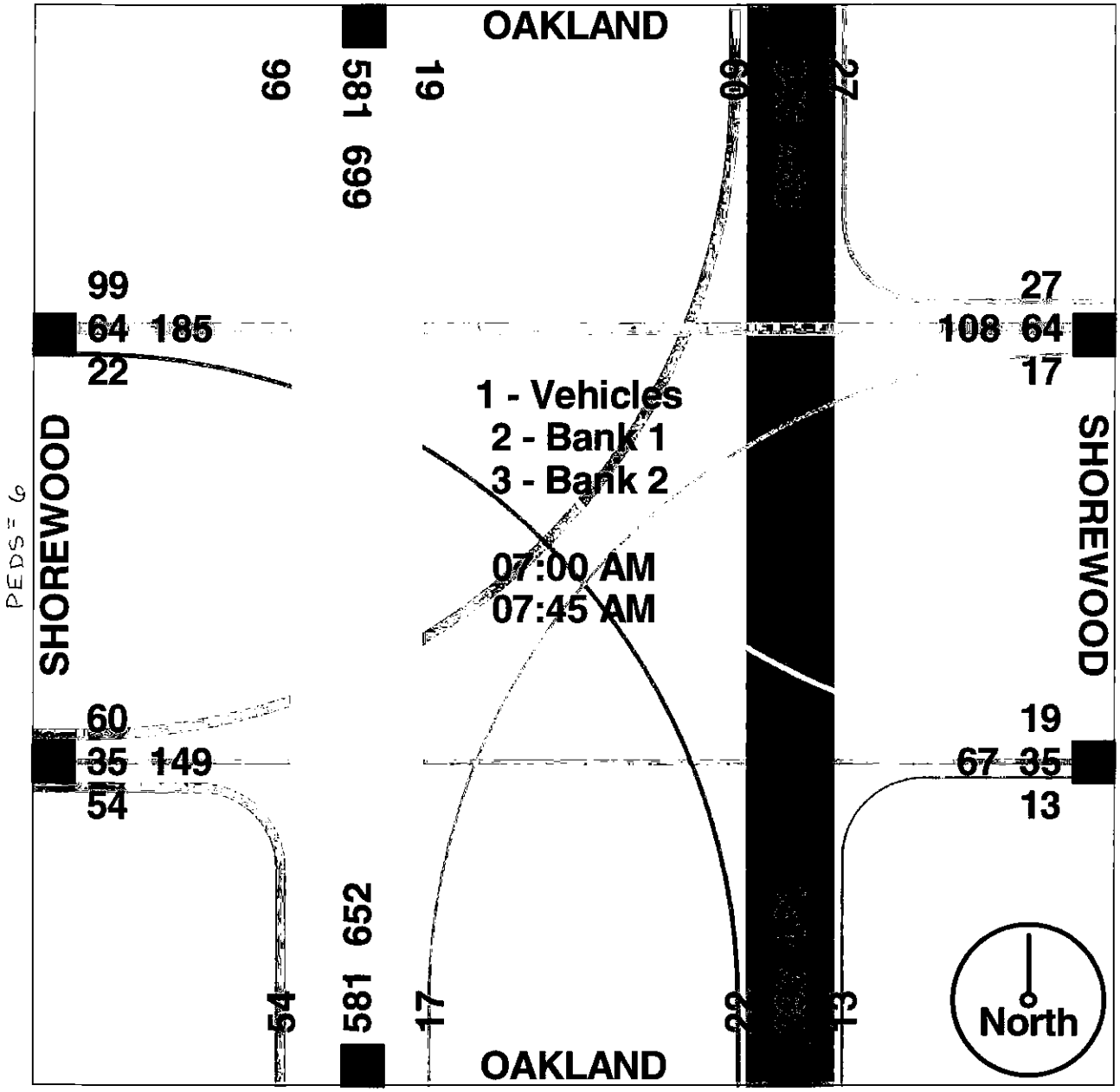
TOTAL PEDS = 87

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Oakland-Shorewood
Site Code : 00000000
Start Date : 10/12/2005

PEDS = 60



PEDS = 6

PEDS = 9

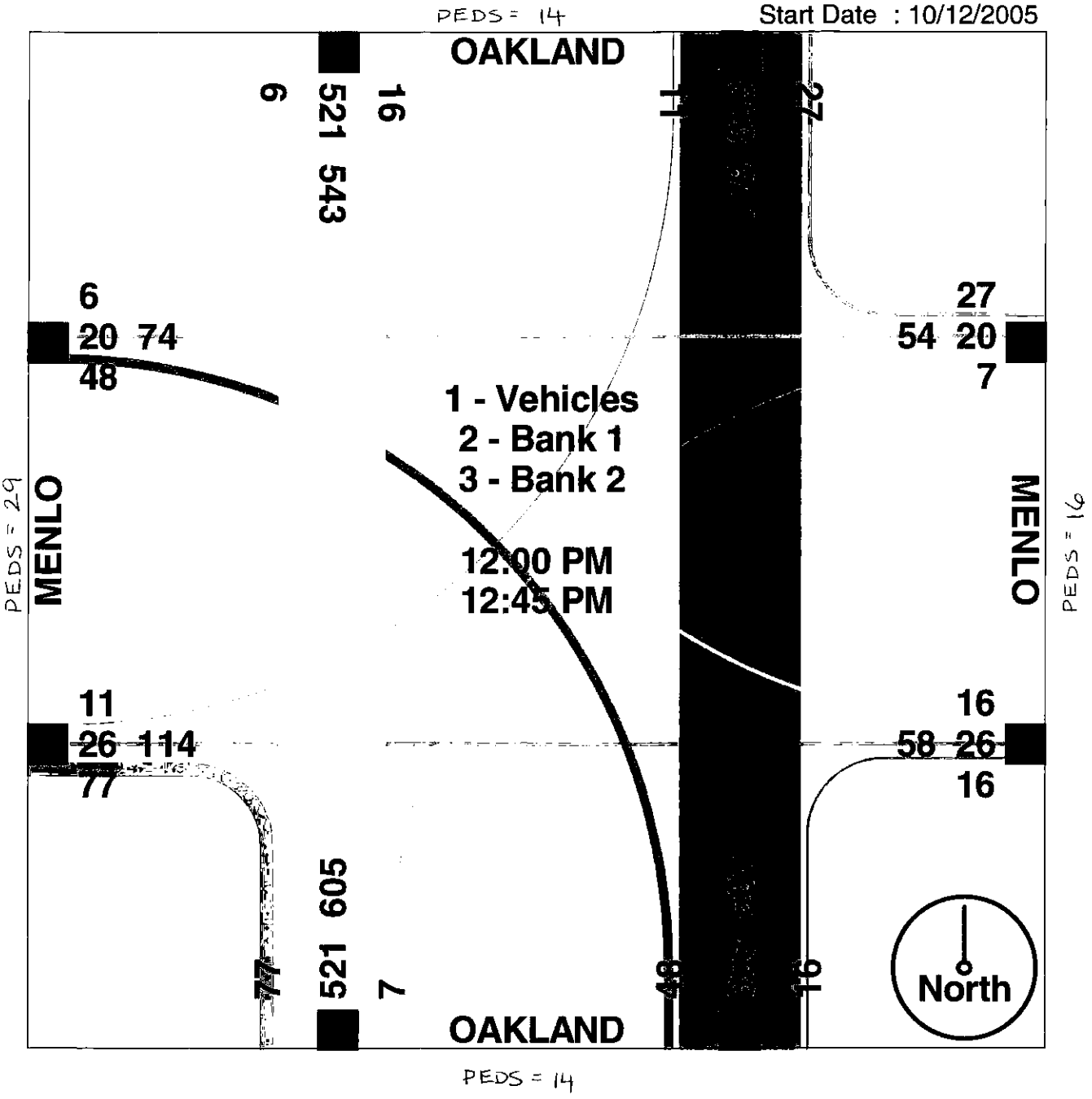
PEDS = 24

TOTAL PEDS = 99

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Oakland-Menlo
Site Code : 00000000
Start Date : 10/12/2005

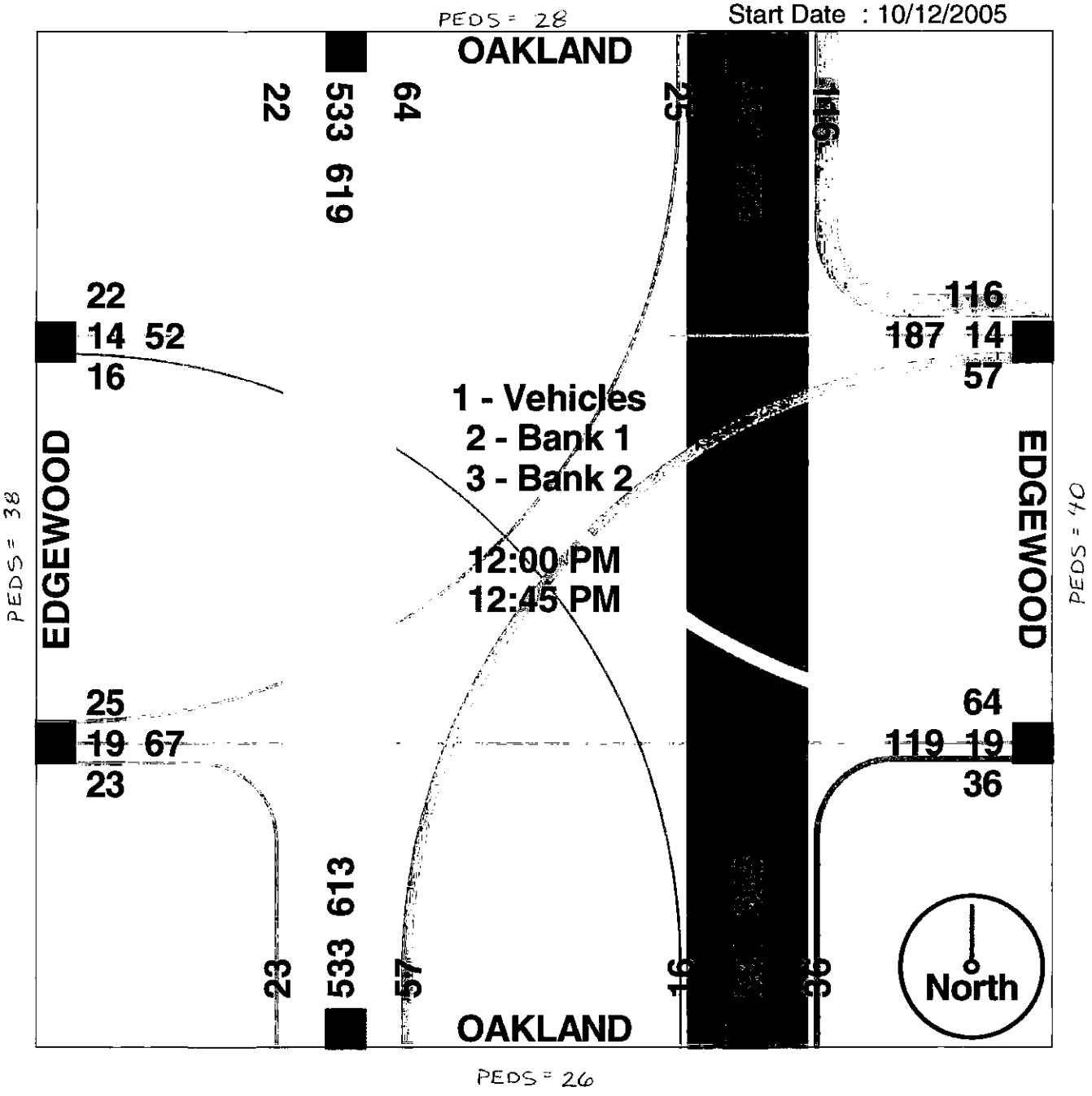


TOTAL PEDS = 73

EXHIBIT 2

Village of Shorewood
Weekday AM Counts

File Name : Oakland-Edgwood
Site Code : 00000000
Start Date : 10/12/2005

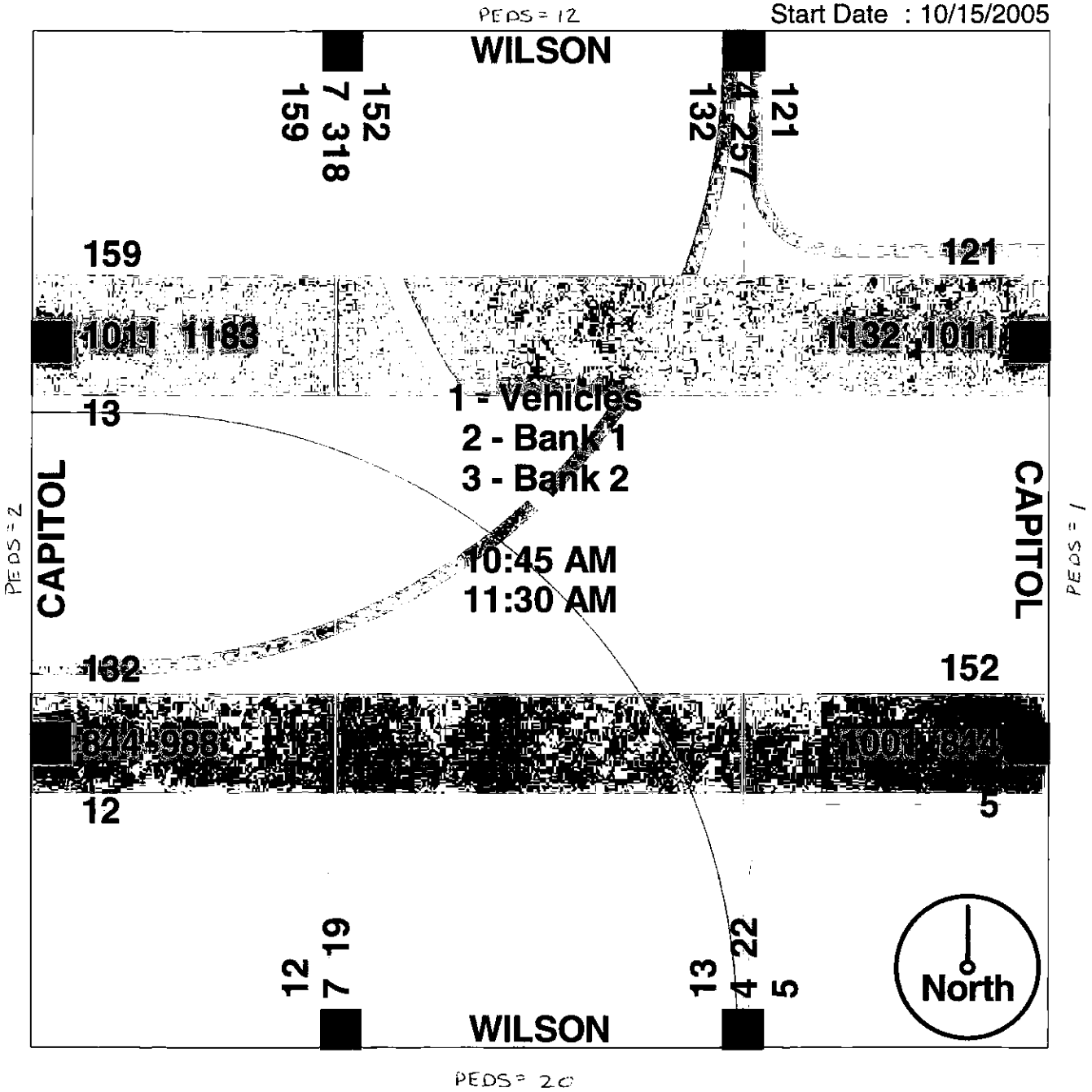


TOTAL PEDS = 132

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Capitol-Wilson
Site Code : 00000000
Start Date : 10/15/2005



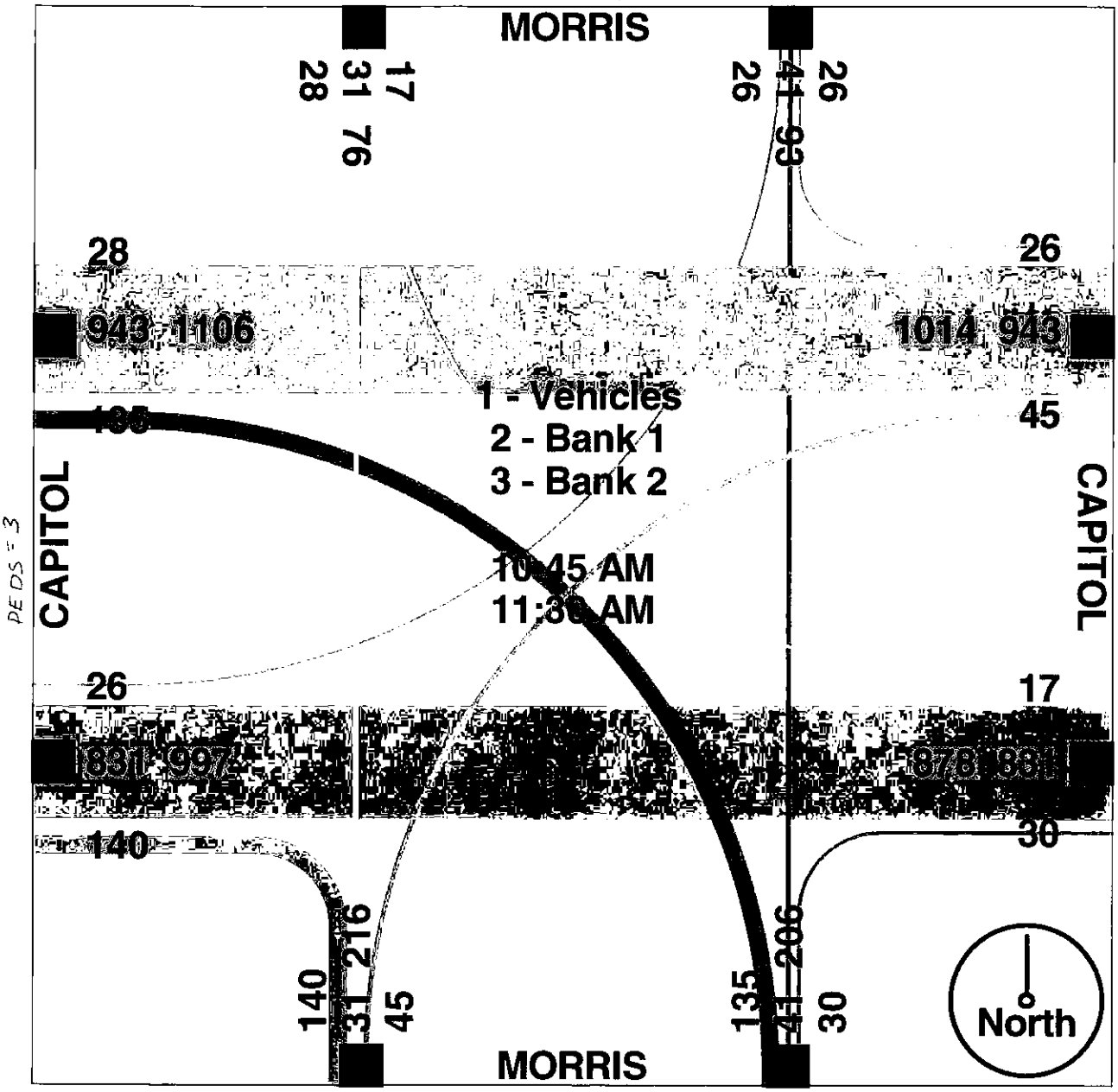
TOTAL PEDS = 35

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Capitol-Morris
Site Code : 00000000
Start Date : 10/15/2005

PEDS = 24



PEDS = 3

PEDS = 19

PEDS = 38

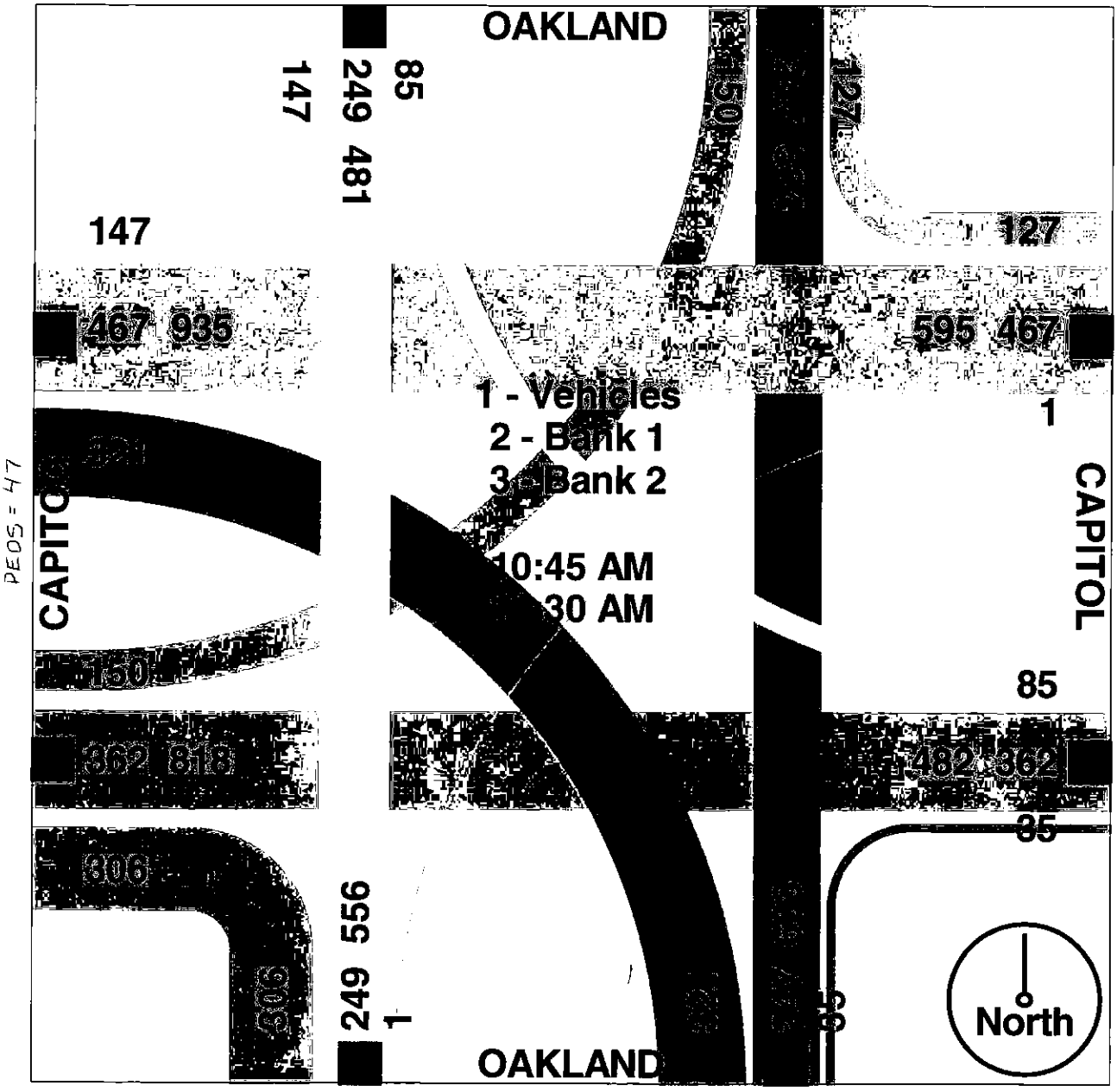
TOTAL PEDS = 84

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Oakland-Capitol
Site Code : 00000000
Start Date : 10/15/2005

PEDS = 39



PEDS = 47

PEDS = 36

PEDS = 20

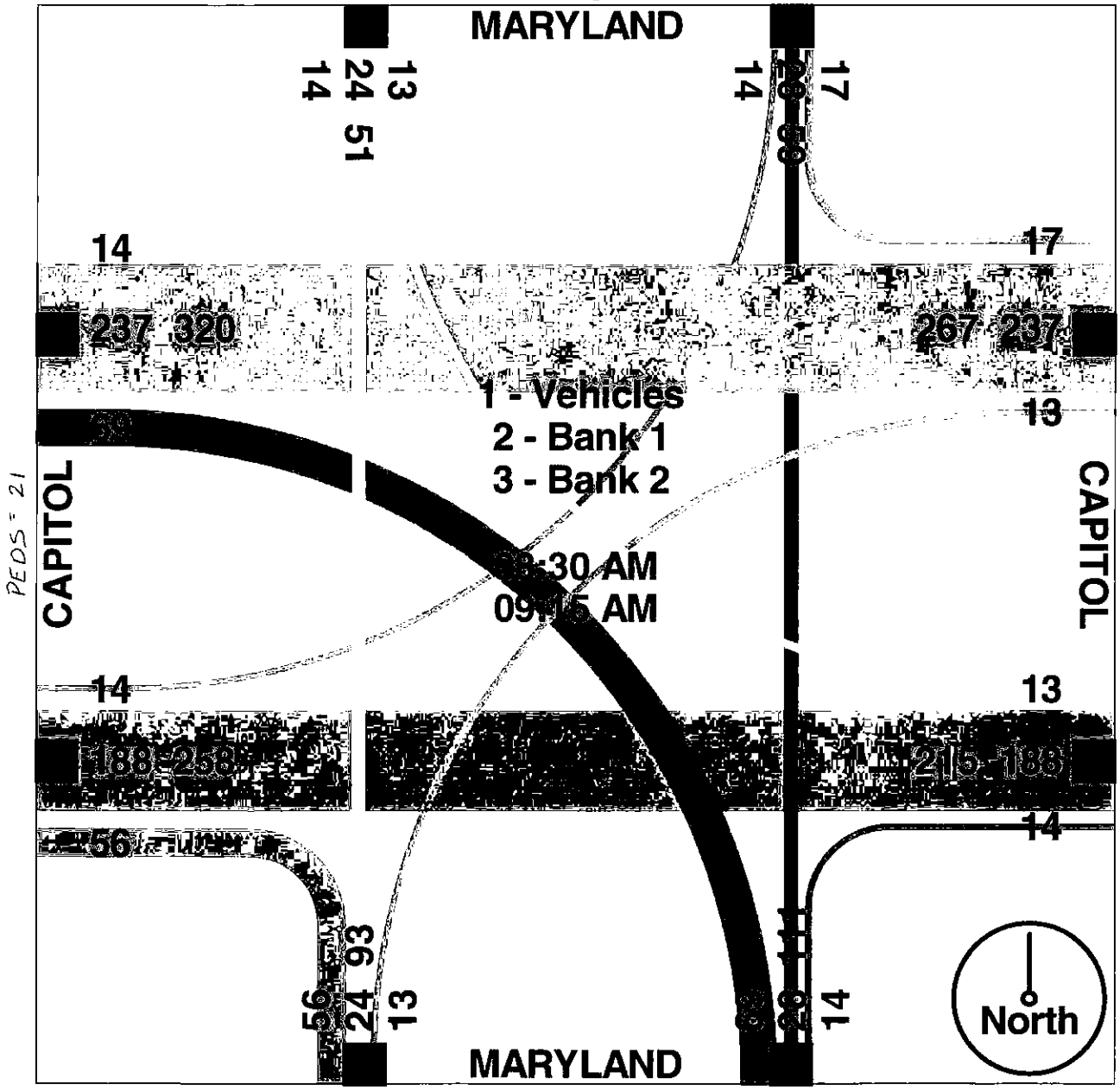
TOTAL PEDS = 142

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Capitol-Maryland
Site Code : 00000000
Start Date : 10/15/2005

PEDS = 15



PEDS = 21

PEDS = 12

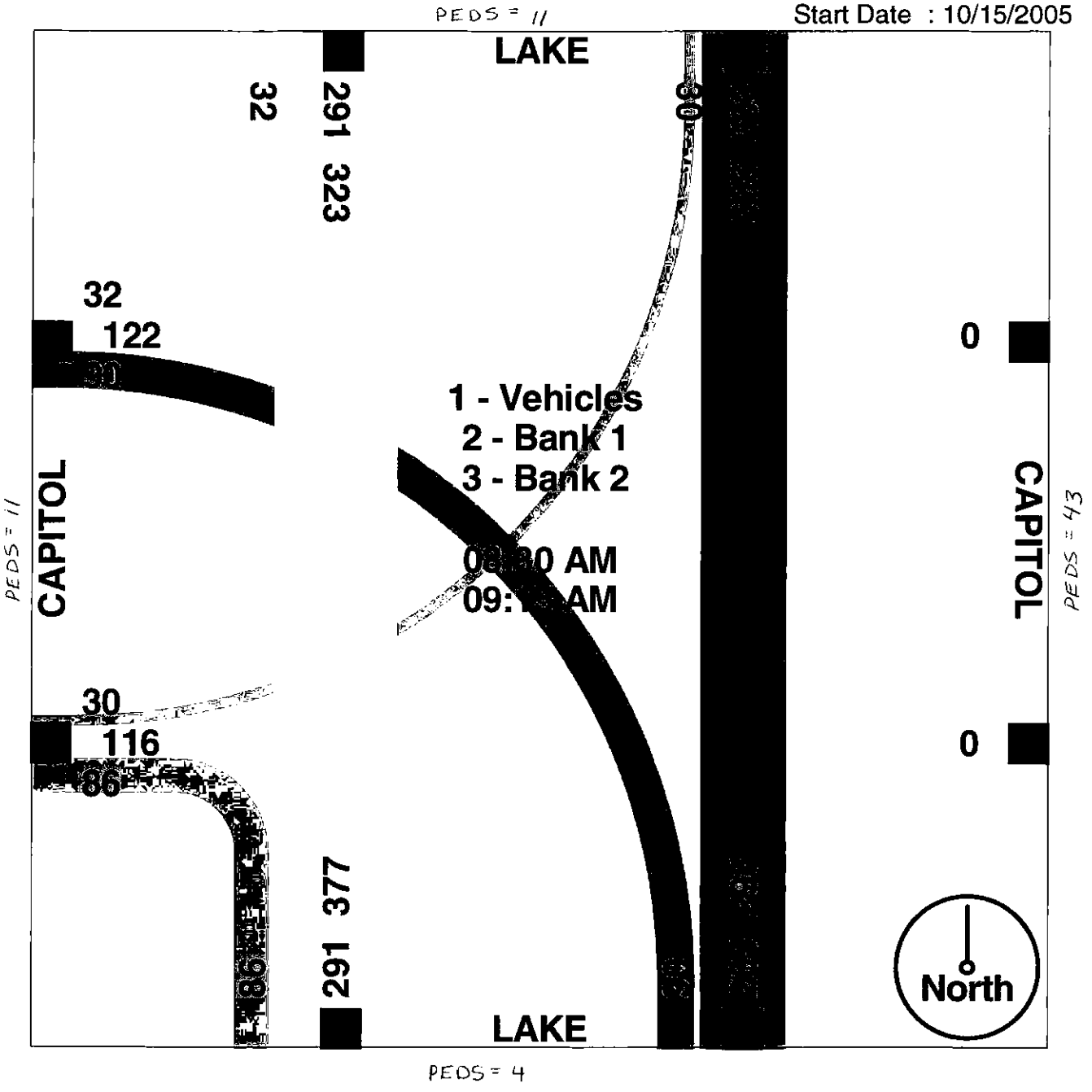
PEDS = 42

TOTAL PEDS = 90

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Capitol-Lake
Site Code : 00000000
Start Date : 10/15/2005

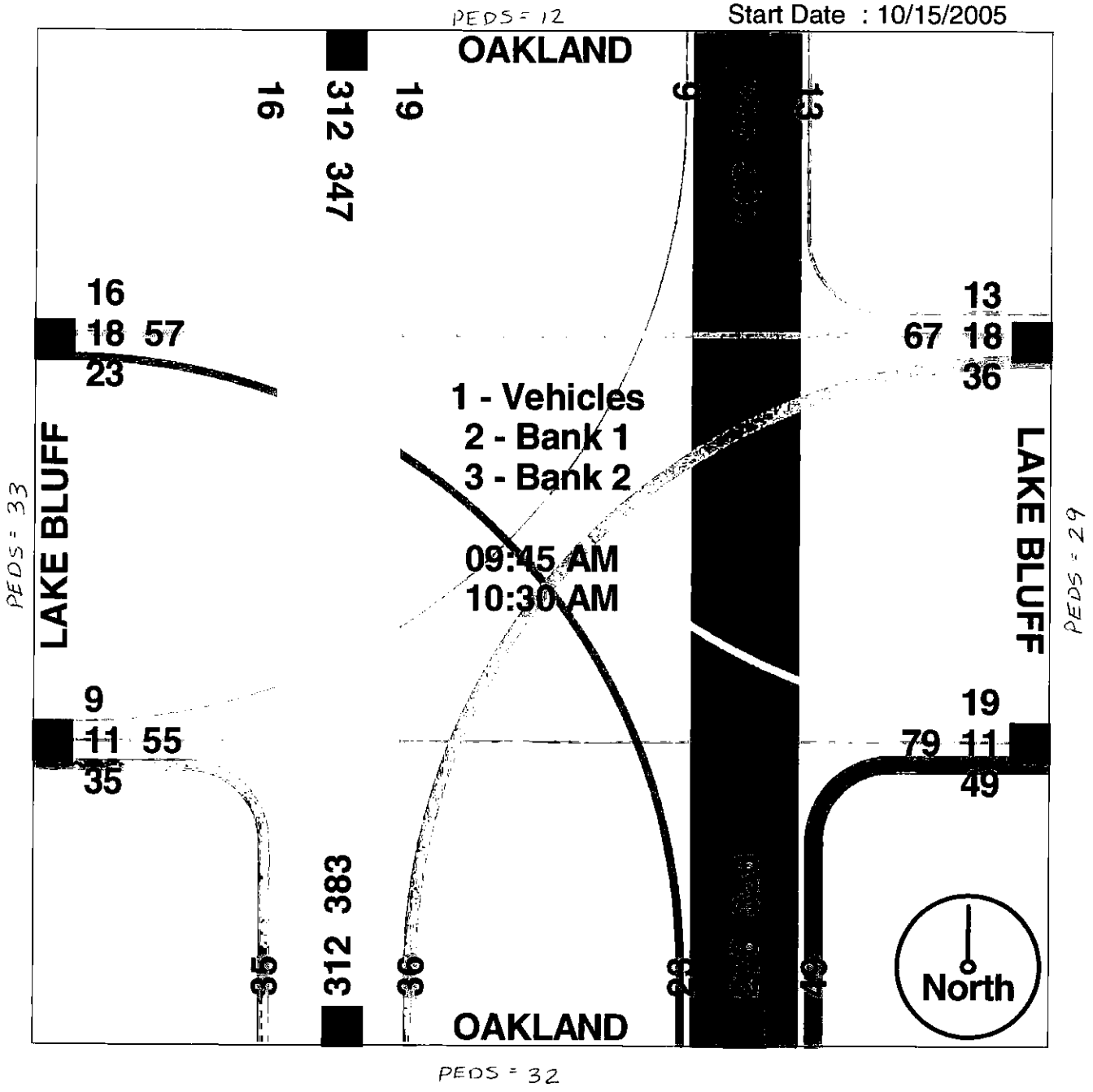


TOTAL PEDS = 69

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Oakland-LakeBluff
Site Code : 00000000
Start Date : 10/15/2005



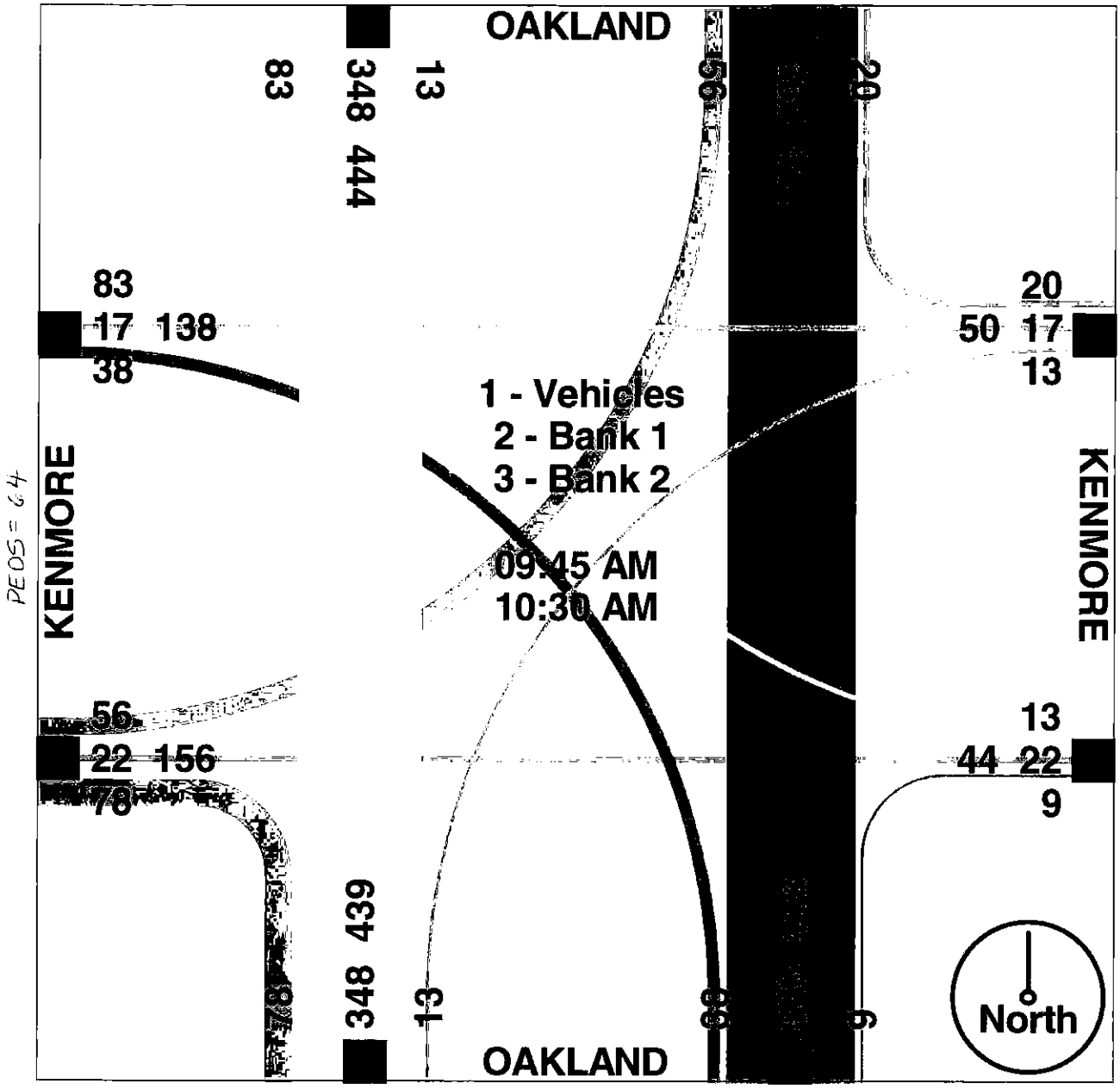
TOTAL PEDS = 106

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Oakland-Kenmore
Site Code : 00000000
Start Date : 10/15/2005

PEDS = 20



PEDS = 64

PEDS = 40

PEDS = 14

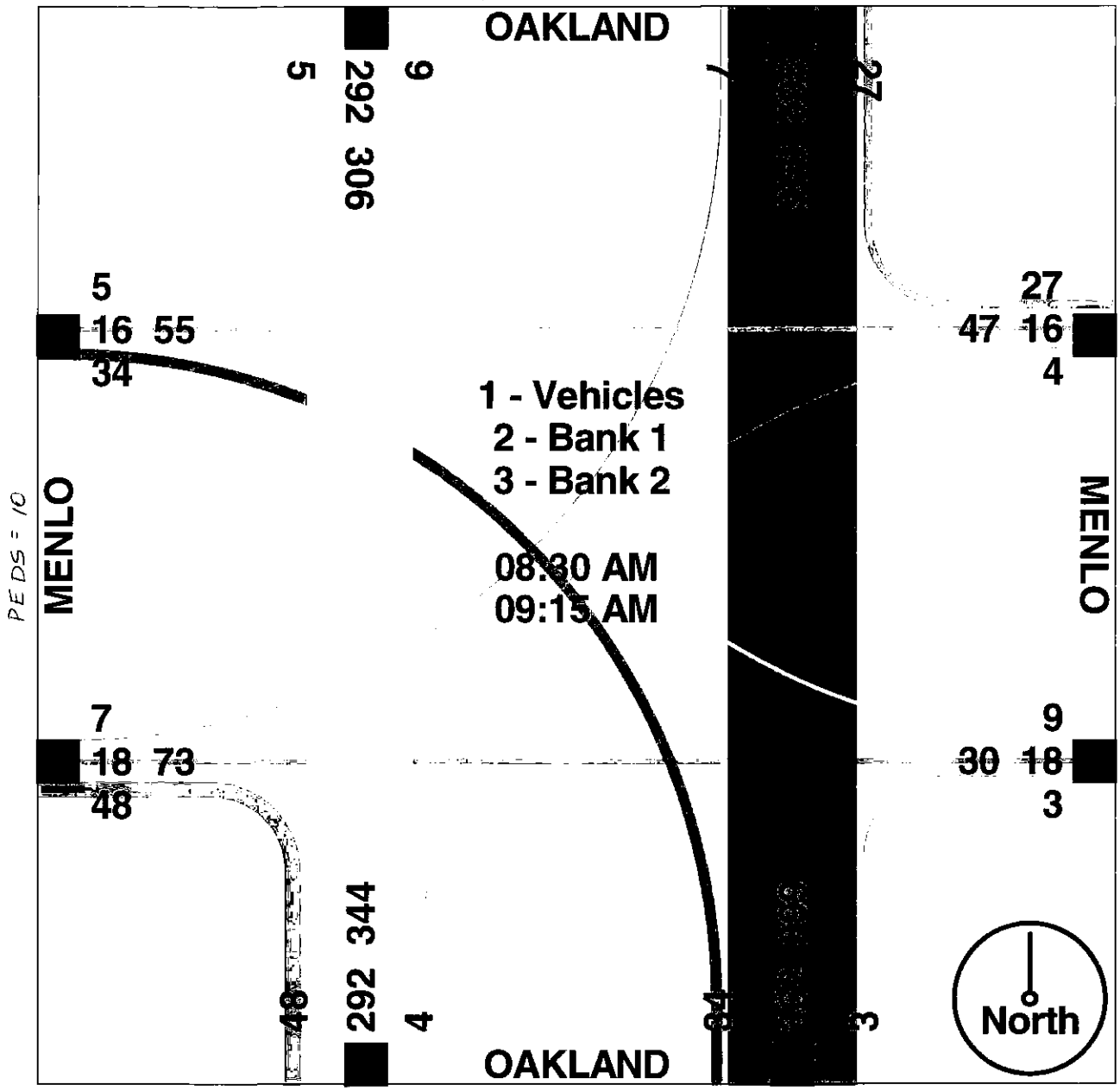
TOTAL PEDS = 138

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Oakland-Menlo
Site Code : 00000000
Start Date : 10/15/2005

PEDS = 5



PEDS = 10

PEDS = 14

PEDS = 8

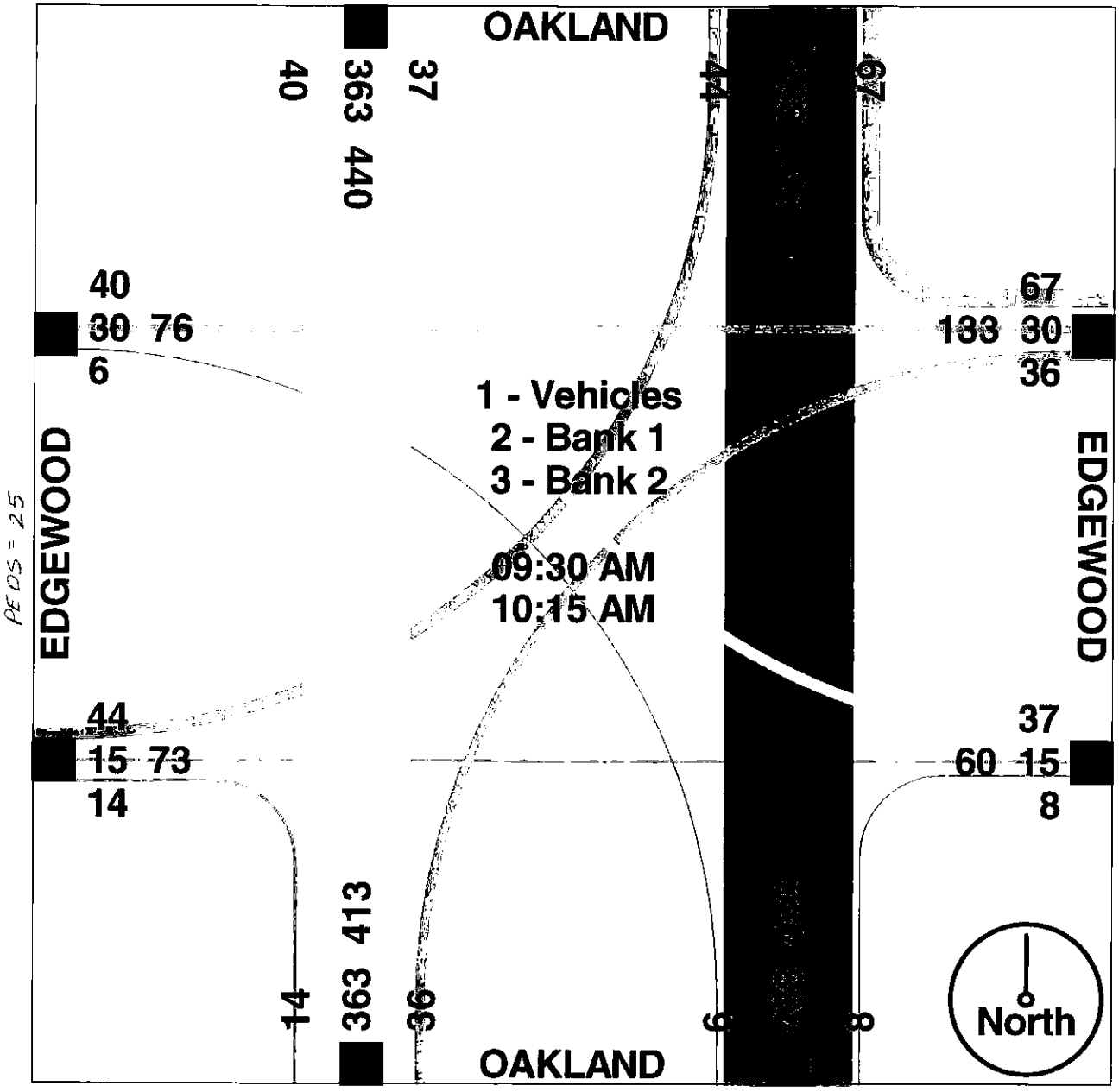
TOTAL PEDS = 37

EXHIBIT 3

Village of Shorewood
Weekend AM Counts

File Name : Oakland-Edgewood
Site Code : 00000000
Start Date : 10/15/2005

PEDS = 32



PEDS = 25

PEDS = 15

PEDS = 20

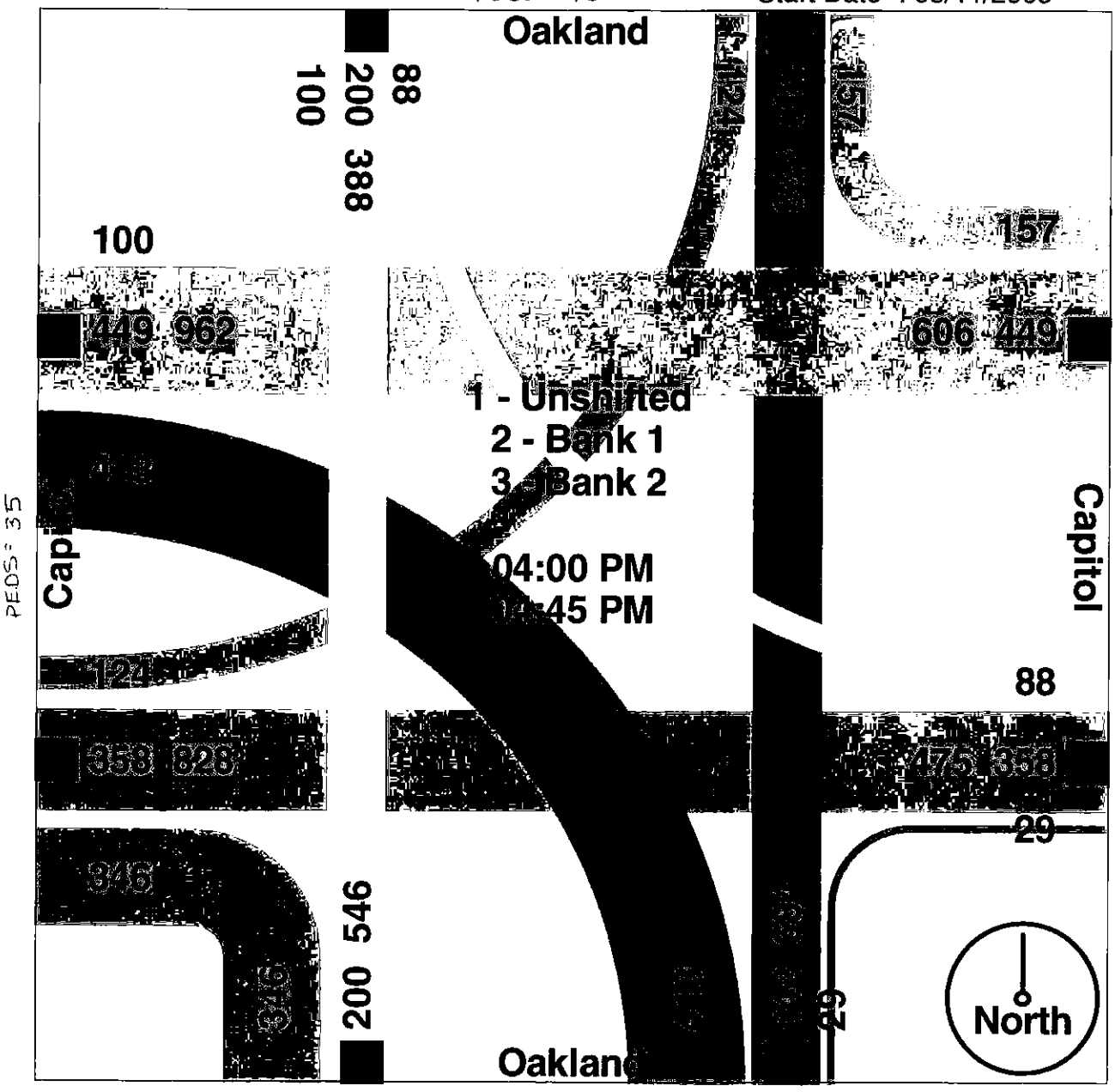
TOTAL PEDS = 92

EXHIBIT 4

Village of Shorewood
Weekday PM Counts

File Name : Oakland-CapitolPM
Site Code : 00006789
Start Date : 08/11/2005

PEDS = 13



PEDS = 35

PEDS = 27

PEDS = 15

TOTAL PEDS = 90

Village of Shorewood
Intersection of Capitol and Wilson
1:15 PM - 2:15 PM

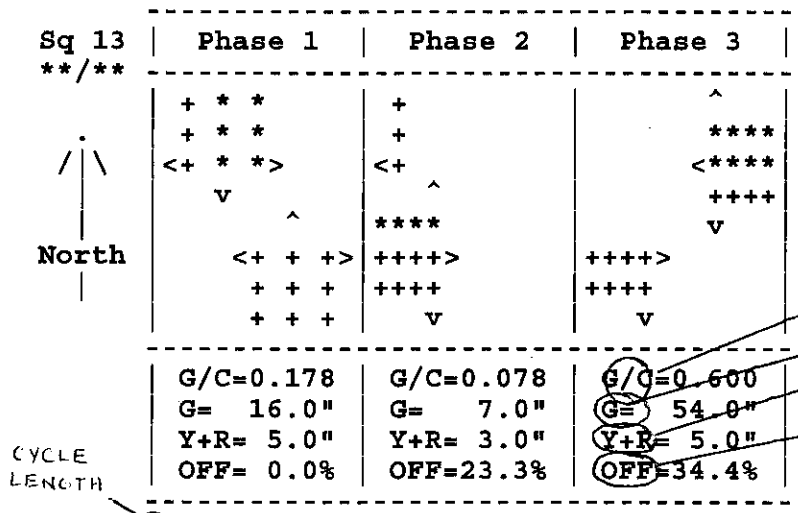
11/17/05
15:53:45

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

AVG VEHICLE DELAY @ INTERSECTION

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.55 Vehicle Delay (14.9) Level of Service (B+)

OVERALL LOS @ INTERSECTION



GREEN TIME TO CYCLE LENGTH RATIO
GREEN TIME
YELLOW + ALL RED TIME
% TIME GREEN IS OFF

CYCLE LENGTH

(C)= 90 sec G= 77.0 sec = 85.6% Y=13.0 sec = 14.4% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	@E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								40.7	D+	
(RT)	12/1	0.189	0.311	256	391	76	0.194	23.8	C+	73 ft
(TH+LT)	12/1	0.240	0.178	67	220	158	0.672	48.9	(*)D	193 ft
S Approach								31.1	C	
RT+TH+LT	16/1	0.131	0.178	68	223	12	0.050	31.1	C	14 ft
E Approach								13.7	B+	
RT+TH	24/2	0.432	0.600	1848	1877	1234	0.657	13.7	*B+	498 ft
LT	12/1	0.122	0.600	272	328	1	0.003	7.2	A	1 ft
W Approach								10.6	B+	
RT+TH	24/2	0.358	0.711	2263	2263	976	0.431	6.0	A	262 ft
LT	24/2	0.149	0.078	1	248	127	0.476	45.7	*D	85 ft

VEHICLE/CAPACITY
LEVEL OF SERVICE
LENGTH OF VEHICLE QUEUE

RIGHT
THRU + LEFT
CLOSE TO DROPPING TO NEXT LOS LEVEL

LOS GUIDE

A	≤ 10	FREE FLOW
B	10-20	REASONABLY FREE FLOW
C	20-35	STABLE FLOW
D	35-55	APPROACHING UNSTABLE FLOW
E	55-80	UNSTABLE FLOW
F	> 80	FORCED FLOW

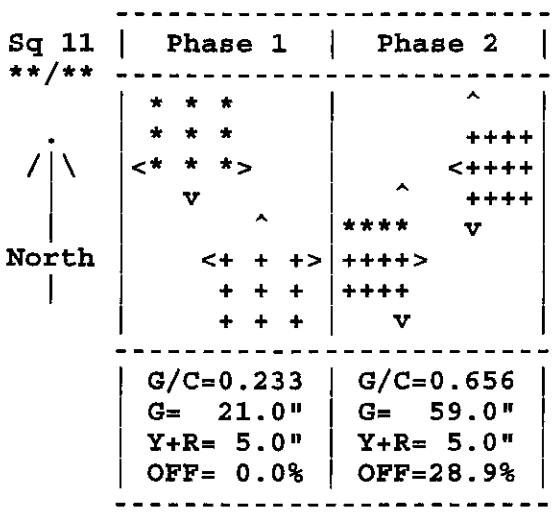
EXHIBIT 5
1 OF 11

Village of Shorewood
Intersection of Capitol and Morris
8:15 AM - 9:15 AM

11/17/05
15:51:26

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.48 Vehicle Delay 11.2 Level of Service B+



C= 90 sec G= 80.0 sec = 88.9% Y=10.0 sec = 11.1% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								29.2	C	
RT+TH+LT	16/1	0.174	0.233	172	340	72	0.209	29.2	*C	75 ft
S Approach								35.2	D+	
RT+TH+LT	16/1	0.234	0.233	131	273	132	0.468	35.2	D+	145 ft
E Approach								7.5	A	
RT+TH	24/2	0.307	0.656	2080	2081	769	0.370	7.6	A	225 ft
LT	12/1	0.266	0.656	181	228	29	0.127	7.0	A	17 ft
W Approach								9.9	A	
RT+TH	24/2	0.424	0.656	2041	2044	1203	0.589	9.9	A	416 ft
LT	12/1	0.182	0.656	360	410	22	0.054	5.8	*A	12 ft

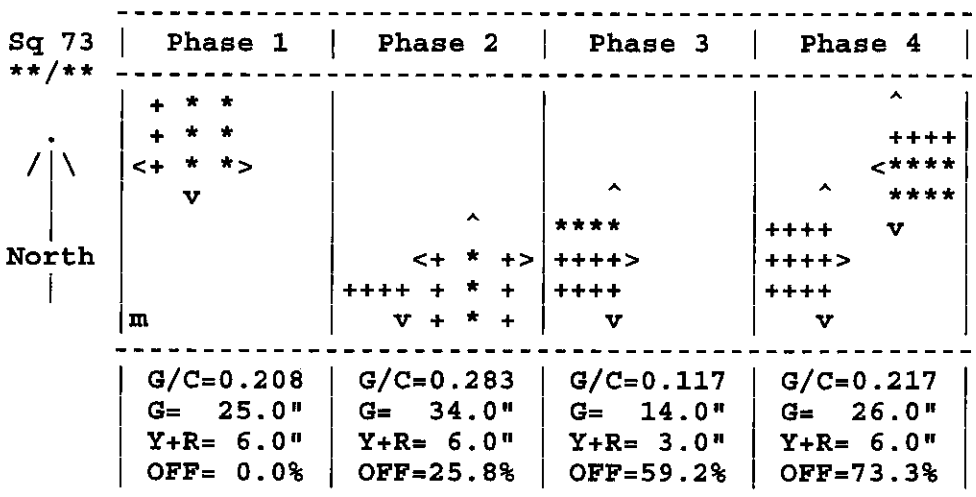
EXHIBIT 5
2 OF 11

Village of Shorewood
Intersection of Capitol Drive and Oakland Avenue
AM Peak Counts (7am-8am)

11/17/05
15:53:02

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.76 Vehicle Delay 72.2 Level of Service E



C=120 sec G= 99.0 sec = 82.5% Y=21.0 sec = 17.5% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								64.0	E+	
RT	12/1	0.262	0.208	1	209	62	0.267	40.4	D+	83 ft
TH+LT	12/1	0.324	0.208	1	325	305	0.884	68.8	*E	497 ft
S Approach								35.0	C	
RT	12/1	0.241	0.283	137	361	13	0.035	31.2	C	15 ft
TH+LT	12/1-	0.285	0.283	178	464	182	0.386	35.1	*D+	225 ft
LT	24/2+	0.283	0.283	346	875	346	0.395	35.0	D+	222 ft
E Approach								222.9	F	
RT	12/1	0.237	0.217	1	204	1	0.004	36.9	D+	1 ft
TH+LT	12/1	0.398	0.217	1	343	490	1.354	223.3	*F	1263 ft
W Approach								25.2	C+	
RT	12/1	0.516	0.692	845	892	564	0.632	11.6	B+	476 ft
TH	12/1	0.390	0.358	396	601	473	0.787	41.3	D+	642 ft
LT	12/1	0.041	0.117	161	237	48	0.195	27.3	*C+	52 ft

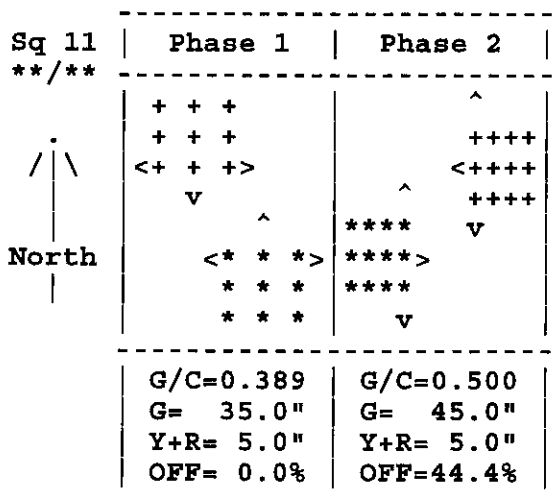
EXHIBIT 5

Village of Shorewood
Intersection of Capitol and Maryland
8:15 AM - 9:15 AM

11/17/05
15:50:43

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.43 Vehicle Delay 17.6 Level of Service B



C= 90 sec G= 80.0 sec = 88.9% Y=10.0 sec = 11.1% Ped= 0.0 sec = 0.0%

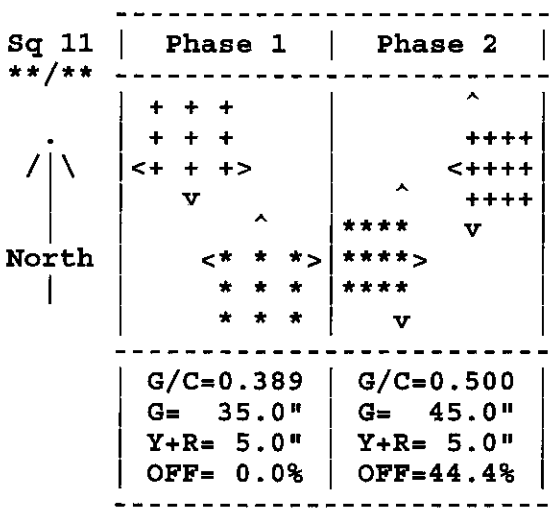
Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								18.1	B	
RT+TH+LT	16/1	0.174	0.389	479	599	77	0.129	18.1	B	65 ft
S Approach								20.1	C+	
RT+TH+LT	16/1	0.229	0.389	391	505	138	0.273	20.1	*C+	119 ft
E Approach								15.8	B	
RT+TH+LT	16/1	0.304	0.500	714	798	330	0.414	15.8	B	246 ft
W Approach								18.1	B	
RT+TH+LT	16/1	0.356	0.500	732	816	446	0.547	18.1	*B	354 ft

EXHIBIT 5
4 OF 11

Village of Shorewood 11/17/05
Intersection of Capitol and Downer 16:06:29
9:30 AM - 10:15 AM

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.26 Vehicle Delay 15.9 Level of Service B



C= 90 sec G= 80.0 sec = 88.9% Y=10.0 sec = 11.1% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								17.4	B	
RT+TH+LT	16/1	0.146	0.389	479	599	35	0.058	17.4	B	29 ft
S Approach								21.0	C+	
RT+TH+LT	16/1	0.249	0.389	374	487	159	0.326	21.0	*C+	139 ft
E Approach								13.1	B+	
RT+TH+LT	16/1	0.217	0.500	711	795	158	0.199	13.1	B+	111 ft
W Approach								13.9	B+	
RT+TH+LT	16/1	0.249	0.500	712	796	220	0.276	13.9	*B+	157 ft

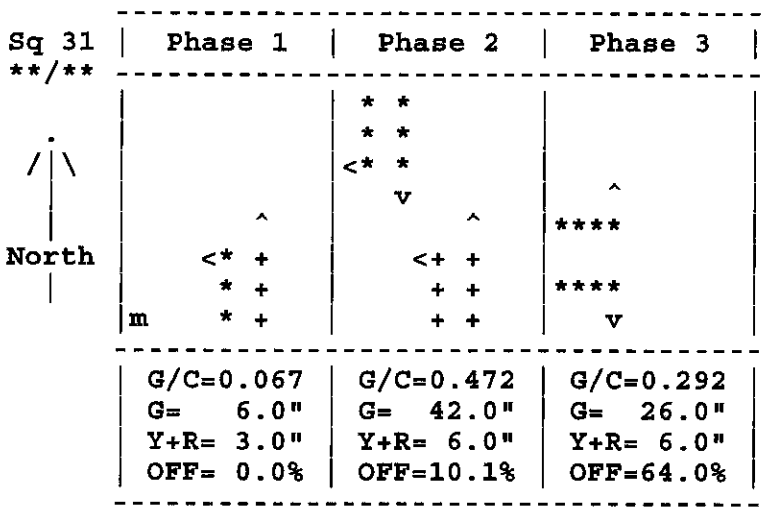
EXHIBIT 5
5 OF 11

Village of Shorewood
Intersection of Capitol and Lake
9:30 AM - 10:30 AM

11/17/05
15:49:52

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.22 Vehicle Delay 13.5 Level of Service B+



C= 89 sec G= 74.0 sec = 83.1% Y=15.0 sec = 16.9% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E (vph)	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								14.7	B+	
RT+TH	22/2	0.217	0.472	1337	1428	383	0.268	14.7	*B+	149 ft
S Approach								8.9	A	
TH	22/2	0.182	0.573	1723	1764	251	0.142	9.0	A	80 ft
LT	11/1	0.000	0.067	506	561	123	0.219	8.5	*A	75 ft
W Approach								25.5	C+	
RT+TH+LT	14/1	0.194	0.292	273	421	105	0.249	25.5	*C+	101 ft

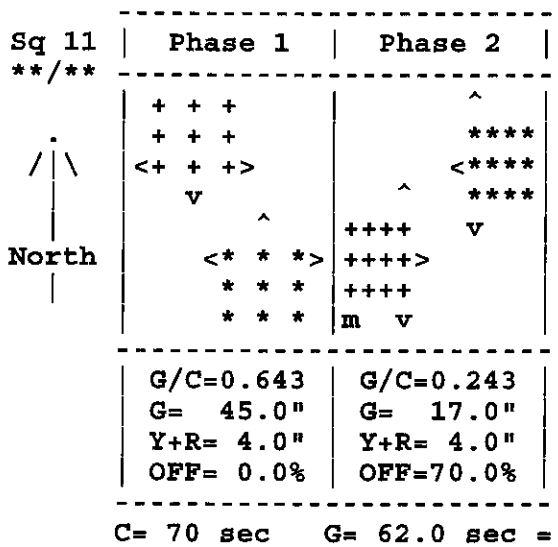
EXHIBIT 5

Village of Shorewood
Intersection of Oakland and Lake Bluff
10:45 AM - 11:45 AM

11/17/05
15:55:58

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.26 Vehicle Delay 8.7 Level of Service A



C= 70 sec G= 62.0 sec = 88.6% Y= 8.0 sec = 11.4% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								6.0	A	
RT+TH+LT	16/1	0.236	0.643	1046	1068	279	0.261	6.0	A	122 ft
S Approach								6.3	A	
RT+TH+LT	16/1	0.265	0.643	1011	1034	319	0.309	6.3	*A	143 ft
E Approach								21.6	C+	
RT+TH+LT	14/1	0.103	0.243	297	409	62	0.152	21.6	*C+	50 ft
W Approach								21.4	C+	
RT+TH+LT	14/1	0.097	0.243	301	414	56	0.135	21.4	C+	45 ft

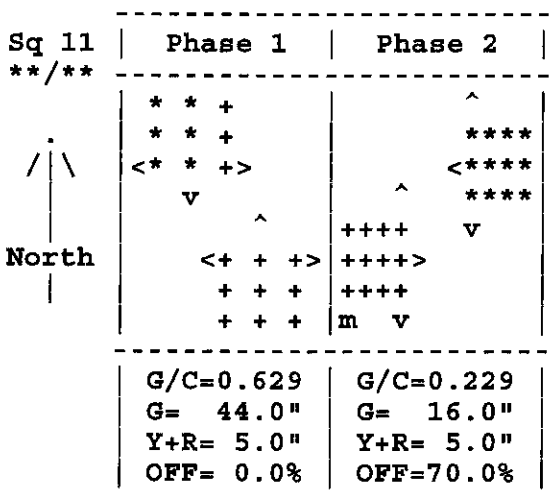
EXHIBIT 5

Village of Shorewood
Intersection of Oakland and Kenmore
10:45 AM - 11:45 AM

11/17/05
15:55:15

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.31 Vehicle Delay 10.3 Level of Service B+



C= 70 sec G= 60.0 sec = 85.7% Y=10.0 sec = 14.3% Ped= 0.0 sec = 0.0%

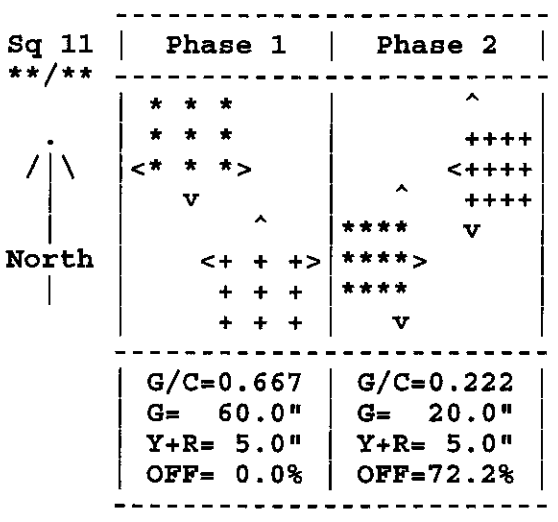
Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								6.8	A	
RT+TH	11/1	0.266	0.629	1086	1109	359	0.324	6.8	*A	165 ft
LT	11/1	0.025	0.629	562	602	9	0.015	4.9	A	4 ft
S Approach								6.6	A	
RT+TH	11/1	0.258	0.629	1104	1126	351	0.312	6.7	A	160 ft
LT	11/1	0.114	0.629	555	595	31	0.052	5.2	A	13 ft
E Approach								22.5	C+	
RT+TH+LT	16/1	0.103	0.229	229	338	51	0.151	22.5	*C+	42 ft
W Approach								27.2	C+	
RT+TH+LT	16/1	0.175	0.229	193	296	122	0.412	27.2	C+	106 ft

EXHIBIT 5
8 OF 11

Village of Shorewood 11/17/05
Intersection of Oakland and Shorewood 15:57:25
7:00 AM - 8:00 AM

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.54 Vehicle Delay 14.3 Level of Service B+



C= 90 sec G= 80.0 sec = 88.9% Y=10.0 sec = 11.1% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								12.4	B+	
RT+TH+LT	16/1	0.501	0.667	1055	1088	733	0.674	12.4	*B+	522 ft
S Approach								8.5	A	
RT+TH+LT	16/1	0.378	0.667	1034	1067	478	0.448	8.5	A	274 ft
E Approach								30.8	C	
RT+TH+LT	16/1	0.182	0.222	164	342	91	0.263	30.8	C	96 ft
W Approach								32.9	C	
RT+TH+LT	16/1	0.205	0.222	180	368	144	0.389	32.9	*C	152 ft

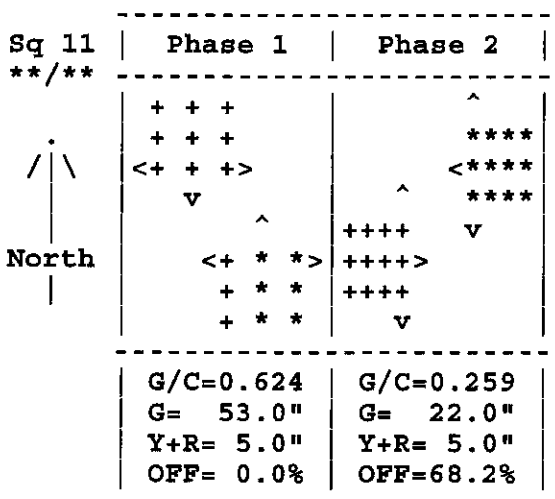
EXHIBIT 5

Village of Shorewood
Intersection of Oakland and Menlo
12:00 PM - 1:00 PM

11/17/05
15:56:50

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.48 Vehicle Delay 12.2 Level of Service B+



C= 85 sec G= 75.0 sec = 88.2% Y=10.0 sec = 11.8% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								9.7	A	
RT+TH+LT	16/1	0.354	0.624	1250	1283	598	0.466	9.7	A	347 ft
S Approach								11.5	B+	
RT+TH	12/1	0.426	0.624	1120	1157	688	0.595	11.8	*B+	449 ft
LT	12/1	0.203	0.624	423	475	53	0.112	6.9	A	29 ft
E Approach								24.8	C+	
RT+TH+LT	14/1	0.139	0.259	294	454	60	0.132	24.8	*C+	57 ft
W Approach								25.7	C+	
RT+TH+LT	14/1	0.160	0.259	287	445	93	0.209	25.7	C+	88 ft

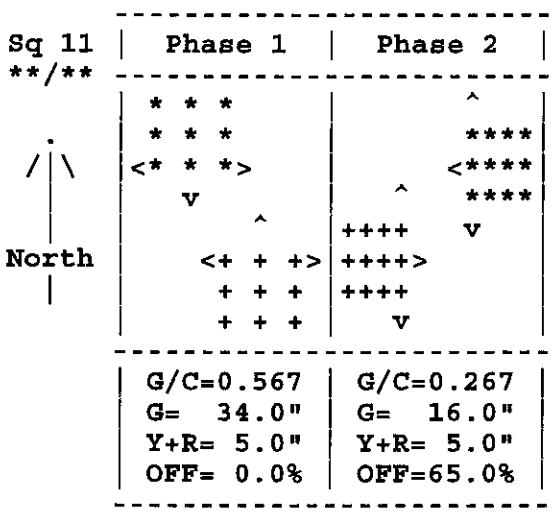
EXHIBIT 5

Village of Shorewood
Intersection of Oakland and Edgewood
12:00 PM - 1:00 PM

11/17/05
15:54:28

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.59 Vehicle Delay 12.6 Level of Service B+



C= 60 sec G= 50.0 sec = 83.3% Y=10.0 sec = 16.7% Ped= 0.0 sec = 0.0%

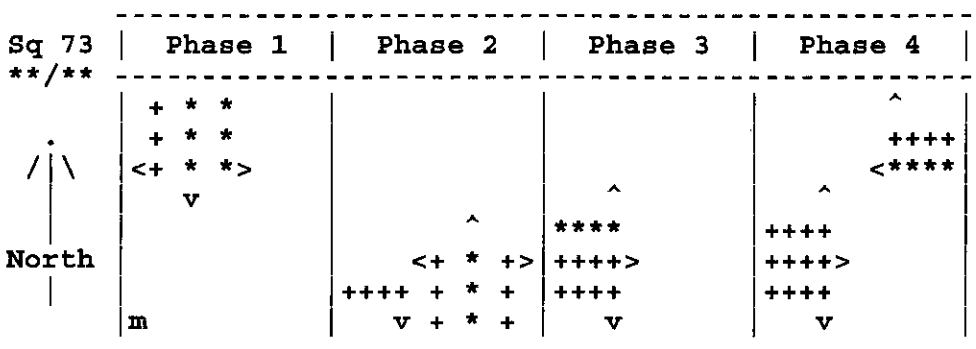
Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	@E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								12.2	B+	
RT+TH+LT	16/1	0.405	0.567	1021	1047	687	0.656	12.2	*B+	380 ft
S Approach								10.9	B+	
RT+TH+LT	16/1	0.376	0.567	1140	1161	704	0.606	10.9	B+	367 ft
E Approach								20.6	C+	
RT+TH+LT	16/1	0.161	0.267	340	425	163	0.384	20.6	*C+	114 ft
W Approach								17.2	B	
RT+TH+LT	16/1	0.078	0.267	354	440	50	0.114	17.2	B	34 ft

EXHIBIT 5

Village of Shorewood 11/17/05
Intersection of Capitol Drive and Oakland Avenue 16:10:48
PM Peak Counts (4pm-5pm)

SIGNAL2000/TEAPAC[Ver 2.60.07] - Capacity Analysis Summary

Intersection Averages for Int # 1 -
Degree of Saturation (v/c) 0.73 Vehicle Delay 73.7 Level of Service E



C=120 sec G= 99.0 sec = 82.5% Y=21.0 sec = 17.5% Ped= 0.0 sec = 0.0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	@E	Adj Volume	v/c	HCM Delay	L S	Queue Model 1
N Approach								70.4	E	
RT	12/1	0.273	0.208	1	195	83	0.381	42.0	D+	114 ft
TH+LT	12/1	0.330	0.208	1	324	320	0.930	77.8	*E	544 ft
S Approach								37.1	D+	
RT	12/1	0.245	0.283	142	373	27	0.070	31.5	C	31 ft
TH+LT	12/1-	0.309	0.283	179	468	269	0.566	38.3	*D+	350 ft
LT	24/2+	0.300	0.283	346	875	459	0.525	36.8	D+	305 ft
E Approach								193.4	F	
RT	12/1	0.292	0.217	1	214	130	0.551	44.6	D+	186 ft
TH	12/1	0.402	0.217	1	344	499	1.375	232.2	*F	1306 ft
W Approach								23.3	C+	
RT	12/1	0.391	0.692	912	959	384	0.400	8.2	A	257 ft
TH	12/1	0.359	0.358	396	601	398	0.662	35.1	D+	503 ft
LT	12/1	0.102	0.117	161	237	138	0.561	31.4	*C	177 ft

EXHIBIT 6

Informal Pedestrian Survey
October 12, 2005

Shorewood/Oakland Intersection (near high school)

- "Intersection seems ok for getting across, the next intersection to the south w/o crossing lights is more dangerous."

Capitol/Morris

- Pedestrian said there have been accidents here, and blames it on drivers with cell phones.

Capitol/Downer

- Crossing guard said sidewalks and ramps could be wider, especially with kids on bikes.

Oakland/Lake Bluff

- "Everyone's always in such a hurry around here. Accidents are almost always the drivers' fault."

Oakland/Kenmore

- "People think Oakland is a freeway. It is very dangerous to cross mid-block."
- "Bicycles are dangerous in the sidewalk. And they don't obey the traffic laws. As a driver, sometimes it is difficult to see bikes because there are blind spots throughout the Village where residents' landscaping is overgrown into the right-of-way. The Village should enforce the landscaping be cut back to eliminate these blind spots."

Oakland/Capitol

- Crossing guard said, "I don't see a pedestrian safety issue here. I help everyone cross when they want to cross."

EXHIBIT 7

Village of Shorewood Traffic/Pedestrian Counts
Traffic and Pedestrian Signal Timing and Crosswalk Measurements
Performed on October 12, 2005

Intersection #1: Capitol Dr. & Wilson Dr.

Traffic Signals:

West Bound on Capitol:
Green: 54 sec – CHANGE TO 45
Yellow: 4 sec

East Bound on Capitol:
Green Arrow: 7 sec
Yellow Arrow: 3sec
Green: 64 sec – CHANGE TO 55
Yellow: 4 sec

North and South Bound on Wilson:
Green: 16 sec – CHANGE TO 25 SEC.
Yellow: 4 sec

All Red: 1 sec for all direction changes

Pedestrian Signals:

East and West Bound on Capitol:
Walk: 36 sec
Flashing Walk: 18 sec

North and South Bound on Wilson:
Walk: 5 sec - CHANGE TO 7
Flashing Walk: 12 sec – CHANGE TO 22

Crosswalk Widths:

North Leg (Wilson): 74 ft
West Leg (Capitol): 88 ft
South Leg (Wilson): Baker's Square Entrance
East Leg (Capitol): No painted cross-walk

Intersection #2: Capitol Dr. & Morris Blvd:

Traffic Signals:

North and South Bound Morris:
Green Arrow: Not working
Yellow Arrow: Not working
Green: 21 – CHANGE TO 28
Yellow: 4 sec.
All Red: 1 sec

East and West Bound Capitol:
Green: 58 – CHANGE TO 52
Yellow: 4 sec.
All red – 1 sec.

Pedestrian Signals:

North and South Bound Morris:
Walk: 16 – CHANGE TO 7
Flashing DW:10 - CHANGE TO 25

East and West Bound Capitol:
Walk: 16 sec.
Flashing DW: 18 sec.

Crosswalk Widths:

North Leg (Morris): 47 ft
East Leg (Capitol): 100 ft
South Leg (Morris): 61 ft
West Leg (Capitol): 100 ft

EXHIBIT 8

Intersection #3: Capitol Dr. & Oakland Ave:

Traffic Signals

West Bound on Capitol:	*East Bound on Capitol:*
	Left Green Arrow: 10 sec
	Left Yellow Arrow: 3 sec
Green: 26 sec.	Green: 40 sec.
Yellow: 3 sec	Yellow: 4 sec
	Right Green Arrow: 80 sec.
	Right Yellow Arrow: 3 s

All red: 3 sec. for all direction changes

North Bound on Oakland	*South Bound on Oakland:*
Green Thru & Left: 34 sec	Green Thru & Left: 25 sec.
Yellow: 3 sec	Yellow: 3 sec.

Pedestrian Signals:

East and West Bound (N&S leg):	*North and South Bound (E&W leg):*
Walk: 6 sec	Walk: 6 sec - CHANGE TO 7
Flashing Walk: 16 sec	**Flashing Walk: 16 sec – CHANGE TO 20**

Island on southwest side of intersection
Walk: 5 sec
Flashing DW: 5 sec.

Crosswalk Widths:

North Leg (Oakland): 64 ft	South Leg (Oakland): 64 ft
West Leg (Capitol): 77 ft	East Leg (Capitol): 64 ft

Intersection #4: Capitol Dr. & Maryland Ave:

Traffic and Pedestrian Signals:

NB and SB Maryland		*EB and WB Capitol:*	
Green:	35 sec.	Green:	45 sec.
Yellow:	4 sec.	Yellow:	4 sec.
Walk:	20 sec.	Walk:	31 sec.
Flashing DW:	15 sec.	Flashing DW:	14 sec.
All red:	1 sec.	All red:	1 sec.

Crosswalk Widths:

North Leg (Maryland): 56 ft	South Leg (Maryland): 60 ft
East Leg (Capitol): 54 ft	West Leg (Capitol): 53 ft

Intersection #5: Capitol Dr. & Downer Ave:

Traffic and Pedestrian Signals:

North & South Bound Downer	*East & West Bound Capitol Dr.*
Green: 35 sec	Green: 45 sec
Yellow: 4 sec	Yellow: 4 sec
Walk: 20 sec	Walk: 31 sec
Flashing Walk: 15 sec	Flash Walk: 14 s – (Should be 17 sec., but OK since Flashing DW does not use Yellow)
All red: 1 sec.	All red: 1 sec.

Crosswalk Widths:

North Leg (Downer): 60 ft	South Leg (Downer): 67 ft
East Leg (Capitol): 47 ft	West Leg (Capitol): 57 ft

Intersection #6: Capitol Dr. & Lake Dr.:

Traffic and Pedestrian Signals:

EB Capitol:

Green: 26 sec.
Walk: 12 sec.
Flashing DW: 14 sec. – (Should be 16 SEC. on North leg but OK since Flashing DW does not use Yellow)
Yellow: 4 sec.

NB Lake:		*SB Lake:*
Left Green Arrow:	6 sec.	
Left Yellow Arrow:	3 sec.	
Green:	51 sec.	Green: 41 sec.
Yellow:	4 sec.	Yellow: 4 sec.
Walk:	26 sec.	Walk and Flashing DW: same
Flashing DW:	15 sec.	
	All red: 2 sec. for all direction changes	

Crosswalk Widths:

North Leg (Lake): 64 ft	South Leg (Lake): 48 ft
West Leg (Capitol): 48 ft	East Leg (Capitol): None

EXHIBIT 8

Intersection #7: Oakland Ave. & Lake Bluff Blvd:

Traffic and Pedestrian Signals:

North & South Bound on Oakland:	*East & West Bound on Lake Bluff:*
Green: 45 sec – CHANGE TO 43	**Green: 17 sec – Change to 19**
Yellow: 3 sec	Yellow: 3 sec
Walk: 35 sec	**Walk: 10 sec – Change to 7**
Flashing Walk: 10 sec	**Flash Walk:10 s– CHANGE TO 15**
All red: 1 sec.	All red: 1 sec.

Crosswalk Widths:

North Leg (Oakland): 57 ft	South Leg (Oakland): 61 ft
East Leg (Lake Bluff): 41 ft	West Leg (Lake Bluff): 39 ft

Intersection #8: Oakland Ave. & Kenmore:

Traffic and Pedestrian Signals:

North & South Bound on Oakland Ave:	*East & West Bound on Kenmore*
Green: 44 sec – Change to 41	**Green: 16 sec – Change to 19**
Yellow: 3 sec	Yellow: 3 sec
Walk: 34 sec - Change to 30	**Walk: 5 sec – CHANGE TO 7**
Flashing Walk: 10 CHANGE TO 14	**Flash Walk: 11– CHANGE TO 16**
All Red: 2 sec	All red: 2 sec.

Crosswalk Widths:

North Leg (Oakland): 62 ft	South Leg (Oakland): 62 ft
East Leg (Kenmore): 43 ft	West Leg (Kenmore): 57 ft

Intersection #9: Oakland Ave. & Shorewood Blvd.:

Traffic and Pedestrian Signals:

North & South Bound on Oakland

Green: On until loop detector along Shorewood or pedestrian signal to cross Oakland is activated.

Yellow: 4 sec

Walk: 7 sec

Flashing Walk: 9 sec – CHANGE WEST LEG TO 13

East & West Bound on Shorewood

Green: 20 sec	Walk: 7 sec
Yellow: 4 sec	Flashing Walk: 13 sec

All Red: 1 sec for all direction changes

CHANGE WALK SYMBOL TO BE ON UNTIL 17S BEFORE PHASE CHANGE

Crosswalk Width:

North Leg (Oakland): 61 ft	South Leg (Oakland): 60 ft
East Leg (Shorewood): 41 ft	West Leg (Shorewood): 52 ft

Intersection #10: Oakland Ave. & Menlo Blvd.

Traffic and Pedestrian Signals:

North & South Bound on Oakland:

Green: 53 sec — Walk: 37 sec
Yellow: 4 sec — Flashing Walk: 16 sec
Left arrow for North Bound traffic – Not operating during time of observation, several cars were in left turn lane, no loop detector present

East & West Bound on Menlo:

Green: 22 sec — Walk: 6 sec
Yellow: 4 sec — Flashing Walk: 16 sec – (SHOULD BE 18 SEC. – OK since Flashing DW does not use Yellow)
All Red: 1 sec for all direction changes

Crosswalk Widths:

North Leg (Oakland): 70 ft — South Leg (Oakland): 71 ft
East Leg (Menlo): 38 ft — West Leg (Menlo): 63 ft

Intersection #11: Oakland Ave. & Edgewood:

Traffic and Pedestrian Signals:

North & South Bound on Oakland:
Green: 34 sec
Yellow: 3 sec
Walk: 26 sec
Flashing Walk: 11 sec
All Red: 1 sec

East & West Bound on Edgewood:
Green: 16 sec
Yellow: 3 sec
Walk: 6 sec
Flashing Walk: 13 sec
All red: 1 sec.

Crosswalk Widths:

North Leg (Oakland): 57 ft — South Leg (Oakland): 54 ft
East Leg (Edgewood): 45 ft — West Leg (Edgewood): 41 ft

M™ Driver Feedback Sign

These signs give the motorist passing through a pedestrian or speed transition zone real-time feedback as to their vehicle's speed. LEDs can be programmed to flash when motorists exceed the speed limit. The sign can also "blink" at a set maximum speed. A "Slow Now" feature is available, whereby the vehicle speed will flash and "Slow Now" will display if a motorist exceeds the posted speed limit.

Features

- Uses AC or solar/battery
- 3M™ Diamond Grade™ Fluorescent Reflective Sheeting
- High impact, non-glare polycarbonate face with UV inhibitor
- 12 inch character height displays speed of oncoming vehicle
- LEDs flash should speed limit be exceeded by more than 5 MPH
- Single pole mount

3M technology meets the visibility challenge
3M™ Driver Feedback Signs advise drivers of their speed, and encourage speed limit compliance to help improve safety. The built-in radar and a highly visible display combine for a dynamic system designed to reduce vehicle speed.

3M™ Diamond Grade™ Fluorescent Reflective Sheeting
The foundation of 3M driver feedback signs is Diamond Grade™ Fluorescent Reflective Sheeting, highly visible day and night and in all conditions. Hybrid LED (light emitting diode) pixels combine LED technology with this fluorescent yellow-green reflective sheeting to stand out against cluttered backgrounds. In addition, the LEDs flash if a vehicle exceeds the speed limit—a clear reminder to the driver to slow down.

3M hybrid LED pixels automatically adjust to optimum brightness
Photocells automatically adjust the LED pixels to appropriate optimum brightness. Together, these pixels and reflective sheeting deliver a viewing angle more than 10 times wider than standard LEDs. Brightness and maximum viewing angle produce attention-getting visibility that gives motorists more time to react. High visibility in daylight with diffuse fluorescent reflective pixels. High visibility at night, dawn, dusk and in adverse weather with LED and retroreflective pixels.

Flexible set-up options
Select from AC, DC, or battery/solar power systems. Control on/off function by key switch, relay/dry contact switch (activated by an external timer on a device such as a flashing beacon), and by scheduling the sign's controller. Schedule the sign using software and a PC connected by direct serial port or remote RF (radio frequency) modem.

Speed data logging
Speed collection software downloads speed, time and count data from the sign, as well as schedules on/off times. Collect vehicle speed data recorded by the sign's internal radar. Build reports of vehicle speeds during different periods of the day.

Durable design
3M driver feedback signs are built tough: environmentally sealed, self-contained, impact-resistant aluminum cabinet with anti-graffiti protective overlay film. These units withstand weather, vandals and flying debris.

Readily accommodates a range of uses and locations

Independent tests and field trials show that driver feedback signs reduce vehicle speeds. Driver feedback signs, available in 24 x 30-inch and 36 x 48-inch versions, are ideally designed to operate successfully in high-hazard areas including:

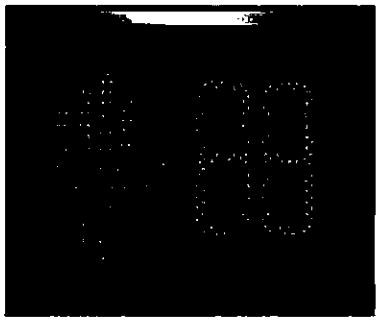
- Speed transition zones
- Pedestrian crossings
- School zones
- Dangerous curves
- Parks and recreational areas
- Work zones
- Collector arterials
- Senior centers, hospitals
- Corporate campuses

Built-in radar detects vehicle speed and alerts the driver.

EXHIBIT 9

Dialight

COUNTDOWN PEDESTRIAN SIGNALS



FEATURES / BENEFITS

- ▲ New 2-Row 9" high countdown digits are MUTCD compliant for crosswalks over 100 ft.
- ▲ Full preemption compatibility... Reverts to it's previous timing immediately following a preemption call
- ▲ Up to 4 units can be connected in parallel without disturbing the monitoring of the Hand/Person
- ▲ Automatically adjusts to traffic controller interval changes
- ▲ 90% reduction in power vs. incandescent
- ▲ Long life; up to 10 times longer than incandescent
- ▲ Sealed moisture resistant enclosure
- ▲ Lens available to fit most pedestrian heads
- ▲ Lens has a textured surface to reduce glare
- ▲ Easy to install into existing signal enclosure

SPECIFICATIONS

- ▲ Operating Voltage Range: 80VAC to 135VAC (120VAC nominal)
- ▲ Fuse and transient suppressor incorporated for line and load protection
- ▲ Power Factor > 0.9
- ▲ Total Harmonic Distortion < 20%
- ▲ Turn-on/Turn-off Time for Hand/Person = 75 msec max
- ▲ Operating Temperature Range: -40°C to +74°C
- ▲ Meets FCC Title 47, Subpart B, Section 15 Regulations for electrical noise
- ▲ Provided with quick connect terminals and spade adapters
- ▲ Written manufacturer's warranty available on request
- ▲ All products traceable by serial number
- ▲ LED Colors:
  Countdown Numerals - Portland Orange
  Hand - Portland Orange
  Walking Person - Lunar White

TYPICAL OPERATING CHARACTERISTICS

Part Number	Housing Size (inches)	SYMBOL			TYPICAL WATTAGE @ 25°C		
		Countdown	Hand	Person	Countdown	Hand	Person
430-6479-001	16 x 18	2-Row	Filled	Filled	5	6	6
430-7773-001	12 x 12	2-Row	N/A	N/A	5	N/A	N/A

ENERGY STAR PARTNER

A4703 UL REGISTERED FIRM ISO 9001
Dialight Corporation

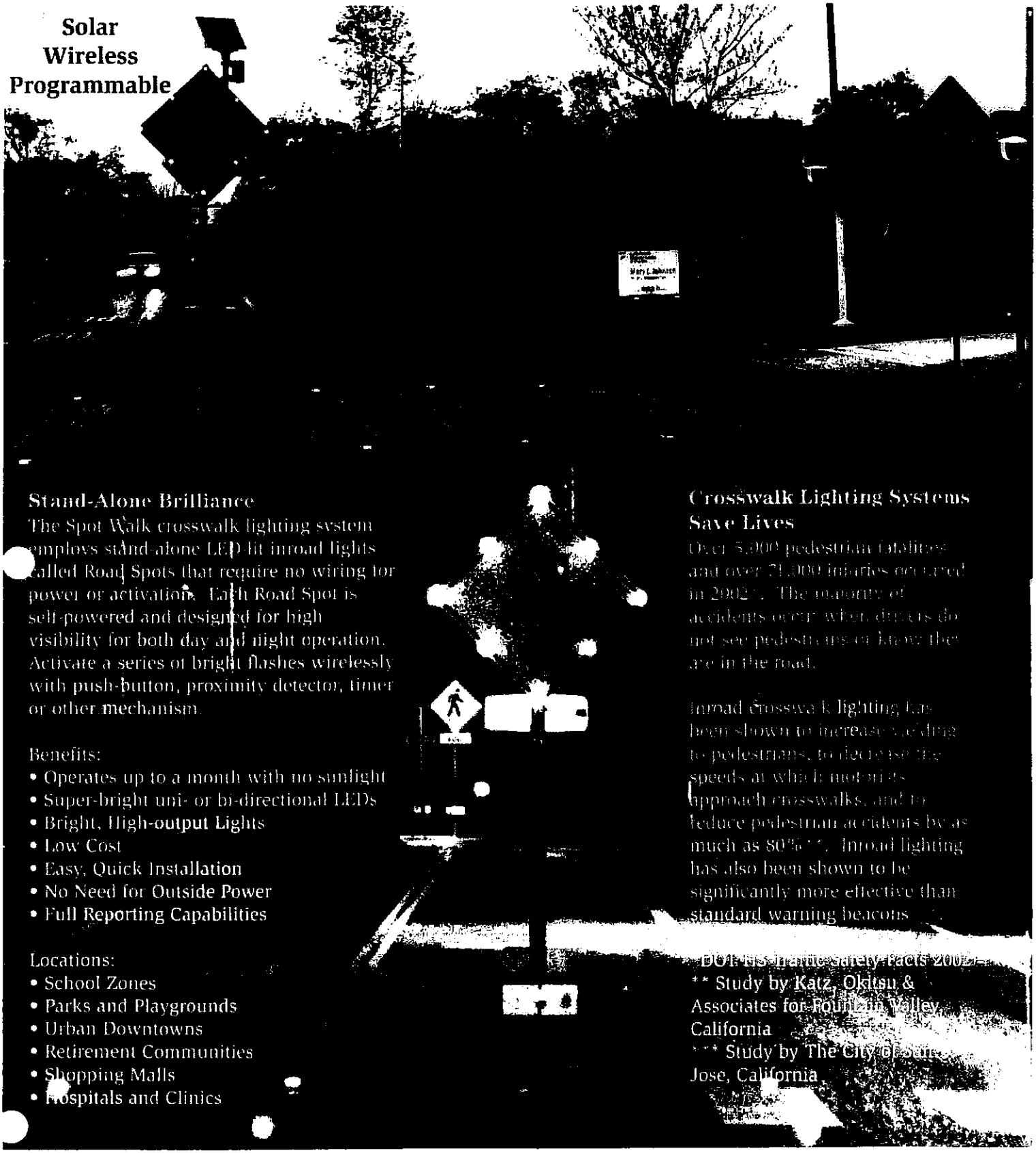
Dialight Corporation
1501 Route 34 South • Farmingdale, NJ 07727 USA
Tel: (1) 732-919-3119 • Fax: (1) 732-751-5778 • www.dialight.com
a Roxboro Group Company

EXHIBIT 9

TAPCO

www.tapconet.com

Solar
Wireless
Programmable



Stand-Alone Brilliance

The Spot Walk crosswalk lighting system employs stand-alone LED lit inroad lights called Road Spots that require no wiring for power or activation. Each Road Spot is self-powered and designed for high visibility for both day and night operation. Activate a series of bright flashes wirelessly with push-button, proximity detector, timer or other mechanism.

Benefits:
- Operates up to a month with no sunlight
- Super-bright uni- or bi-directional LEDs
- Bright, High-output Lights
- Low Cost
- Easy, Quick Installation
- No Need for Outside Power
- Full Reporting Capabilities

Locations:
- School Zones
- Parks and Playgrounds
- Urban Downtowns
- Retirement Communities
- Shopping Malls
- Hospitals and Clinics

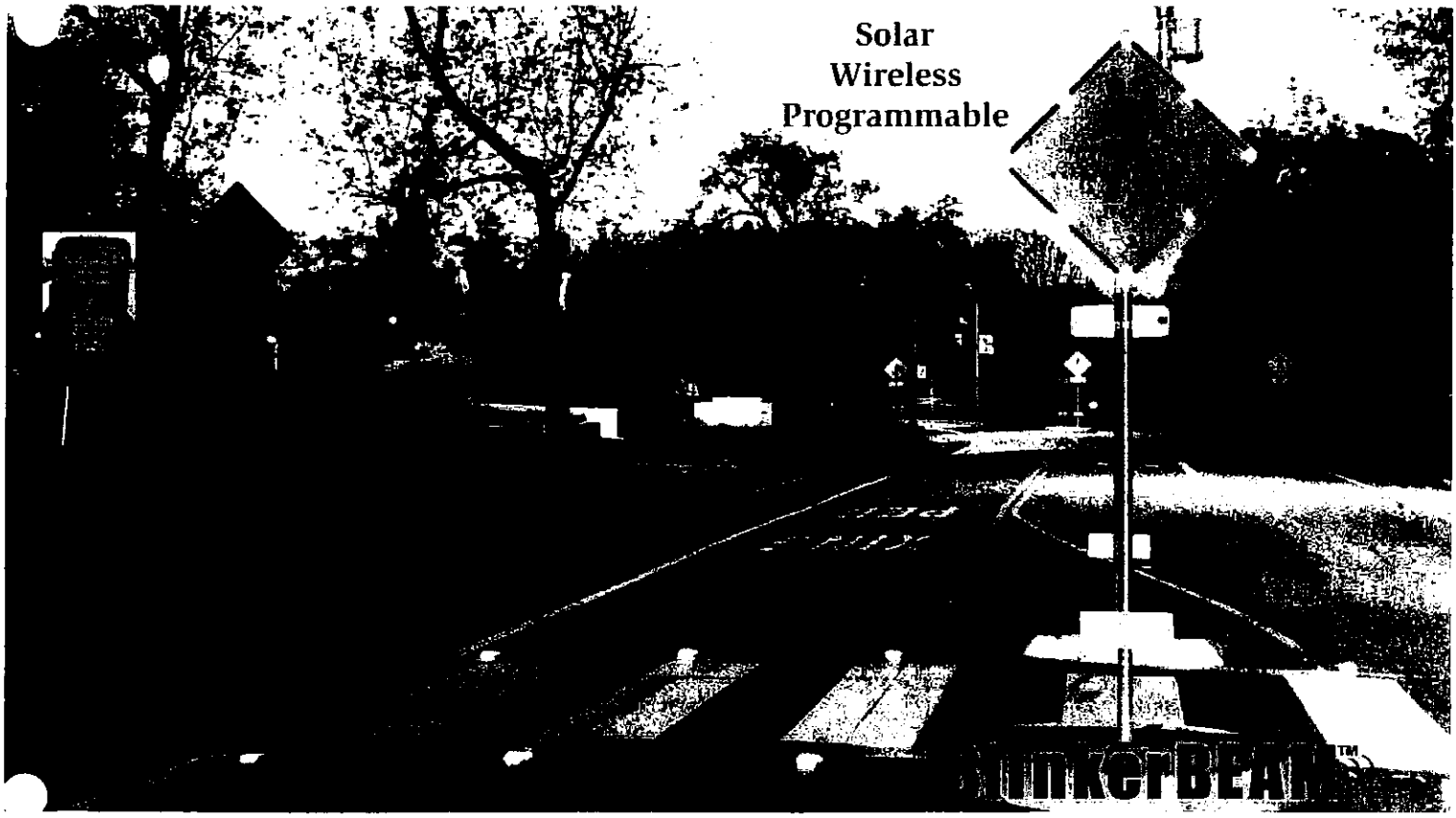
Crosswalk Lighting Systems Save Lives

Over 5,000 pedestrian fatalities and over 71,000 injuries occurred in 2002*. The majority of accidents occur when drivers do not see pedestrians or know they are in the road.

Inroad crosswalk lighting has been shown to increase yielding to pedestrians, to decrease the speeds at which motorists approach crosswalks, and to reduce pedestrian accidents by as much as 80%**, ***. Inroad lighting has also been shown to be significantly more effective than standard warning beacons.

* DOT-HS-Traffic Safety Facts 2002
** Study by Katz, Okitsu & Associates for Fountain Valley, California
*** Study by The City of San Jose, California

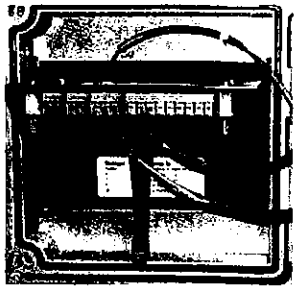
EXHIBIT 9
SHEET 3 OF 6



Wireless Computer-controlled Circuitry (can also operate BlinkerSigns™)

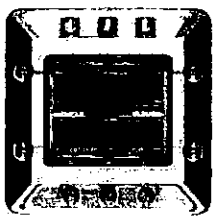
The compact pole-mounted Controller activates one or more independent inroad lights via sophisticated wireless signaling. The same controller may also activate flashing beacons and BlinkerSigns. The controller utilizes a proprietary, optimized communications protocol for maximum reliability and security.

Controller Specifications



- 6" x 6" x 4" NEMA 4M cabinet
- Center-mounts easily to any pole
- Controlled access (lockable)
- Range of over 200' per controller
- 3.5 to 10 volt power
- Operates at 866 MHz or 916 MHz
- Easy to install
- Provides power to push-button
- Audio integration capability

In-road LED Lights



- MUTCD and Caltrans compliant
- Surface Size: 4.9" x 4.9" x .75"
- Visibility: Day- Over 400 feet, Night- Over 900 feet
- Light Colors: Yellow (amber), Red, Clear (white), Blue, Green, or Custom

BlinkerBeam™ Self-powered Wireless Solar Controller for BlinkerSigns™

This compact pole-mounted controller activates one or more independent BlinkerSigns™ via wired or wireless signaling at a range of 500 feet, up to one mile with the addition of an external antenna and a direct line of sight. For advance warning sign activation, the controller can be activated by remote push-button with a stand-alone 5-year battery.

BlinkerBeam Specifications

BlinkerBEAM™

- 6" x 6" x 4" NEMA 4M cabinet
- Center-mounts easily to any pole
- Controlled access (lockable)
- Range of 500 feet per controller
- 3.5 to 10 volt power
- Operates at 902 MHz to 928 MHz
- Provides power to push-button
- Audio integration capability
- Stand-alone 5-year battery

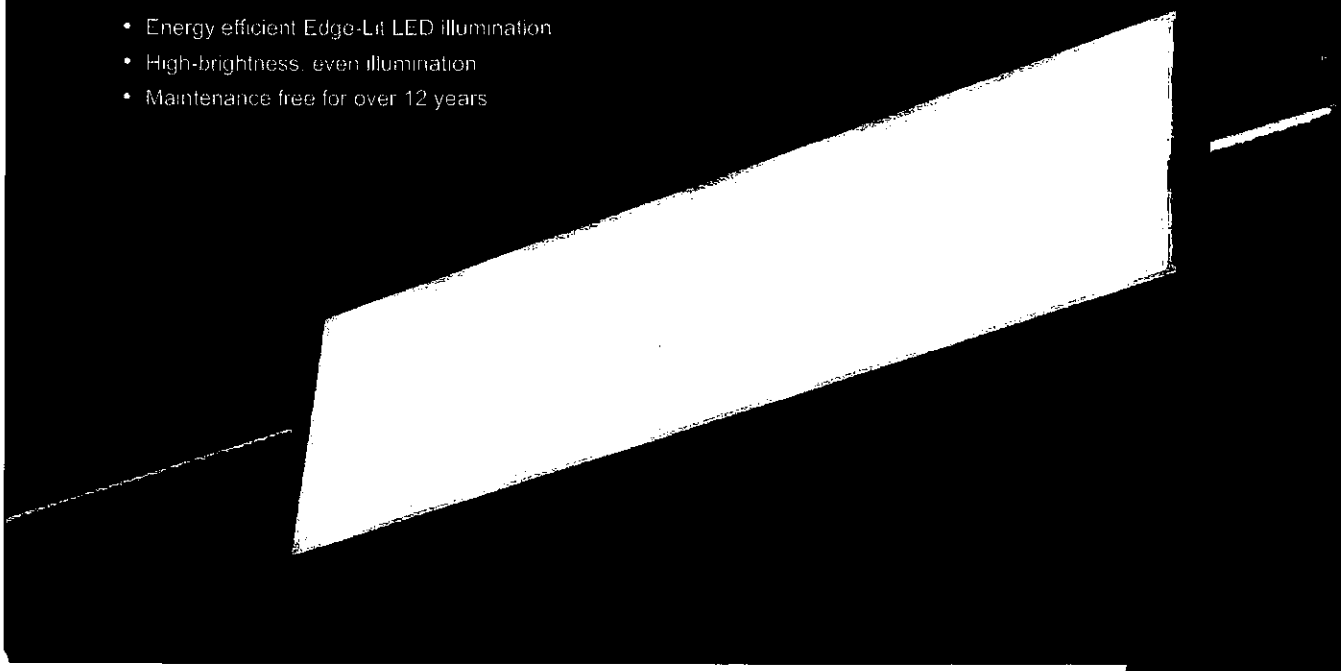
Features of both Controllers:

- Two-way wireless transmission
- Encoding assures clear, secure communications
- Activate by Push-button, Infrared detector, Loop detector or other vehicle detection device
- Auto-resend of unconfirmed activation requests
- Wirelessly downloads usage and power data
- Requires no outside power or expensive control cabinet

Internally Illuminated Street-Name Sign

Carmanah®

- Energy efficient Edge-Lit LED illumination
- High-brightness, even illumination
- Maintenance free for over 12 years



A Logical Choice

Carmanah's LED edge-lit technology is the new standard for internally illuminated street-name signs. The ultra-efficient LEDs offer maintenance-free performance for over 12 years. The rugged, slim-profile design is redefining expectations for illuminated signs.

Improve Traffic Safety

- The 2003 MUTCD recommends illuminating overhead signs.
- Advanced visibility and legibility of street-name signs is critical for safe maneuvering, particularly for drivers who are unfamiliar with an area.
- Overhead signs receive only 10% of headlamp illumination compared to roadside signs, making retro-reflective signs far less effective in this application.
- Changes in headlamp specifications will reduce overhead sign illumination by 33%.

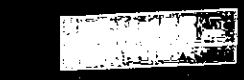
Cost Savings

Carmanah's edge-lit signs provide exceptionally low life-cycle costs. Compared to traditional fluorescent signs, Carmanah LED signs do not require bulb or ballast replacement, provide 90% energy savings and are easier to handle and less expensive to install. The savings on maintenance alone will immediately prove significant.*

Typical Applications

- Large signalized intersections
- Business Districts
- Tourist Corridors
- Streetscape Projects

30 day satisfaction guarantee and three year warranty!



Single-sided fixed mount
Tyler Texas

Single-sided fixed mount
Various British Columbia

Double-sided under-base mount
Broomfield Colorado

*See the cost calculator at www.roadlights.com for a customer cost analysis.

Toll-Free: 1-877-722-8877 **Worldwide:** + 250-380-0052 **www.carmanah.com**

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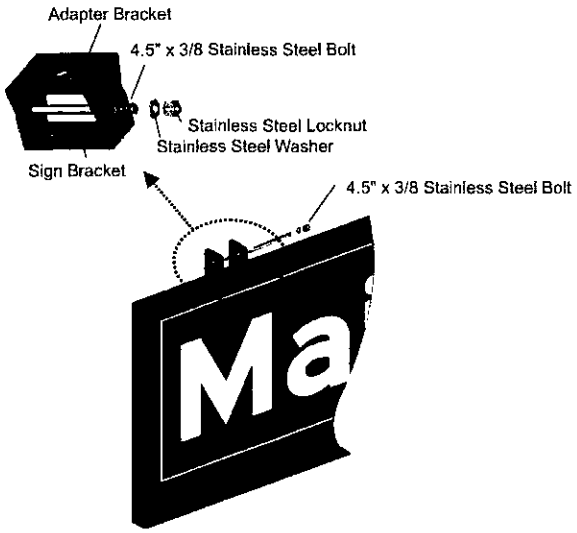
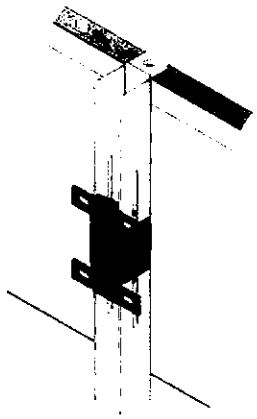
Internally Illuminated Street-Name Sign

Carmanah®

Underhang Mounting
(Double-Sided and Single-Sided)



Single-Sided Fixed Mount
(for Pelco Astro-Brac)



MECHANICAL

Length	48" - 96" at 6" increments
Height	15", 18", 22", 24"
Thickness	1.38" Single sided, Double sided 1.77"
Weight	Maximum: 7 lbs/sqft single sided 8lbs/sqft double sided

MATERIAL

Frame	6063-T5 Aluminum housing with durable non-glare powder coat finish
Lens	High impact strength / UV and abrasion resistant Polycarbonate

MOUNTING OPTIONS

Under-hang mount	Accepts Pelco SE-5015, SE-5146, Hawkins M10J-OCB250AL(SAC), or equivilent
Single-sided fixed mount	Accepts Pelco Astro-brac AS-3009 or equivalent

ILLUMINATION

Luminance	Up to 600 Feet
Contrast Ratio	Legend / Background contrast ratio 4:1 minimum
Optional Sheeting	ASTM Type IX Retroreflective Sheeting (sign legend and background)

ELECTRICAL

Energy requirements	Maximum: Four Watts per square foot
Power Supply	Internal Power Supply, 120 VAC in, UL Class 2 and UL Outdoor damp location rated
Operating Temperature	-40° F to +140° F (-40° C to +60° C)

STANDARD COLORS - Background and Legend

3M™ Electrocut™ film

- 1177 Green
- 1175 Blue
- 1179 Brown
- 1178 Black (opaque)

FONTS

Default	MUTCD Clearview Font, HWY E Series B, C, D, E Modified, Custom fonts available

PATENTS

Trademarks and Patents	Patents pending

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