TRAFFIC CALMING PLAN
for
THE TOWN OF BELLEAIR

FINAL REPORT

INC. 1925

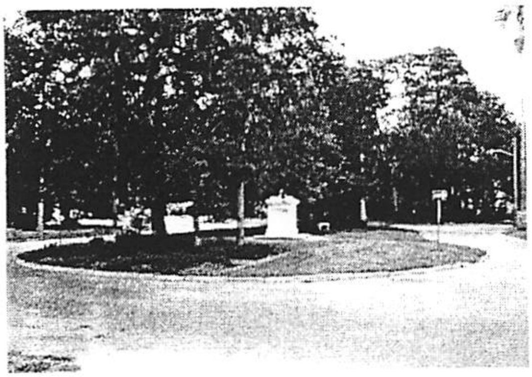
Town of Belleair, Florida

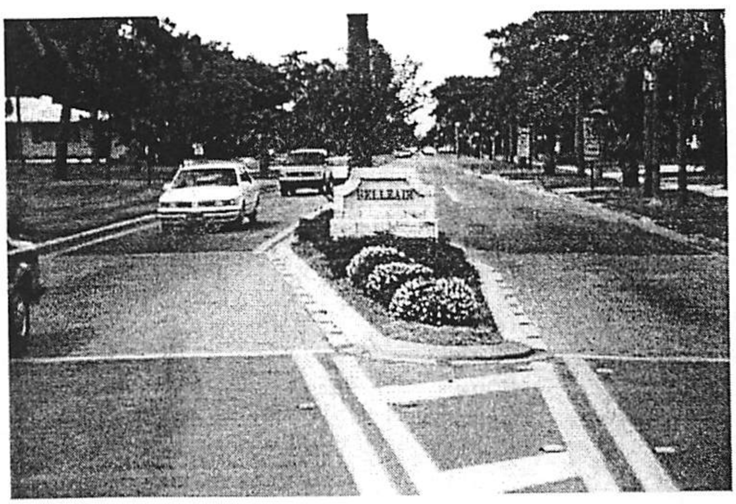
Prepared for the
Town of Belleair
By
Hall Planning & Engineering, Inc.
&
Dr. Reid Ewing

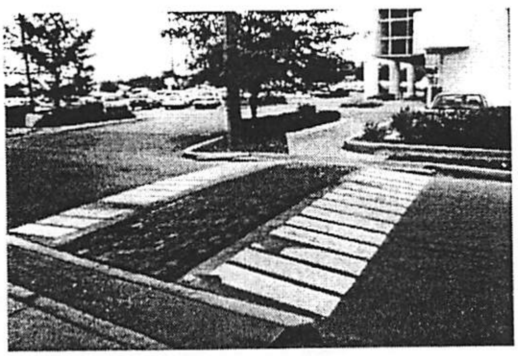
March 13, 1997

Traffic Calming Plan for the Town of Belleair

Final Report







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Submitted by
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Introduction

Continuing urbanization and the general increase in vehicular travel in western Pinellas County have combined to create traffic problems in the Town of Belleair. Since its design by the respected town planner John Nolan, the town has enjoyed a reputation as a pleasant and well-proportioned place. Thus, in responding to the changing conditions on its borders, Belleair must act to maintain the community character its citizens have long enjoyed.

This project, completed in 1997 by Hall Planning & Engineering, Inc. and Dr. Reid Ewing, recommends thoroughfare changes intended to reduce commuter traffic driving through Belleair and to increase overall safety in the town. The plan is divided into three phases including a total of twelve raised junctions, five roundabouts, twelve raised crosswalks, eight locations for narrowing with center islands and other improvements. Most of the improvements are specified for Indian Rocks Road, the north-south thoroughfare experiencing the most traffic.

In addition to the customary tasks of data collection, analysis and reporting, this project incorporated a dialogue with town residents, staff and elected officials to determine perceived problems and reactions to proposed solutions. The communication channels opened with Belleair townspeople were instrumental in the success of the project. They responded enthusiastically to requests for discussion and comment, thus providing an underlying philosophy for plan development.

There are several other unique aspects of this project including the first national summary of current practice entitled "U. S. Experience with Traffic Calming," a report developed by Reid Ewing based on surveys of traffic calming activity in twenty U.S. cities (see appendix). This project also includes a system for prioritizing traffic calming improvements, depending on the speed and volume characteristics of each street. Summaries of traffic and thoroughfare measurements taken in Belleair are contained in the appendix.

In summary, the plan is based on traffic calming literature we have surveyed and summarized in earlier publications;[1] on our state-of-the-practice survey of 20 communities with active traffic calming programs;[2] on focus groups involving Belleair community leaders and citizens;[3] and on traffic volume and speed studies conducted by Hall Planning & Engineering and Computerized Traffic Data, Inc.

Focus Groups

Since the essence of traffic calming is designing for target speeds and volumes in a community, it is essential that residents have an opportunity to comment on existing conditions and desired outcomes. To this end, three "town meeting" type focus groups were held in September 1996. The Meeting Notice, shown in **Figure 1**, was printed in the local newspaper. The Town Commission meeting was followed by meetings with residents, representatives of organizations, and former commissioners. An extensive record of these discussions was captured both on tape and graphically on large town maps. Data collection and design efforts were directly influenced by these focus group meetings. The underlying project philosophy, garnered from these meetings, is stated below:

- Stress aesthetics in the selection of traffic calming measures. As one Commissioner remarked in a focus group interview, even opponents of traffic calming may be turned around if traffic calming measures will enhance the appearance of the community.

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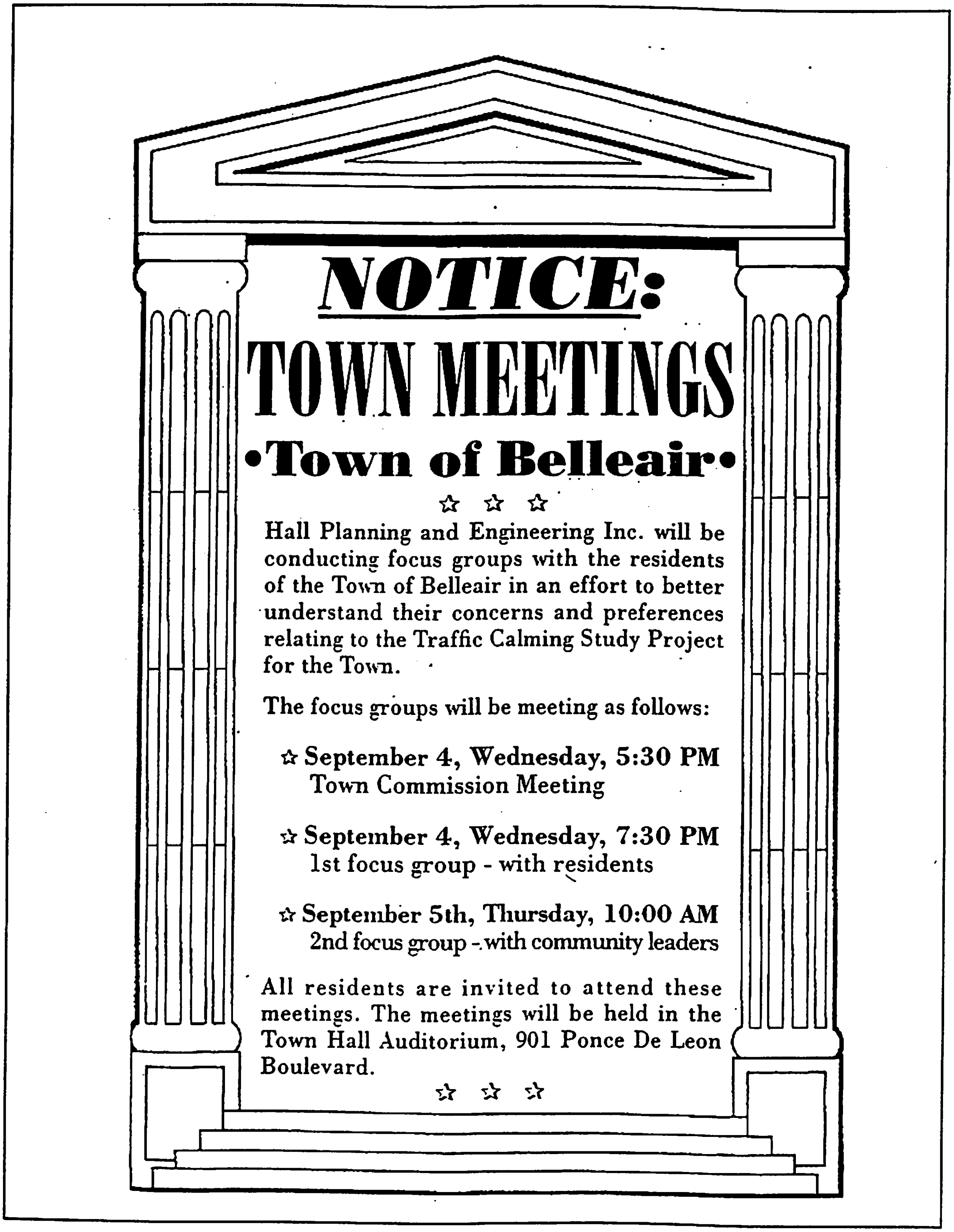
[1] R. Ewing, "Residential Street Design - Do the British and Australians Know Something We Americans Don't?" *Transportation Research Record 1455*, 1994, pp. 42-49; R. Ewing, *Best Development Practices - Doing the Right Thing and Making Money at the Same Time*, American Planning Association (in cooperation with the Urban Land Institute), Washington, D.C., 1996, pp. 62-65; and C. Hoyle and R. Ewing, "Traffic Calming for New Residential Streets Enhances Housing Value," *Land Development*, Vol. 9, Fall 1996, pp. 7-11.

[2] R. Ewing and E. McClintock, *Traffic Calming in Practice*, Report prepared for the Town of Belleair, Florida, November 1996.

[3] E. McClintock, "Traffic Calming Focus Groups," Report to the Town of Belleair, Florida, November 1996.

Figure 1 - Town Meeting Notice



- Make sure that any measures installed are more than cosmetic. Two focus group members commented on the lost opportunity when the southern entry to the community was designed as a visual amenity only. This mistake should not be repeated.

- Remain a good neighbor to abutting communities by leaving all connections to the external street network open. At the same time, compel cut-through traffic to respect Belleair's speed limits.

- Avoid shifting traffic problems from one street to the next. With one minor exception, no support was voiced in the focus groups for street closures or other measures that would exclude traffic from certain streets, thereby increasing it on others.

- Do not punish drivers who obey the speed limit. For every outsider inconvenienced by harsh measures, some resident will be inconvenienced several times over due to his/her greater use of the Belleair street network. No support was voiced for standard speed humps and outright antipathy was expressed toward speed bumps (which could not be installed in any case on public streets).

Traffic Volume and Speed Measurements

The focus groups produced a long list of candidate thoroughfares for traffic calming. All are residential streets perceived as carrying excessive traffic volumes and/or experiencing excessive traffic speeds.

To distinguish reality from perception, traffic volume and speed measurements were taken along "problem" streets in Belleair. Traffic counts were done using tubes and automatic counters. The counts began on the afternoon of Monday, October 28, 1996 and continued for 24 hours. Speed measurements were taken on October 29th and 30th using the Belleair Police Department's radar gun. The volume of traffic on all streets but one, Pinellas, was heavy enough to generate samples of 20 or more speed observations. On all but five streets, traffic was heavy enough to generate 30 or more observations, a sample size considered adequate for statistical purposes. As for Pinellas, its 15-foot pavement width and the presence of stop signs at each intersection guarantee that speeding is not much of a problem.

Samples of speed profiles are shown in Figures 2 and 3 for Indian Rocks Road and Poinsettia, respectively. It is clear that Indian Rocks Road is operating well above the desired speed. Poinsettia on the other hand is much closer to the desired speed.

Priority Rating and Phasing Plan

As with most municipal projects, the required traffic calming projects will likely exceed available funding. To help prioritize improvements, we have developed a traffic calming priority index. Our priority index is a weighted sum of traffic volumes and traffic speeds.

Our literature survey uncovered three communities with priority rating systems, and our state-of-the-practice survey uncovered another two. Without going into the details of each system, Table 1 shows the relative weights assigned to volume and speed and lists other factors that enter into each index.

The relative weights placed on volume and speed vary greatly from locality to locality. At one extreme, Boulder, CO treats every 1 mph increase in speed as equivalent to a 1,000 vehicle per day (vpd) increase in volume. At the other extreme, Tallahassee, FL treats the same 1 mph increase in speed as equivalent to only a 100 vpd increase in volume.

The lack of consensus among localities caused us to look elsewhere for guidance in priority rating. From Smith and Appleyard's landmark study of street livability, we know that a traffic speed of 15 mph is acceptable to almost all residents, while a speed of 30 mph is unacceptable (a speed differential of 15 mph).[4] We also know that a traffic volume of 1 vehicle per minute, or about 600 vehicles per day (vpd), is generally acceptable to residents, while a volume of 6 vehicles per minute, or about 3,600 vpd, is generally unacceptable (a volume differential of 3,000 vpd). Thus, in terms of resident reaction, a 1 mph increase in speed appears equivalent to a 200 vpd increase in volume (3,000 vpd/15 mph = 200 vpd per 1 mph).

It is tempting to use threshold values from Smith and Appleyard -- 15 mph and 600 vpd -- as baselines in a priority index. But using the same threshold values for all streets would gloss over differences in the functions of Belleair streets. Some are local access streets, others subcollectors, and still others residential collectors. While all are residential streets, the degree to which they are designed to accommodate through-traffic, as opposed to strictly local traffic, differs.

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[4] D.T. Smith and D. Appleyard, "Studies of Speed and Volume on Residential Streets," *Improving the Residential Street Environment*, Federal Highway Administration, Washington, D.C., 1981, pp. 113-130.

Figure 2

Spot Speed Survey (Counter #5)

Indian Rocks (Althea to Rosery)

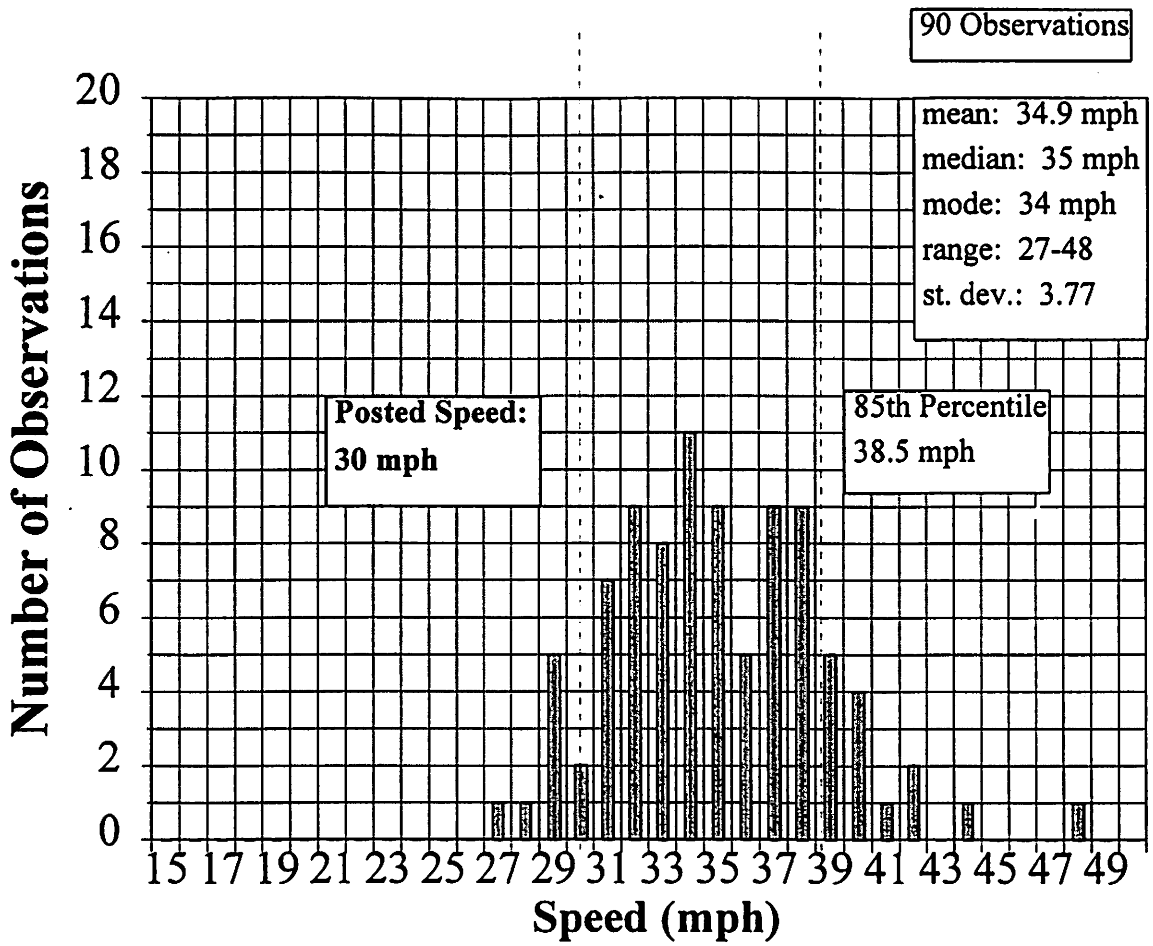


Figure 3

Spot Speed Survey (Counter #7)

Poinsettia (Cypress to Hibiscus)

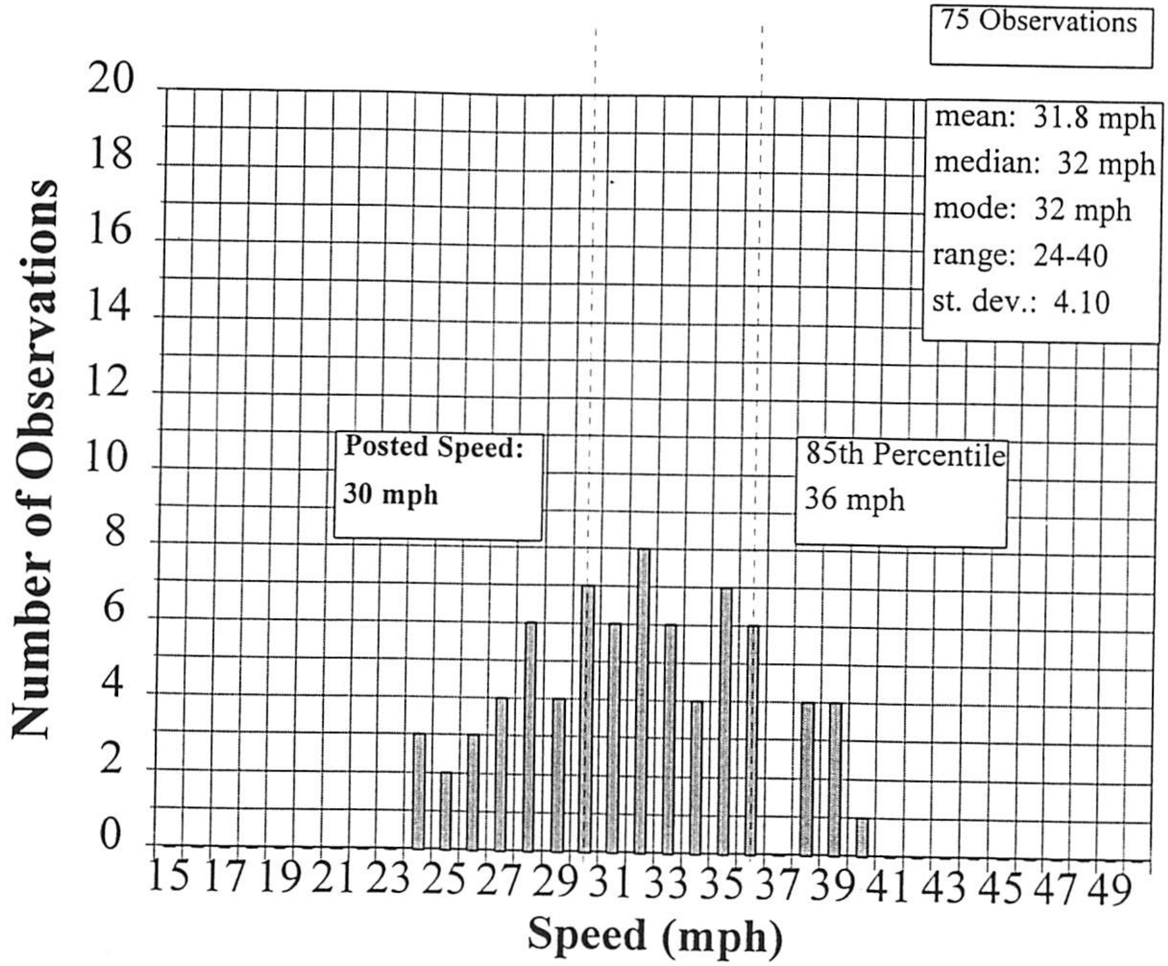


Table 1
Priority Rating Systems

Location	Volume/Speed Trade Off	Other Factors in Index
Boulder, CO	500 vpd = ½ mph, for speeds over posted speed limit	❖ gaps long enough for street crossings during peak hour ❖ housing units per 1,000 feet of frontage ❖ numbers of pedestrians, bicyclists, bus stops, etc. ❖ already programmed improvements to roadway
Dallas-Ft. Worth, TX	400 vpd = 3 mph, for volumes over 500 vpd and speeds over 31 mph***	❖ accident rate
North York, Canada	100 vpd = 1/3 x % over posted speed limit	❖ accident rate ❖ pedestrian generators ❖ pedestrian volumes
Seattle, WA	600 vpd = 3 mph, volumes over 500 vpd and for speeds over 26 mph	❖ number of accidents
Tallahassee, FL	500 vpd = 5 mph, for speeds over 25 mph	❖ number of accidents over 3-year period ❖ school within 1 mile ❖ other pedestrian generators within 1 mile ❖ absence of sidewalk ❖ residential density

We therefore distinguish among the three functional classes in our priority index, using recommended maximum volumes from a residential street design manual published jointly by American Society of Civil Engineers, the National Association of Home Builders, and the Urban Land Institute. Their recommendations are listed in Table 2. These values are used in the volume element of the priority index as the recommended maximum volume in vehicles per day (vpd). The measured speed value is the 85th percentile speed.

Table 2
Recommended Maximum Volumes by Functional Class

Local Access Streets	250 vpd
Subcollectors	1,000
Residential Collectors	3,000
Source: Residential Streets Task Force, *Residential Streets*, American Society of Civil Engineers/National Association of Home Builders/Urban Land Institute, Washington, D.C., 1990, p. 28.	

Using these recommended values, posted speeds, and Smith and Appleyard's volume/speed relationship of 200 vpd equals per 1 mph, our priority index takes the form:[5]

$$\textit{Priority Index} = (vpd_{measured} - vpd_{recommended}) + 200 \times (mph_{measured} - mph_{posted})$$

where,

$vpd_{measured}$ is the 24-hour traffic count,
$vpd_{recommended}$ is the recommended maximum volume by functional class (Table 2),
$mph_{measured}$ is the 85th percentile observed speed, and
mph_{posted} is the posted speed.

The difference terms in this equation are computed only if measured values are greater than recommended/posted values; otherwise, they are set equal to zero on the theory that either volume or speed is not an issue. Recommended/posted values may thus be thought of as thresholds, above which traffic is problematic, below which it is not.

This index has been computed for 17 of 18 street segments, and priority rankings have been assigned. Results are presented in Table 3. Note that the top four priorities -- Indian Rocks (north), Indian Rocks (central), Indian Rocks (south), and Belleview -- are already scheduled for reconstruction. Table 4 lists the recommended traffic calming improvements by phase.

[5] In computing this index, we could have used recommended speeds from the same source as our recommended volumes, the ASCE/NAHB/ULI residential street design manual. The recommended speeds are 20 mph for local access streets and subcollectors, and 35 mph for residential collectors. Frankly, Belleair's posted speed limits seem a little low in some cases and a little high in others. The reason for using them in the index is, of course, that they represent the town's own judgment as to what constitutes safe and livable speeds.

Table 3
Performance Data for Selected Streets

	Pavement Width	Posted Speed Limit	24-hour Traffic Count	85th Percentile Speed	Functional Class*	Priority Index	Rank/Phase
(1) Druid	22 ft**	30 mph	4,042	36.5 mph	C	2,342	#5/II
(2) Belleview	22	30	8,204	34.5	C	6,104	#4/I
(3) Indian Rocks (north)	24	30	10,328	37	C	8,728	#3/I
(4) Indian Rocks (central)	24	30	10,571	36	C	8,771	#2/I
(5) Indian Rocks (south)	24	30	11,732	38.5	C	10,432	#1/I
(6) Ponce de Leon (east)	15/15**	30	3,083	33	C	683	#11/III
(7) Poinsettia	24**	30	2,483	36	C	1,200	#7/I
(8) Cypress	24**	30	998	40	S	2,000	#6/I
(9) Belleair Forest	30	30	1,430	30	S	430	#16/I
(10) Ponce de Leon (west)	15/15**	30	668	33	S	600	#12/III
(11) Osceola	17**	25***	353	27	L	503	#14
(12) Rosery	22**	30	1,047	34	S	847	#9/II
(13) Wildwood	15**	25	618	27	L	768	#10/II
(14) Pinellas	15**	25***	224	unknown (but very low)	L	---	#18
(15) Pineland	24	30	328	35	S	1,000	#8/II
(16) Eagles Nest	24	30	899	31	S	200	#17
(17) North Pine	23	25	589	26	L	539	#13/III
(18) Sunset Bay	17.5	25	685	25	L	435	#15/III

* L = local access street; S = subcollector; C = residential collector
** On these streets, gutters provide additional clear width for large vehicles.
*** While no speed limit is posted on these streets, the lowest speed limit used in Belleair, 25 mph, would apply to streets as narrow as these.

Table 4
General Cost Estimates

Phase	Location	Priority Ranking	Treatment (Quantity)
I	(5) Indian Rocks (south)	1	Roundabout (1) Raised Junction (2)
I	(4) Indian Rocks (central)	2	Roundabout (3)
I	(3) Indian Rocks (north)	3	Raised Junction (2)
I	(2) Belleview	4	Roundabout (1) Raised Junction (1) Raised Crosswalk (2)
I	(8) Cypress	6	Narrowing w/Center Island (3)
I	(7) Poinsettia	7	Raised Junction (2) Raised Crosswalk (2)
I	(6)(10) Ponce de Leon	11/12	Bike Lanes
I	(9) Belleair Forest	16	On-Street Parking
II	(1) Druid	5	Raised Junction (2) Raised Crosswalk (2)
II	(15) Pineland	8	Narrowing w/Center Island (2)
II	(12) Rosery	9	Raised Junction (2)
II	(13) Wildwood	10	1-Lane Choker (2)
III	(6) Ponce de Leon (east)	11	Raised Junction (1)
III	(10) Ponce de Leon (west)	12	Raised Crosswalk (6)
III	(17) North Pine	13	Narrowing w/Center Island (3)
III	(18) Sunset Bay	15	1-Lane Choker (2)
Not Phased	(11) Osceola	14	Not Determined
Not Phased	(16) Eagles Nest	17	Not Determined
Not Phased	(14) Pinellas	18	Not Determined

Traffic Calming Plan

Based on priority rankings, a three-phase traffic calming plan has been formulated. The plan in its entirety is shown in Figure 4. The individual phases are shown in Figures 5, 6 and 7.

Phasing

Phase I consists of top priorities to solve the most urgent speed and high volume problems. Phase II includes other priorities that are somewhat less urgent. Phase III consists of additional improvements that are warranted but less pressing. Phase III streets should be monitored, particularly as Phases I and II are implemented. The town will want to respond quickly if traffic on these streets worsens as a result of diversion from other streets.

No treatments are recommended on streets with the lowest priority rankings (with one exception, Belleair Forest, whose proximity to Cypress makes it risky to calm one street without calming the other). While not priorities today, these streets should also be monitored on the chance that traffic will significantly worsen on them, too.

Our traffic calming plan is outlined, street by street, in the following sections.

Indian Rocks Road

In their priority rankings, the three segments of Indian Rocks rank #1, #2, and #3 among the 18 street sections studied. Speeding contributes to their high ratings, with 85th percentile speeds exceeding the posted speed limit by 6-8 mph. Contributing even more are traffic volumes approaching or exceeding 10,000 vpd. A substantial share of that traffic is cutting through the community on the way to Clearwater to the north or the beaches and other communities to the southwest. If Belleair can bring travel speeds down to the posted speed limit, some of the cut-through traffic will find alternative routes such as Mehlenbacher-Alternate 19 more attractive.

Our plan for Indian Rocks combines two types of traffic calming measures, spaced at regular intervals along its length. The two are raised junctions and roundabouts. Support for both was voiced by the focus groups.

Figure 4
Belleair Traffic Calming Plan - All Phases

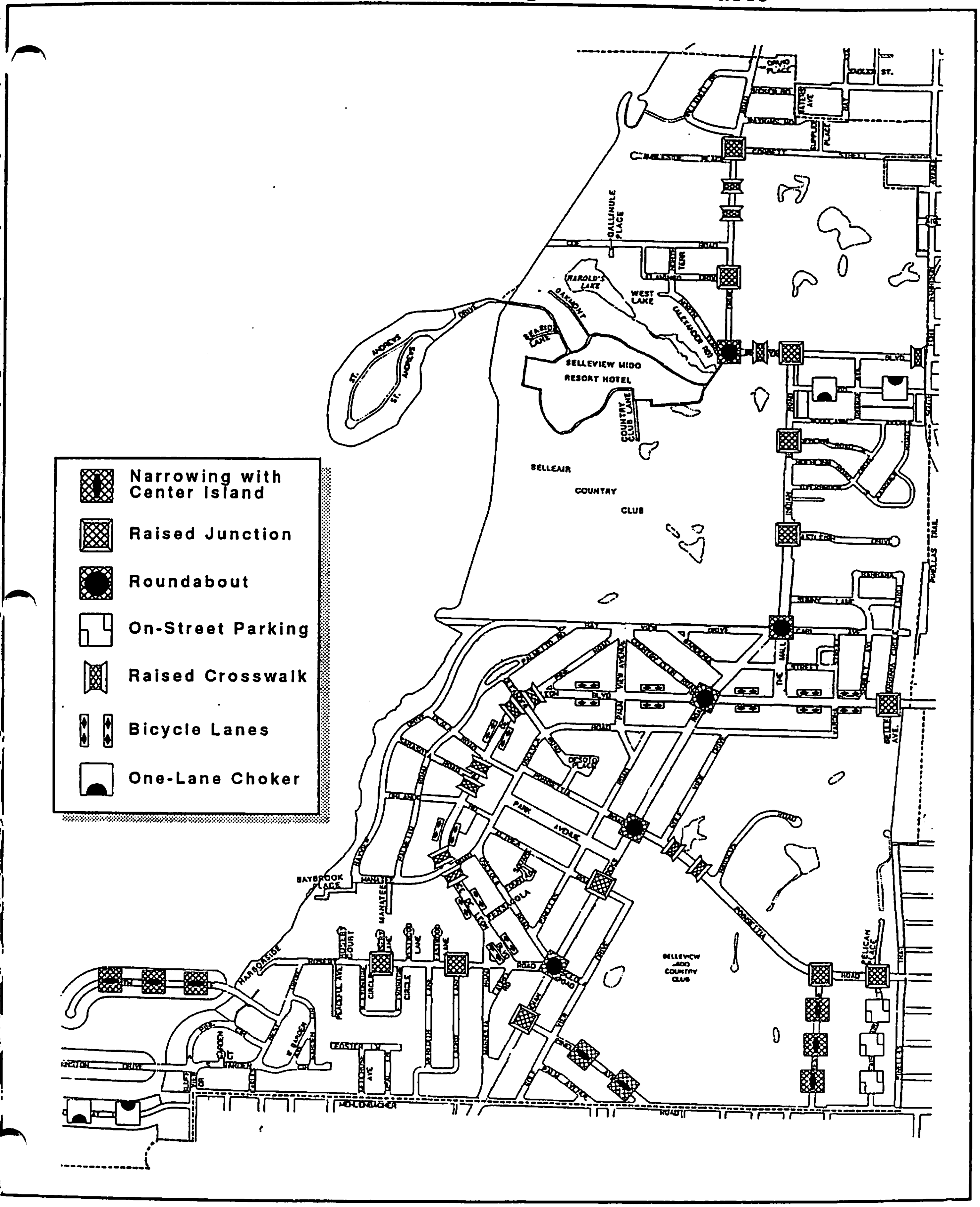


Figure 5
Belleair Traffic Calming Plan - Phase I

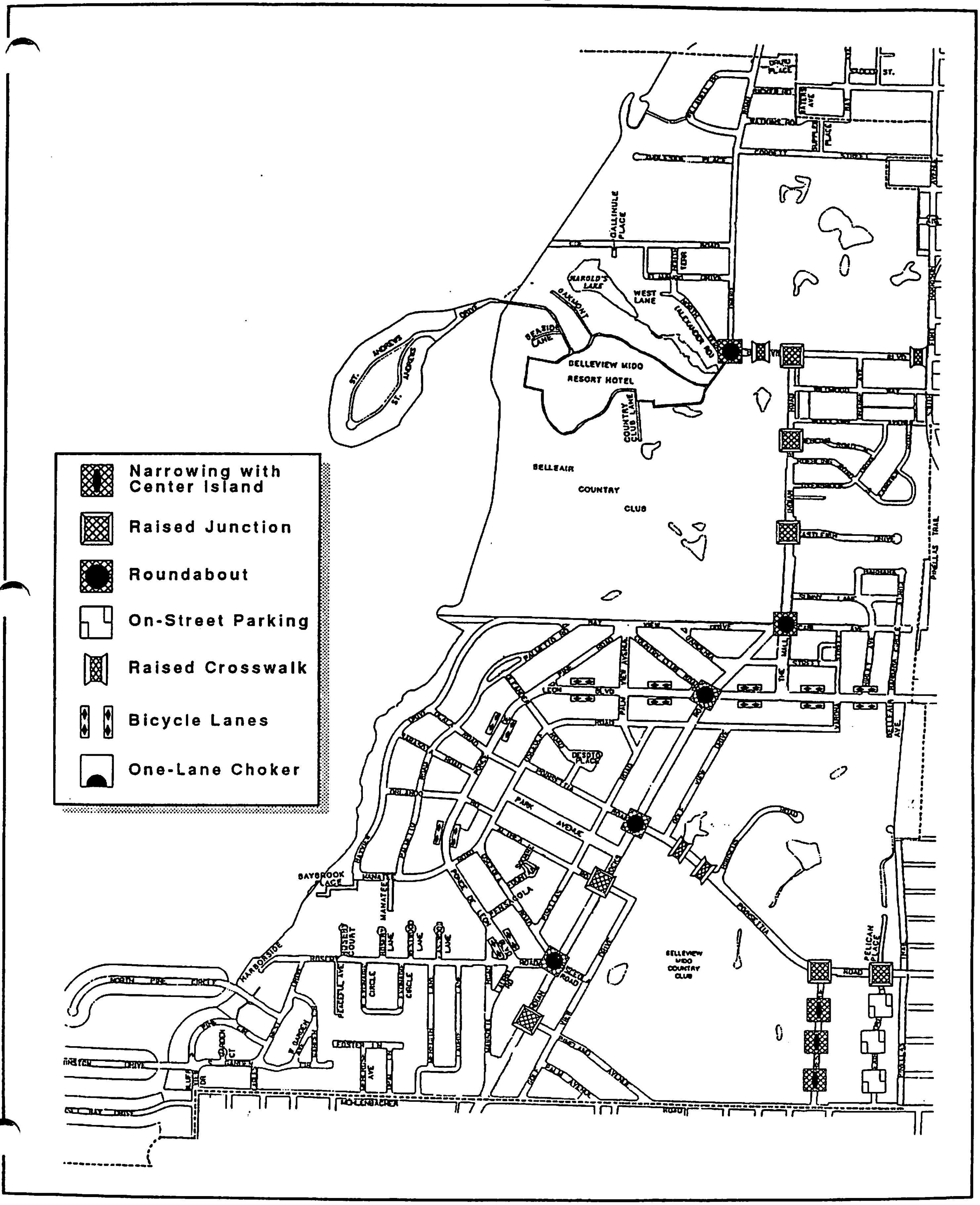


Figure 6
Belleair Traffic Calming Plan - Phase II

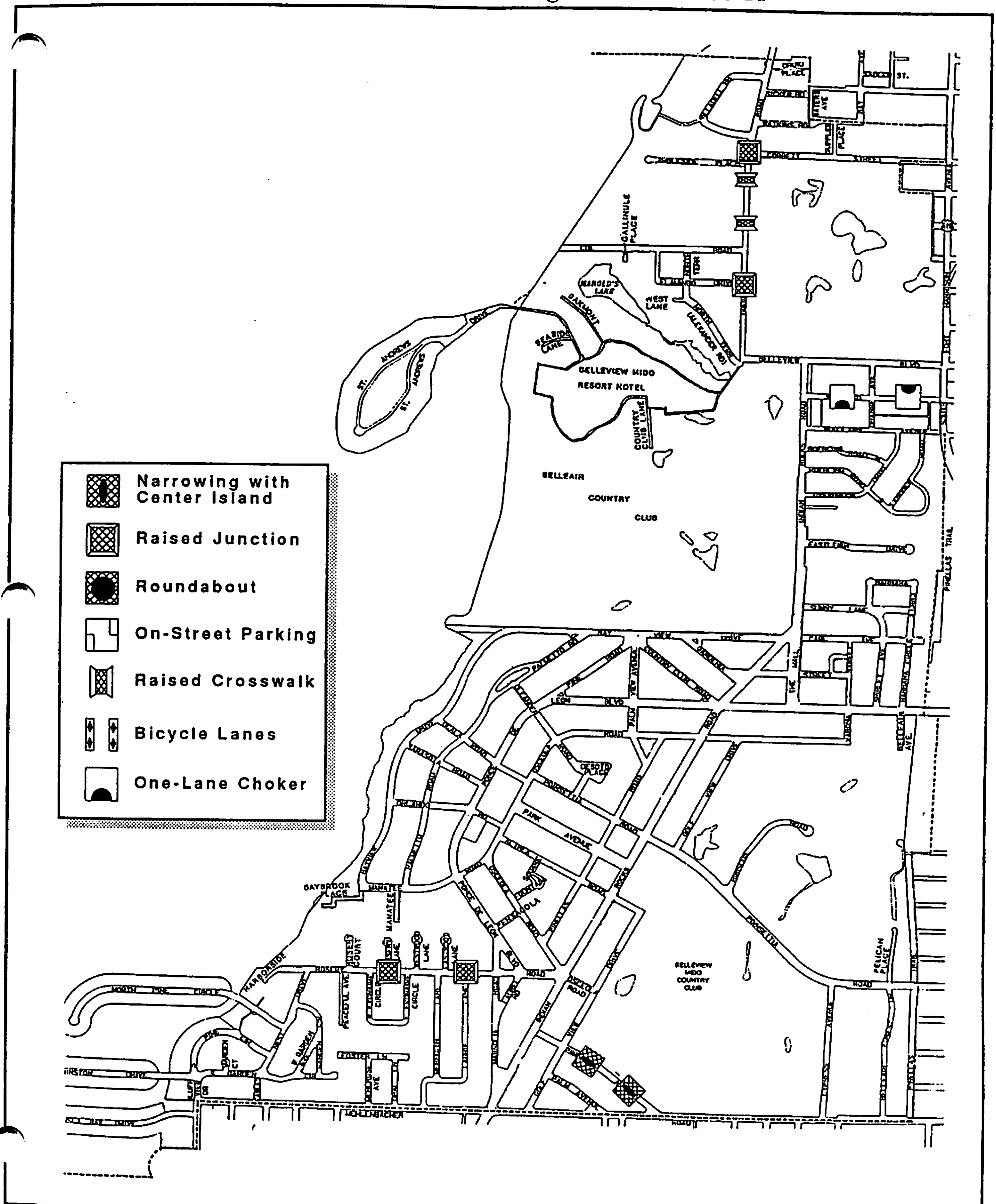


Figure 7
Belleair Traffic Calming Plan - Phase III

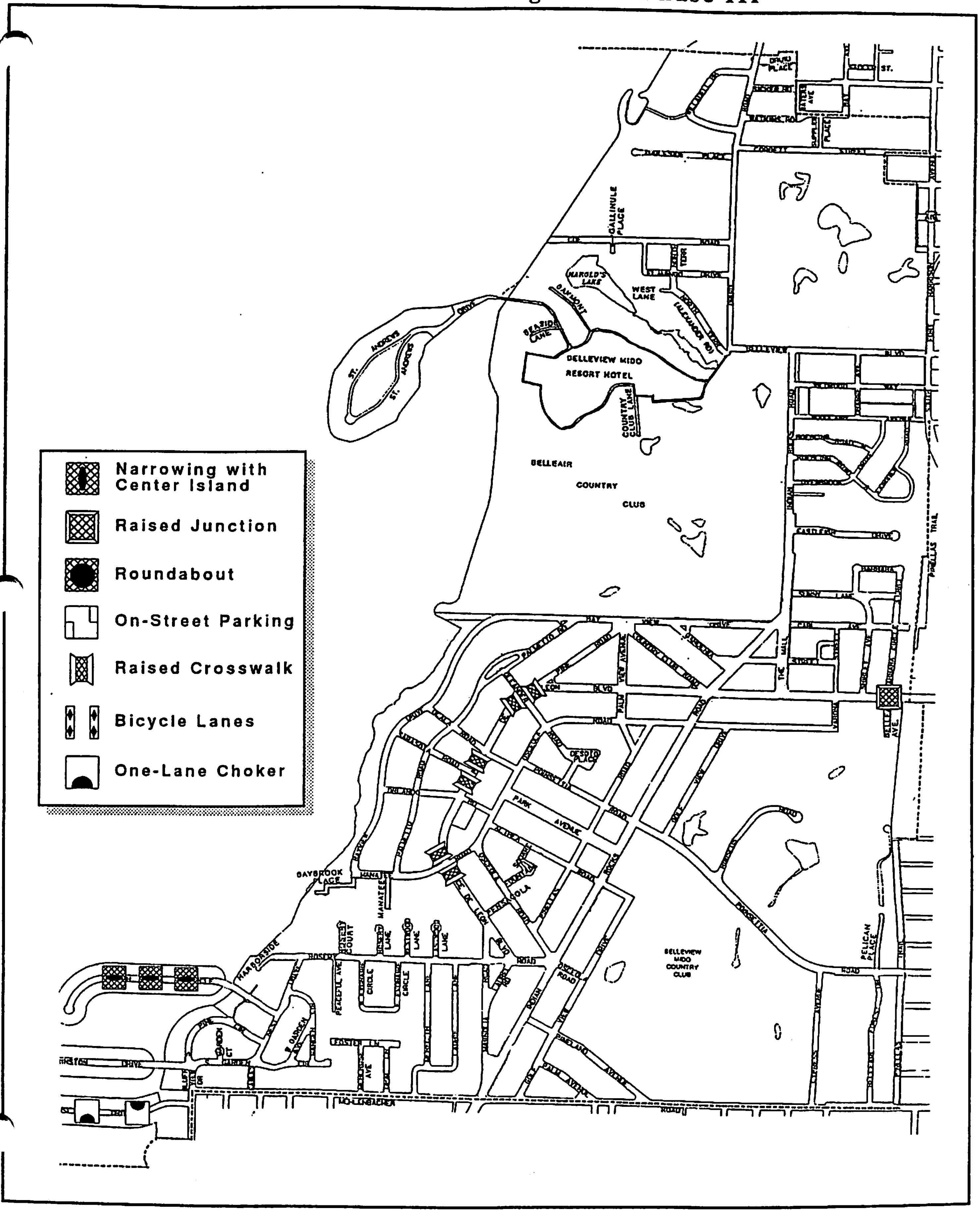
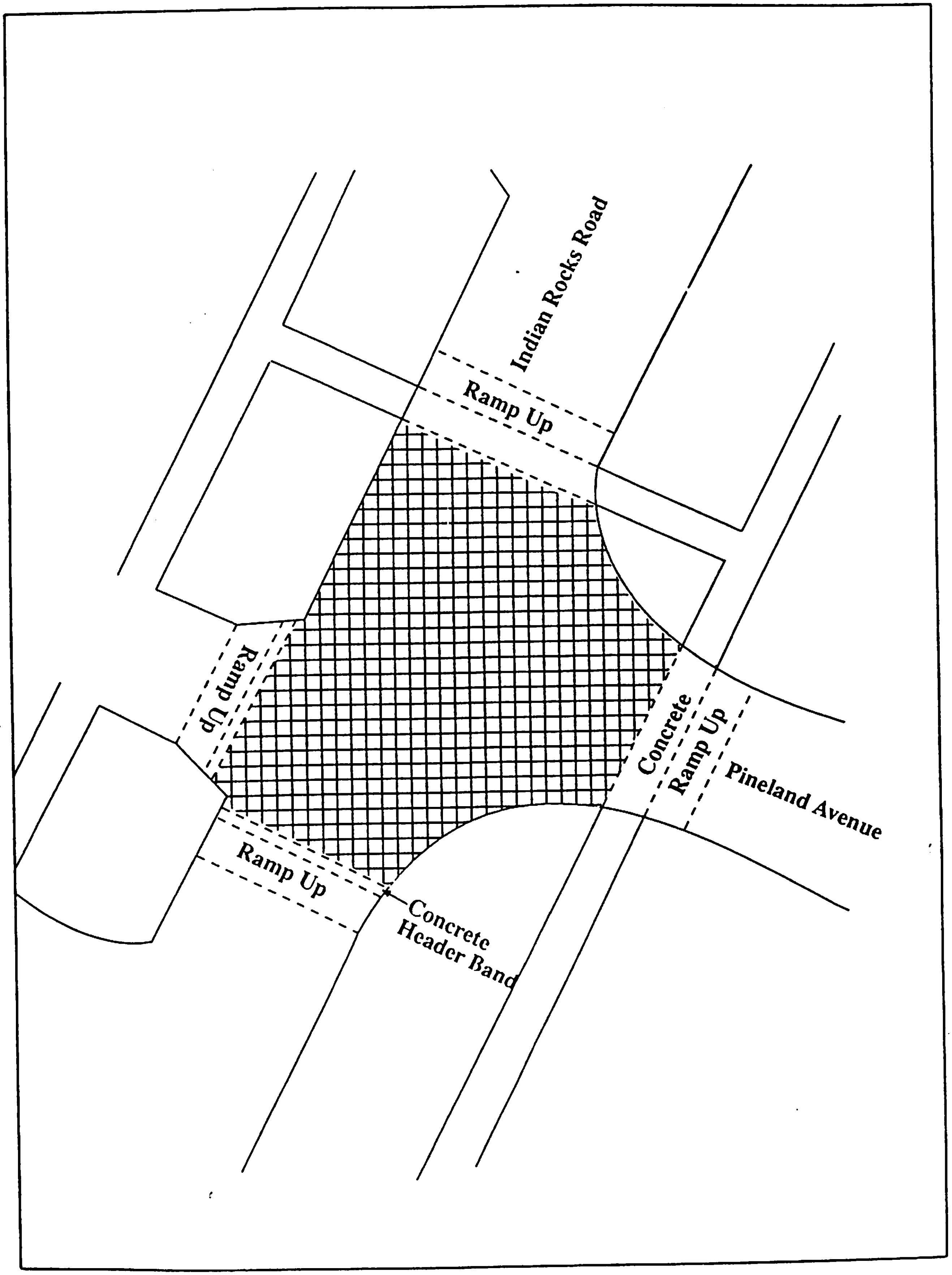


Figure 8
Conceptual Design -Raised Junction at Indian Rocks and Pineland



Several junctions (intersections) would be raised 4 to 5 inches above the street surface. Such an abrupt change in vertical alignment naturally slows traffic. The vertical rise feels uncomfortable at speeds above the posted limits, but acceptable at speeds at or below the limit. This is the principle behind speed humps, speed tables, and raised crosswalks. Raised junctions are popular in Europe and Australia. They not only calm traffic but pedestrianize intersections by raising the street to (or almost to) sidewalk level.

Raised junctions were chosen over the main alternatives -- street narrowings and chicanes -- because Indian Rocks is so narrow to begin with (24 feet, curb-to-curb). Geometric design manuals, both state and national, recommend at least 24 feet of pavement width on collector roads such as Indian Rocks.[6]

A typical raised junction, this one at the corner of Indian Rocks and Pineland, is laid out in **Figure 8**. The ramps to the junction are 6 feet long and made of either asphalt or concrete. The crosswalks at the top of the ramps are 5 feet wide and made of the same material as Belleair's sidewalks, Portland cement concrete. The crosswalks act as concrete header bands for the rest of the raised junction, which is paved with the same textured material as the southern entrance to Belleair, a 3-1/8 inch brick paver (**Figure 9**). These junctions will look a bit like the raised junctions of Toronto, Canada, but with better defined crosswalks and without chokers (**Figure 10**).

Figure 9
Southern Entrance to Belleair

Figure 10
Raised Junction in Toronto

[6] Residential Streets Task Force, op. cit., p. 38; American Association of State Highway and Transportation Officials (AASHTO), *A Policy on Geometric Design of Highways and Streets*, Washington, D.C., 1990, p. 482; ITE Technical Council Committee 5A-25A, *Guidelines for Residential Subdivision Street Design - A Recommended Practice*, Institute of Transportation Engineers (ITE), Washington, D.C., 1993, p. 13; and Florida Department of Transportation (FDOT), *Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways (The Green Book)*, Tallahassee, 1994.

Three intersections along Indian Rocks have enough cross street traffic, surface area, and/or geometric complexity to be good candidates for roundabouts. The three are at Rosery, Poinsettia, and Bay View. A fourth candidate is at Ponce de Leon. Note that the first, third, and fourth intersections are 5-legged and oversized. Roundabouts are particularly well-suited to such intersections in that they channelize traffic, break up unsightly paved expanses, and simplify crossing and turning movements.

Modern roundabouts (as opposed to old-fashioned traffic circles) seem to be catching on.[7] Bradenton Beach, Boca Raton, Gainesville, Ft. Walton Beach, Naples, Tallahassee, Tampa, Tavares, and West Palm Beach have constructed roundabouts recently. Compared to traffic signals or 4-way stop signs, roundabouts have more capacity and produce shorter delays when traffic flows are somewhat balanced.[8] The yield condition allows this reduction in delay compared to the stop at 4-way stops or the red phase of traffic signals. Properly designed, roundabouts force traffic to slow down as it enters intersections, while traffic can speed through signalized intersections and sometimes through stop signs. Driver error at standard intersections often causes 90 degree crashes at full speed, where roundabout crashes are more often at low speed and at low angles of incidence. This gives roundabouts a safety advantage.[9]

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[7] Modern roundabouts are distinct from old-fashioned traffic circles. With a roundabout, approaching traffic must wait for a gap in the traffic flow before entering the intersection, while traffic enters a traffic circle at high speeds and then must merge and weave, a more hazardous operation. Roundabouts also differ from traffic circles in their smaller center islands, greater angles of deflection at entries, and flared approaches (characteristics which moderate land consumption, slow traffic, and increase capacity, respectively). Thus, at a time when traffic circles are *non grata* among traffic engineers and are being from removed from high-accident locations in the Northeast, roundabouts are growing in popularity.

[8] K. Todd, "Modern Rotaries: A Transportation System Management Alternative," *Transportation Research Record 737*, 1979, pp. 61-72; S. Sabanayagam, "Capacity Analysis of Unsignalized Traffic Circles," *ITE 1990 Compendium of Technical Papers*, Institute of Transportation Engineers, Washington, D.C., 1990, pp. 298-302; M.J. Wallwork, "Roundabouts for the U.S.A.," *ITE 1991 Compendium of Technical Papers*, Institute of Transportation Engineers, Washington, D.C., 1991, pp. 608-611; W.F. Savage and K. Al-Sahili, "Traffic Circles - A Viable Form of Intersection Control?" *ITE Journal*, Vol. 64, September 1994, pp. 40-45; E.J. Myers, "Modern Roundabouts for Maryland," *ITE Journal*, Vol. 64, October 1994, pp. 18-22; L. Ourston, "Nonconforming Traffic Circle Becomes Modern Roundabout," *ITE 1994 Compendium of Technical Papers*, Institute of Transportation Engineers, Washington, D.C., 1994, pp. 275-278;

[9] British and Australian accident studies are reviewed in A. O'Brien and E. Richardson, "Use of Roundabouts in Australia," *ITE 1985 Compendium of Technical Papers*, Institute of Transportation Engineers, Washington, D.C., 1985, pp. 180-187. Several European studies are reviewed in Savage and Al-Sahili, op. cit.; and L. Ourston, "A Synthesis of Roundabout Safety Research, with Recent Increases in Numbers of Roundabouts in a Few Countries," Unpublished manuscript available from the author, Leif Ourston & Associates, Santa Barbara, CA, 1993. Also see Myers, op. cit.; M.A. Rahman and T. Hicks, "A Critical Look at Roundabouts," *ITE 1994 Compendium of Technical Papers*, Institute of Transportation Engineers, Washington, D.C., 1994, pp. 260-264; and A. Flannery and T.K. Datta, "Modern Roundabouts and Traffic Crash Experience in the United States,"

The design of roundabouts along Indian Rocks should follow guidelines adopted recently by the Florida Department of Transportation (FDOT).[10] All should have splitter islands to channelize approaching traffic and roundabouts should be signed to require approaching traffic to yield to traffic already in the intersection and should be configured for deflection at entry points, thereby slowing traffic. Landscaped center islands with raised aprons that can be mounted by large vehicles are also key design elements. The landscaping should be Belleair's signature palette to help unify the community visually. All roundabouts should have inner and outer radii large enough (at least 22 and 40 feet, respectively, including the raised apron) for all but the largest trucks to turn 270 degrees around them.

Conceptual designs of two roundabouts are shown in **Figures 13 and 14**. The roundabouts at Poinsettia and Rosery will require corner clips, as indicated. The ones at Ponce de Leon and Bay View will be irregularly shaped to fill intersection space. As long as the individual curves of the center island are smooth enough and large enough, elliptical and other odd-shaped islands function just fine (**Figures 11 and 12**).

Figure 11
Elliptical Roundabout in Tallahassee

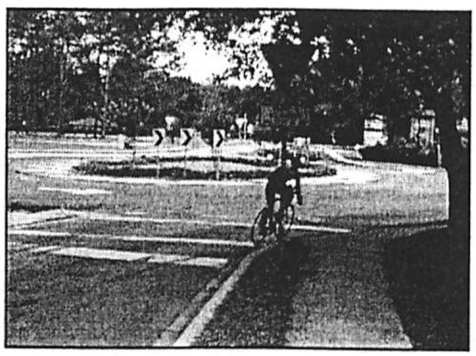
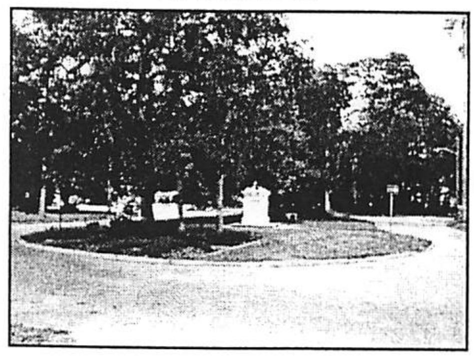


Figure 12
Kidney-Shaped Traffic Circle in Sarasota



Turn movement counts were performed at Indian Rocks and Poinsettia by Hall Planning & Engineering. Using these counts, the capacity of this intersection, redesigned as a roundabout, can be analyzed during final design using an Australian software program called *SIDRA*. We would expect that replacing the existing 4-way stop at Indian Rocks and Poinsettia with a roundabout will significantly reduce peak-hour delay and frustration.

Paper presented at the 75th Annual Meeting, Transportation Research Board, Washington, D.C., 1996.

[10] Florida Department of Transportation (FDOT), *Florida Roundabout Guide*, Tallahassee, 1996.

Figure 13
Conceptual Design - Roundabout at Indian Rocks and Poinsettia

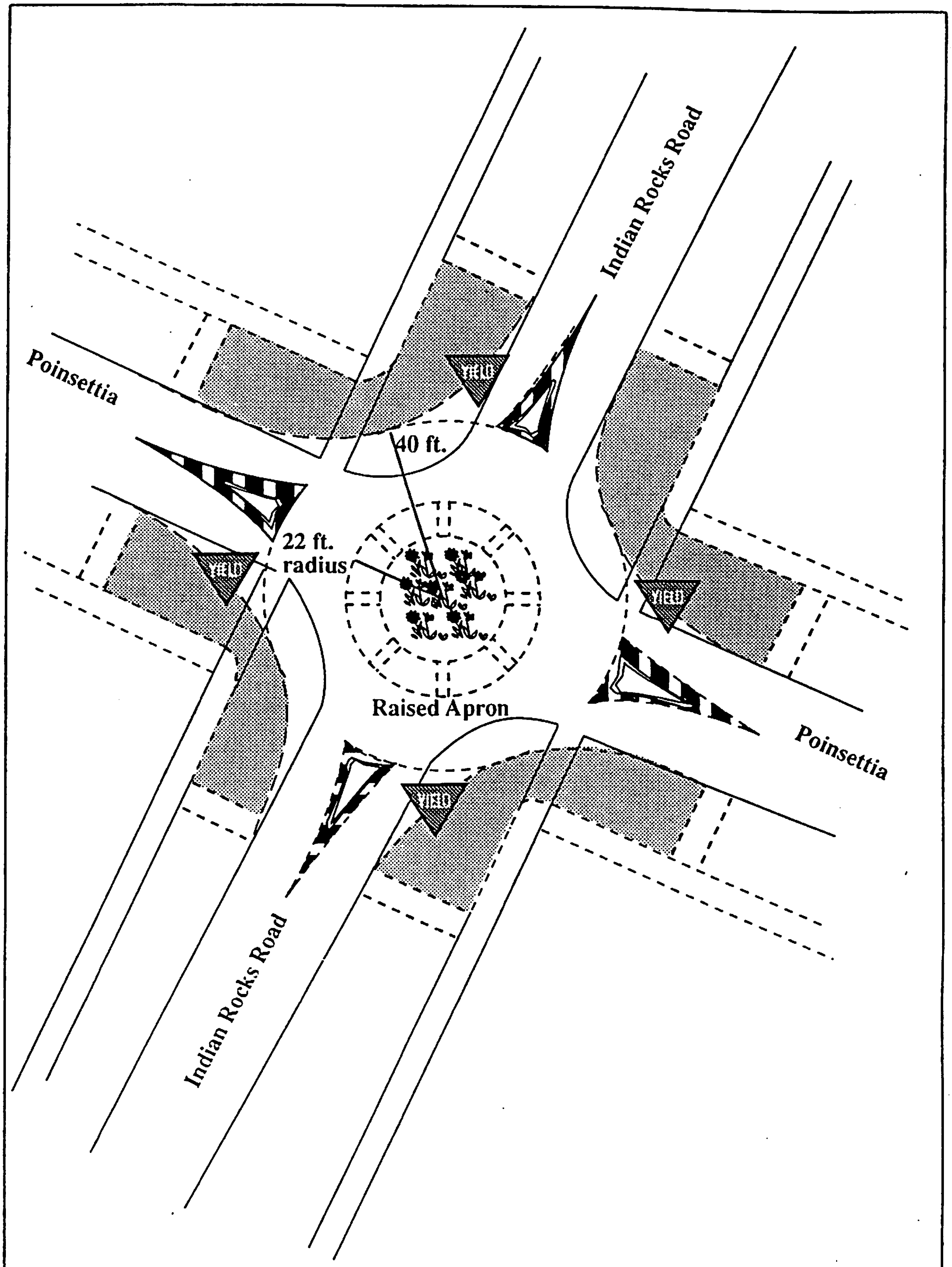
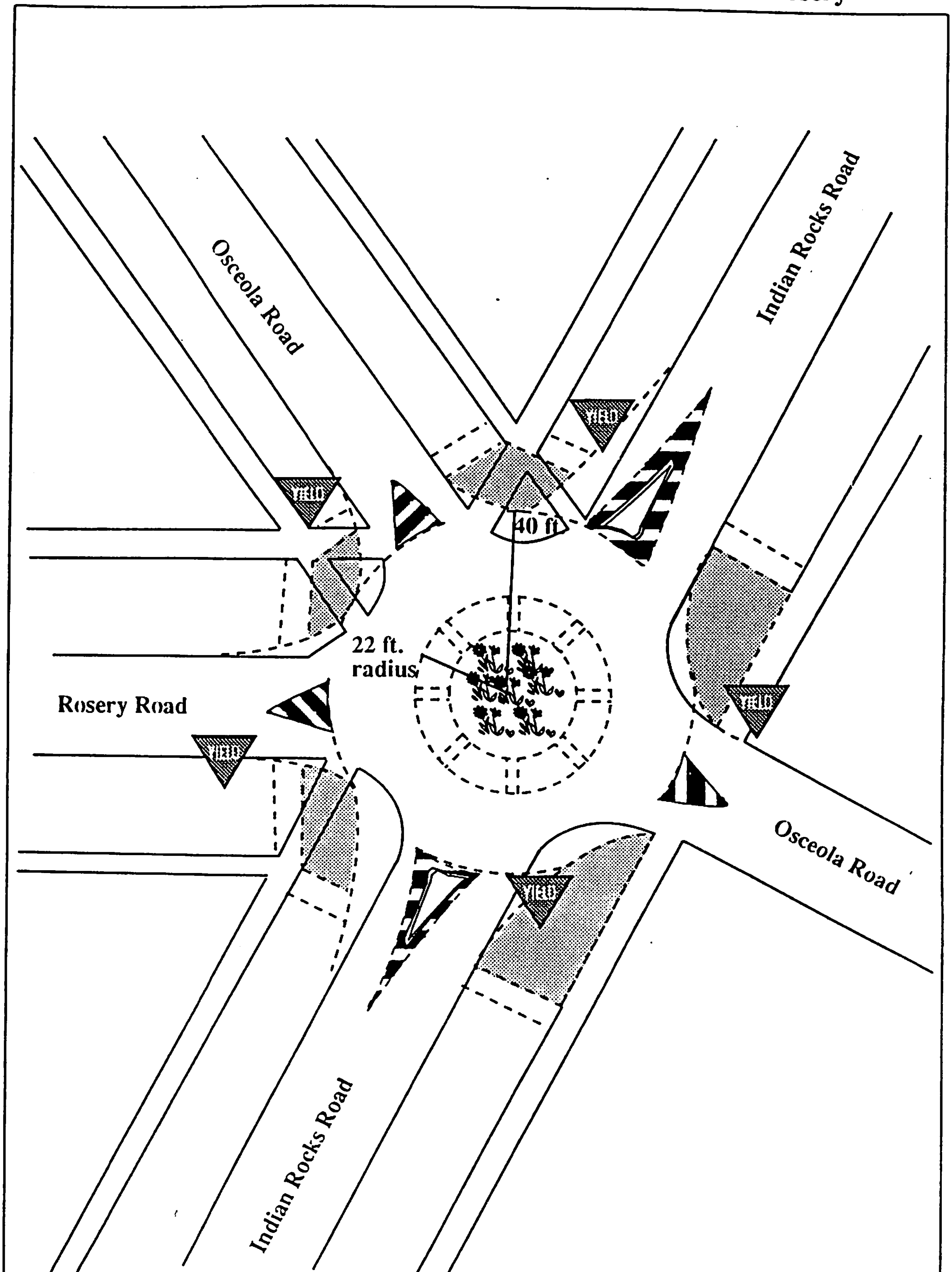


Figure 14
Conceptual Design - Roundabout at Indian Rocks and Rosery

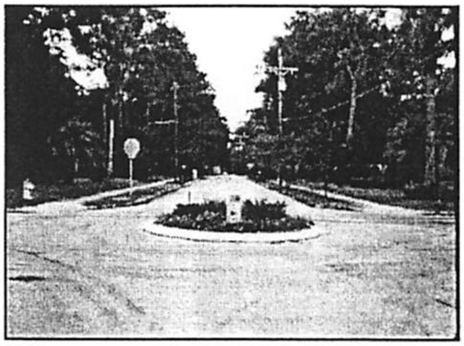


Belleview Boulevard, Druid Road, and Poinsettia Road

While slightly different in function, and very different in appearance, Belleview, Druid, and Poinsettia are lumped together in this analysis because they call for the same traffic calming treatments. All are residential collectors carrying mostly through-traffic. All have 85th percentile speeds well above the posted speed limit of 30 mph. All have crossings for golf carts that create natural opportunities for traffic calming. None demands the kind of intensive traffic calming recommended along Indian Rocks.

These streets are too narrow, and cross street traffic volumes are too low, to justify large traffic circles or full-scale roundabouts (but for the one recommended at the entrance to the Belleair Country Club - see below). Functioning as collectors, Belleview and Druid are also too narrow for landscaped center islands like those recommended on Cypress, Pineland, and North Pine.

Figure 15
Mini-Traffic Circle in Gainesville

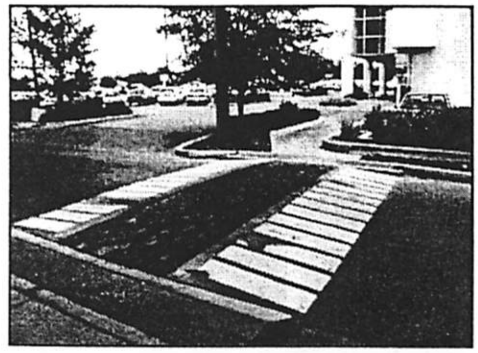


This leaves us with three options: mini-traffic circles, chokers, or raised areas. Mini-circles are nearly always limited to low-volume neighborhood streets. Their function is simply to block high-speed through movement (**Figure 15**). On higher volume streets, it could be hazardous to allow left turns in front of traffic circles, the only option with such tight intersections. Mini-circles are our third choice for traffic calming along these streets.

A type of choker could be installed at each T-intersection. The curb at the top of the T-intersection would flare out into the intersection a few feet to force some vehicle deflection. It would be landscaped, signed, and marked to warn oncoming traffic. The centerline of the street would similarly veer toward the neck of the T-intersection, with reflective pavement markers to accentuate the curve. The stop line on the neck would be set back a like distance to make room for deflected traffic. We have seen such treatments on low-volume residential streets, and believe they could be made to work safely on the higher volume streets in question. However, one respondent to our state-of-the-practice survey told of minor accidents at chokers on a high-volume collector. For this reason, chokers are our second choice for traffic calming along these streets.

Our first choice is a series of raised junctions at indicated intersections, plus raised crosswalks at all five golf cart crossings. As on Indian Rocks, the raised areas are guaranteed to slow traffic to the desired speed levels and make routes through Belleair less attractive relative to travel on Alternate 19, thereby diverting some traffic to Alternate 19. In our plan, the raised areas are sufficiently far apart to tempt motorists to accelerate between treatments, possibly causing the speed limit to be exceeded at the midpoints. The town always has the option, at some later date, of installing raised junctions at additional cross streets or raised crosswalks at additional crossing points.

Figure 16
Raised Crosswalk in Palmetto



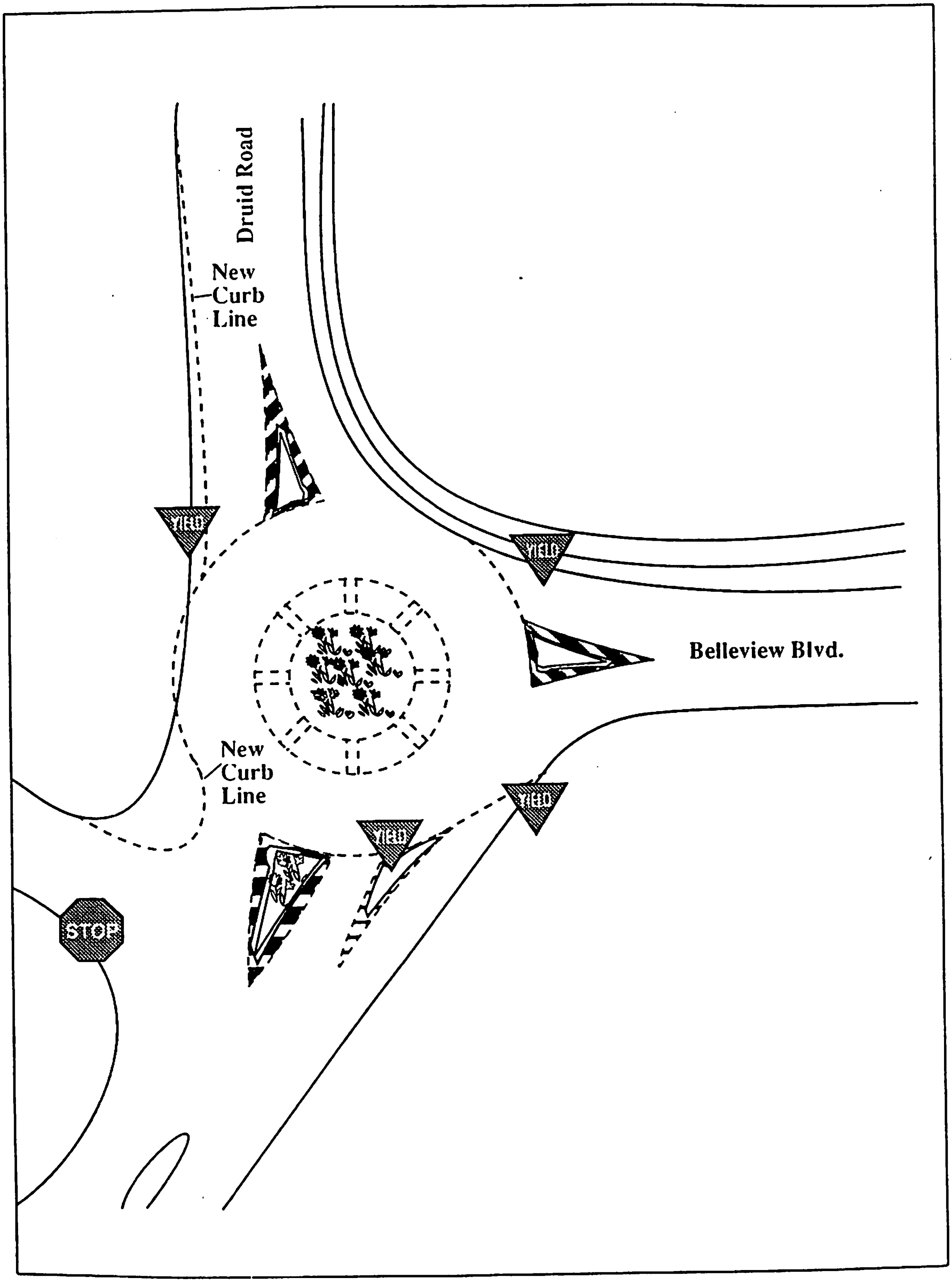
The design of the raised junctions will be the same as on Indian Rocks. The raised crosswalks will have asphalt or concrete ramps (6 feet long) with flat sections on top that are wide enough for golf carts to cross safely (6 feet). They will be slightly wider than the raised crosswalks in Palmetto, Florida, but similar in appearance (**Figure 16**). The flat sections will have Belleair's signature paver surface to unify the community visually. Given the narrowness of the devices, we would recommend that they be only 2 to 3 inches high (rather than the 4 to 5 inches recommended for raised junctions). At this height, they will not be jarring to motorists going the speed limit.

For reasons of safety as well as traffic calming, we recommend that the intersection of Druid and Belleview, at the entrance to Belleair Country Club, be outfitted with a modern roundabout. Presently, traffic is poorly channelized and left turns from Belleview into the club would benefit from more positive control. A conceptual design for the intersection, following FDOT's new roundabout guidelines, is presented in **Figure 17**.

Ponce de Leon

The west leg of Ponce de Leon is perceived as having a cut-through traffic problem caused by rush-hour traffic seeking to avoid the 4-way stop at Indian Rocks Road and Poinsettia. Both east and west legs are perceived as having speeding problems due to their extra wide lanes and landscaped medians separating traffic in the two directions.

Figure 17
Conceptual Design - Roundabout at Belleview and Druid



These perceptions are not entirely borne out by our volume and speed measurements. Indeed, based on real data, Ponce de Leon, both east and west of Indian Rocks, merits relatively low priority among street sections studied. The 85th percentile speeds are only 3 mph above the posted speed limit. The daily traffic volume on the east leg is only slightly above the acceptable level for residential collectors, and on the west leg is below the acceptable level for residential subcollectors.

Our plan for Ponce de Leon includes a raised junction, raised crosswalks, striped bicycle lanes, and a roundabout at the intersection with Indian Rocks (see above). Due to Ponce de Leon's low priority ranking, improvements would be postponed until Phase III of our traffic calming plan, with one exception and one caveat:

- Ponce de Leon's 15-foot lanes should be restriped immediately to provide 5-foot bicycle lanes. This is a low-cost improvement that may calm traffic slightly by reducing drivers' psychological space. It is consistent with the expressed desire of the focus groups to make Belleair more bicycle-friendly. It will improve bicycle access from the west side of Indian Rocks to attractions on the east side (the school, recreation center, and Pinellas Trail).

- Ponce de Leon's cut-through traffic problem should be closely monitored as Phase I improvements are made to Indian Rocks. It is impossible to predict whether replacing the 4-way stop at Poinsettia with a series of roundabouts and raised junctions along Indian Rocks will lead to more or less cut-through traffic on the western leg of Ponce de Leon. If it leads to more, improvements to Ponce de Leon will have to be given higher priority.

Cypress Avenue and Pineland Avenue

These overly wide streets have speeding problems. Their posted speed, 30 mph, is too high for residential subcollectors, and the speeds at which most drivers travel are higher still. Indeed, these two streets have the highest 85th percentile speeds of all local streets studied ("local" includes subcollectors and local access streets).

Many options exist for controlling speeds on these streets. We considered the possibility of speed tables -- flat-topped speed humps usually decked with bricks or interlocking pavers. They are attractive enough, and if properly designed, would slow traffic to 25 mph, the speed limit we are recommending for both streets. Aesthetically similar treatments -- raised junctions and raised crosswalks decked with pavers -- are recommended for speed control along Indian Rocks, Druid, Belleview, Poinsettia, and Ponce de Leon. The use of speed tables at these additional locations would tend to visually unify the community.

We also considered the possibility of one-lane chokers or chicanes along these streets (as in **Figures 18 and 19**). Such treatments are attractive enough, and if properly designed, would slow traffic to 25 mph or less. They would likewise tend to visually unify the community if the same landscape palette were used in these treatments as in the center islands of roundabouts recommended along Indian Rocks.

Figure 18
Choker in Sarasota

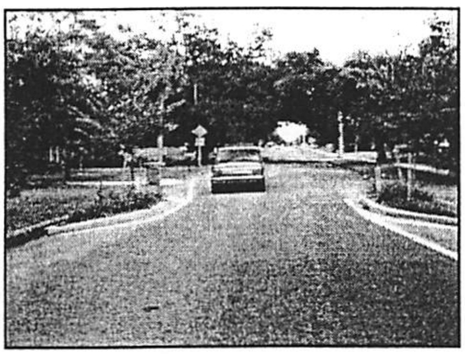
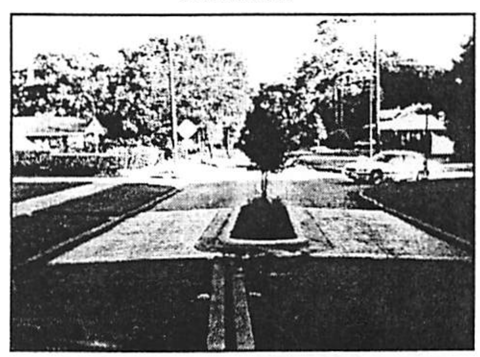


Figure 19
Chicane in Alachua

Both of these options were ultimately rejected in favor of street narrowings by means of landscaped center islands, with a textured street surface extending upstream and downstream of the islands by a few feet. Lacking vertical curbs, these streets will also require bollards, trees, or other vertical elements near the street edge across from the islands to confine traffic. The combination will be very attractive, and will visually unify the community by extending Belleair's signature landscaping and paver surface to two streets near the edge of the community. This traffic calming measure is currently used on a long, straight, wide street in Orlando (**Figure** 20).

Figure 20
Center Island Narrowing in Orlando



Admittedly, this treatment will not create the same imperative for speed reduction as the other two treatments considered and rejected. While most drivers will naturally slow down, some will not because it is not absolutely necessary that they do so for driver comfort or vehicle control.

Frankly, the reason for recommending this treatment over the alternatives is our absolute confidence that residents will like it. Residents of streets like these are far more proprietary about street treatments than are residents of longer, higher-volume streets. They will likely accept a treatment that simply slows traffic somewhat, while enhancing property values by visually breaking up wide streets with landscaped center islands.

Center islands should be spaced no more than about 300 feet apart. Cypress will require three islands along its length. Pineland will require at least two.

We recommend that the islands leave only 9 feet of pavement width on each side. Currently 24-feet wide (plus an extra 3 feet of gutter on Cypress), these streets will require 6-foot-wide center islands to fill street space.

Belleair Forest Drive

The problem on Belleair Forest is cut-through traffic. The curves, on-street parking, tree canopy, and street life generated by multifamily housing hold travel speeds down to the speed limit. To discourage cut-through traffic, and do so quickly and at low-cost, we recommend that on-street parking be allowed selectively on the west side of the street, as it already is on the east. The posted speed limit should be reduced from 30 mph to 25 mph to reflect this change.

In one focus group meeting, we learned that some residents on the west side of the street were concerned about on-street parking due to restricted visibility as they pull out of driveways. Parking was once allowed on the west side and subsequently banned. Obviously, this time, parking zones must be delineated in a manner that maintains adequate sight distances.

Parking lanes should be interspersed with "no parking" zones (**Figure 21**). One such zone is already striped and signed on the east side of the street. Another should be added on the same side of the street at the south end. Two additional zones, staggered relative to the first two, should be delineated on the west side. This would create a chicane effect and leave gaps for cars heading in one direction to wait while cars from the other direction pass.

Two questions arise. One is whether the street cross-section should be reduced to one travel lane at certain points by allowing parking on both sides, opposite each other. Given a 30-foot pavement width, and 8-foot parking lanes, the clear pavement width would still be 14 feet, more than adequate for any design vehicle. These two locations would become natural slow points, where opposing traffic would have to take turns passing. Single-lane slow points are widely used in Europe and Australia, and have begun to appear in the U.S. They occur naturally in older U.S. cities and towns where streets are narrow and on-street parking is permitted on both sides. To be conservative, we are not recommending single-lane slow points on Belleair Forest as part of Phase I. Additional on-street parking can always be added in later phases.

The other question is whether individual parking spaces should be delineated with lateral stripes, or whether it is sufficient to have parking lanes delineated with longitudinal stripes. We think that the individual spaces might send a stronger signal that on-street parking is encouraged, thereby generating more parked cars and producing the desired traffic calming effect. Thus, we recommend striping of individual parking spaces.

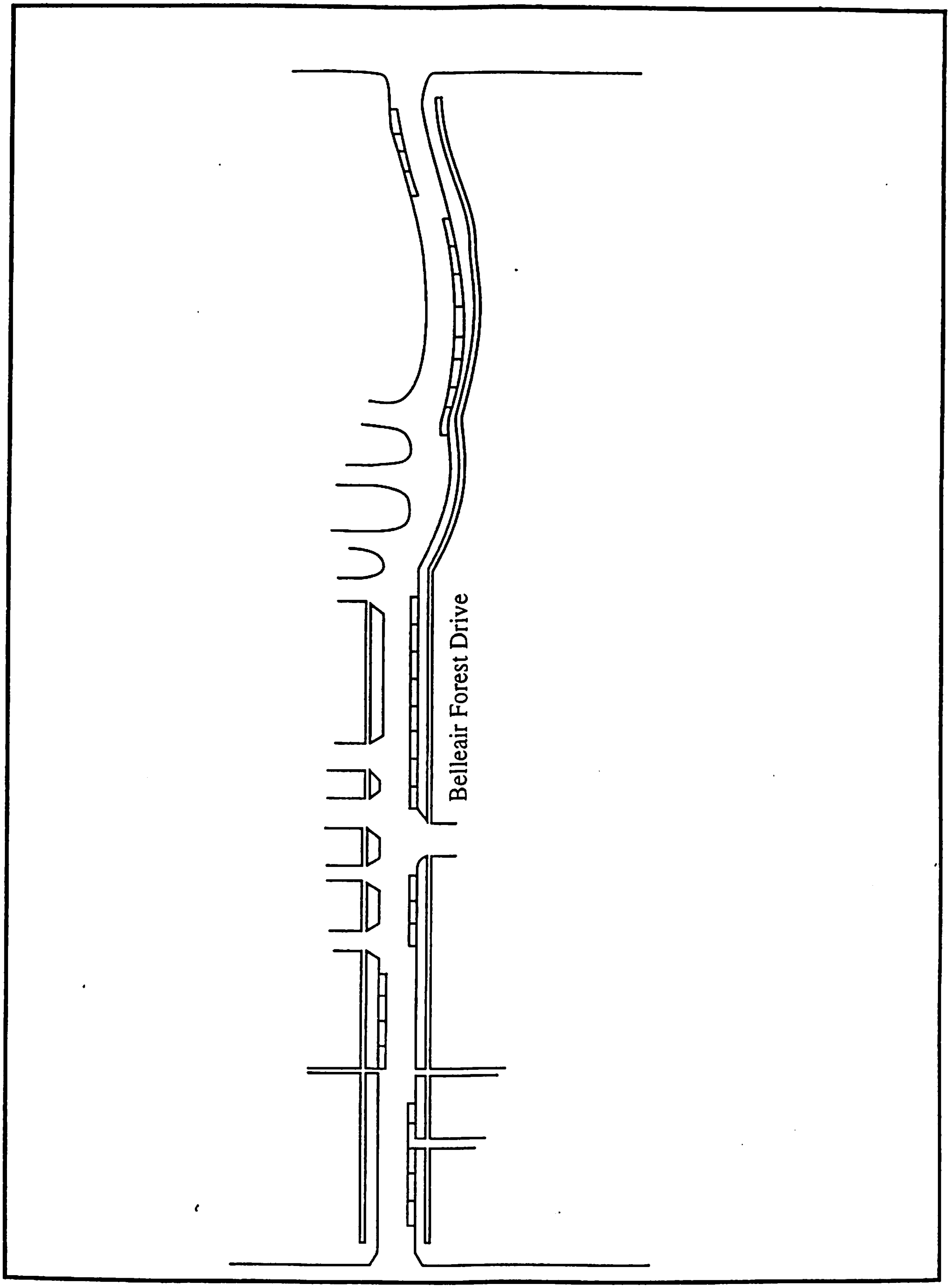
<u>Rosery Road</u>

As a traffic calming priority, Rosery ranks exactly in the middle. While it serves as a cut-through route from Mehlenbacher to Indian Rocks, the daily traffic volume is only marginally above the acceptable level for a subcollector. Speeding is a bigger problem. Yet, with an 85th percentile speed 4 mph above the posted speed limit, speed is not as big a problem on Rosery as on the top priority streets.

We had originally planned to recommend two mini-traffic circles along Rosery of the type pioneered in Seattle, WA and Portland, OR and now used in Gainesville, FL. They would work beautifully on a street with this volume and speed; however, as two respondents to our state-of-the-practice survey warned, it might confuse drivers if mini-circles were used in combination with roundabouts. In one case drivers would be allowed to turn left in front of circles, while in the other case, they would be required to circulate counter-clockwise around them. Thus, we are left with either chicanes or raised junctions as the preferred design solution.

Our current plan for Rosery shows raised junctions. It may be modified based on Belleair's experience with raised junctions in Phase I, or on Ft. Lauderdale's experience with chicanes being installed on a street similar to Rosery.

Figure 21
Conceptual Design - On-Street Parking Along Belleair Forest



Wildwood Way

In one focus group, someone mentioned that cut-through traffic had once been a major problem on Wildwood due to a left-turn prohibition on Alternate 19 one block north, at Belleview. When the prohibition was removed, the problem subsided but did not disappear.

Spending time at the intersection of Wildwood and Orange, seeing little traffic, and noting the narrowness of these two streets (15 feet, plus gutters), it was hard to imagine any traffic problems. Yet, when the results of the volume and speed measurements came in, the traffic count was several hundred vehicles per day above the acceptable level for a local street, and the 85th percentile speed was above the posted speed limit of 25 mph, a high speed in itself for local access streets this narrow.

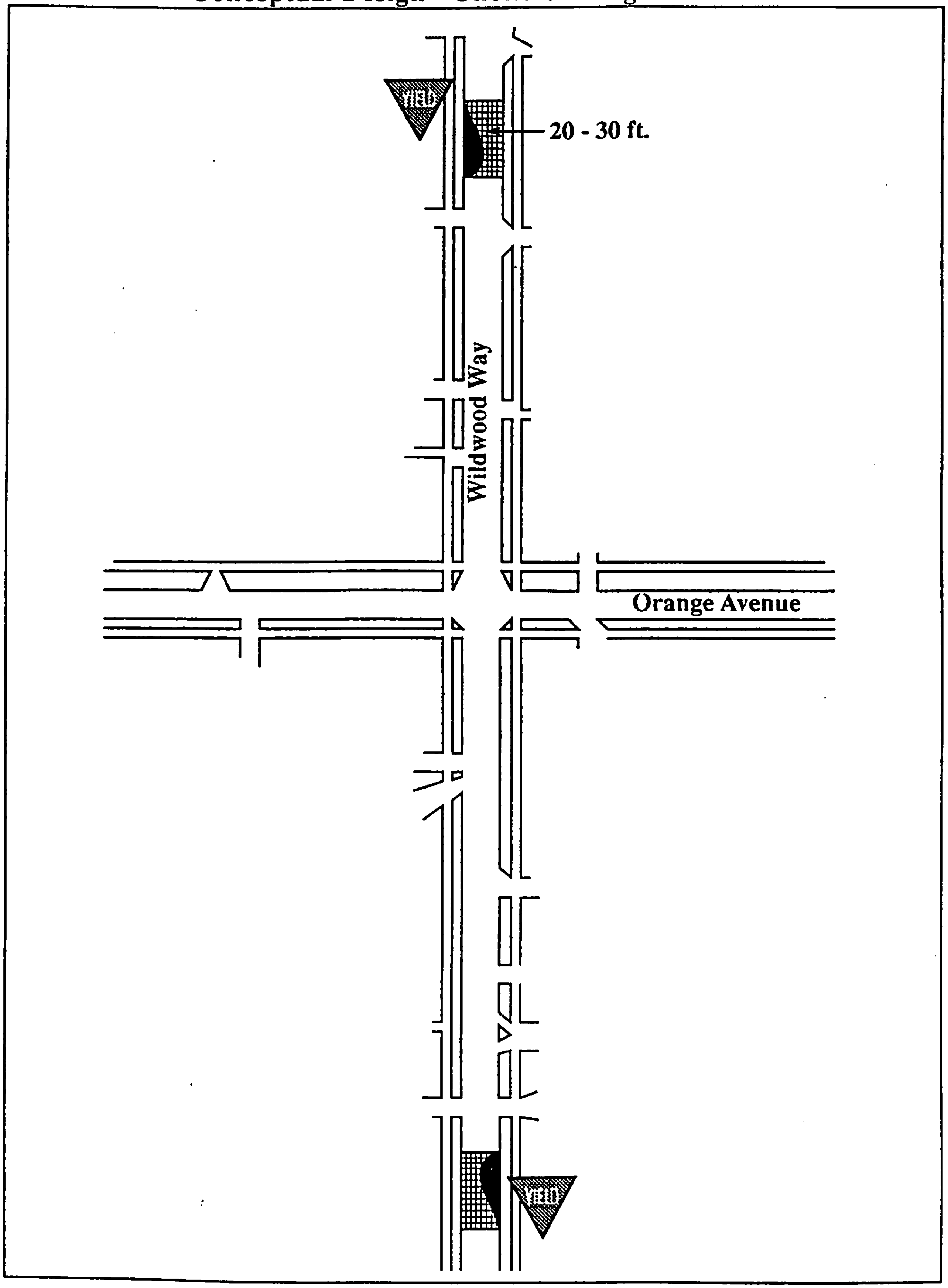
Our recommendation for Wildwood is to place single-lane chokers on opposite sides at midblock locations (as in **Figure 22**). The street should be taken down to about 10 feet at its narrowest. To clearly indicate who has the right-of-way, a yield sign should be placed on the side of the street with the blocked lane. Belleair's signature brick pavers and/or landscaped palette may be used on the chokers to increase their visibility and enhance their appearance.

The chokers will force east-west traffic to deflect and, when two cars meet, take turns passing the choker. As a cut-through route, Wildwood-Orange will be less attractive. As a through-route, Wildwood will no longer provide a straight shot for speeders.

North Pine Circle and Sunset Bay Drive

These streets and dead-ends serve only local traffic. This makes traffic calming less imperative on these streets than some others. Drivers tend to behave on their own streets, knowing they may be confronted by angry neighbors if they do not. The 85th percentile speeds are thus only marginally above the posted speed limits of 25 mph. Traffic volumes on these streets are higher than ideal for local access streets, but this is a simple function of these streets being longer than ideal for cul-de-sacs. Nothing can be done about this, there being no alternative route to which traffic could be diverted.

Figure 22
Conceptual Design - Chokers Along Wildwood



As part of Phase III, we show North Pine with a series of landscaped center islands like those recommended on Cypress and Pineland. Sunset Bay is too narrow for this treatment, and so would have to be outfitted with chokers, chicanes, speed tables, or some similar device. Our plan for Sunset Bay shows single-lane chokers on alternating sides of the street, in a chicane-like pattern.

Summary of Improvement Costs

Preliminary cost ranges for each treatment type are provided to facilitate decisions regarding program budgeting and implementation (Table 5). These cost estimates are based on general data including assumed quantities and material costs from similar projects along Florida's west coast.

First Year Pilot Program

Although the traffic calming plan is designed to be implemented in phases, it is understood that there may be obstacles to the construction of an entire phase at once. Therefore, we are recommending that only a portion of Phase I be constructed in the first year as a pilot program. Beginning the plan's implementation with a pilot project will drastically reduce the total committed funds at the onset of the project. At the same time, reduced traffic volumes and increased traffic safety will result.

The pilot project would consist of the four traffic calming treatments recommended for Belleview Boulevard. These four treatments are all within close proximity to each other. Traffic calming measures effectively reduce traffic speeds when they are close together rather than far apart. If they are close together, then traffic will continue to move slowly from one treatment to the next. If there is a considerable distance between traffic calming measures, then motorists have an opportunity to speed up. The latter condition does little to solve speeding problems and safety is further compromised.

The four traffic calming measures recommended for Belleview Boulevard include one roundabout at the South Druid intersection, a raised junction at Indian Rocks Road, a raised crosswalk between South Druid and Indian Rocks where there is an existing golf cart crossing, and a second raised crosswalk just west of Alternate 19. Table 6 provides cost estimates for this pilot project.

Table 5
Treatments and General Unit Cost Estimates

Treatment	General Unit Cost
Roundabout	$55,000 - $68,000
Raised Junction	$15,000 - $20,000
Raised Crosswalk	$8,000 - $12,000
Narrowing w/Center Island	$13,000 - $18,000
Bike Lanes	$.70 per linear foot of striping (including pavement legend)
On-Street Parking	$.60 per linear foot of striping
1-Lane Choker	$14,000 - $19,000

Estimate Assumptions:

- The mobilization costs for one construction project are spread across several treatments. This translates into less cost per treatment when several individual improvements are included in the same project.
- Maintenance of Traffic equipment to be supplied, installed and maintained by City forces.

Table 6
Traffic Calming Plan Implementation - First Year

Location	Treatment	Estimated General Cost
Belleview Blvd. and S. Druid intersection	Roundabout	$58,000 - $61,000
Belleview Blvd. and Indian Rocks Road	Raised Junction	$15,000 - $16,000
Belleview Blvd. between S. Druid and Indian Rocks Road	Raised Crosswalk	$8,500 - $9,000
Belleview Blvd. just west of Alternate 19.	Raised Crosswalk	$8,500 - $9,000
Total Estimated Cost - First Year		**$90,000 - $95,000**

It should be noted that the range of cost estimates in Table 6 are somewhat lower than the general estimates listed in Table 5. The estimates in Table 5 are based on each traffic calming treatment being constructed in isolation, which includes the costs associated with mobilization, maintenance of traffic, and landscaping. The estimates in Table 6 assume that these extraneous costs can be spread across the four treatments. There is an opportunity for the roundabout at South Druid and Belleview Boulevard to be constructed at a lower cost since it is a three-legged intersection instead of four, and it is likely that it could be constructed within the existing pavement width.

The implementation of these calming measures would provide a good test of the traffic calming plan's effectiveness. The plan can then be implemented on an annual basis until all phases have been constructed.

APPENDIX

U.S. EXPERIENCE WITH TRAFFIC CALMING

Reid Ewing,[a] Edith McClintock,[b] and Richard A. Hall[c]

With growing interest in traffic calming, scattered applications, and little published information about the U.S. experience, we decided to conduct what may be the first state-of-the-practice survey of traffic calming in the United States. The survey included eight jurisdictions within Florida and 12 jurisdictions outside.

A written questionnaire was mailed out, and answers were recorded in lengthy, free-wheeling telephone interviews. Site visits were also conducted to see and photograph traffic calming measures around the State of Florida. A representative sample of photos appears at the end of this article.

Our survey covered: types of traffic calming measures used and reasons for selecting these particular measures; before-and-after studies of traffic speed, volume, and accidents; concerns of police, fire, public works, and citizens, and how their concerns have been addressed; liability, lawsuits, and damage claims associated with traffic calming measures; geometric design and spacing of measures; cost vs. aesthetic trade offs; and other thorny issues of implementation.

A highly *abbreviated* summary of our findings follows.

In-State	Out-of-State
Ft. Lauderdale	Arlington County, VA
Gainesville	Bellevue, WA
Lee County	Berkeley, CA
Naples	Boulder, CO
Orlando**	Charlotte, NC
Sarasota	Dayton, OH**
Tallahassee	Gwinnett County, GA
Tampa	Howard County, MD*
	Phoenix, AZ
	Portland, OR
	Sacramento, CA
	Seattle, WA

* No interview yet -- only written response.
** No interview or written response yet.

1. What traffic calming measures are used in your jurisdiction...?

(a) Florida jurisdictions use a limited array of traffic calming measures. While examples of nearly all measures can be found somewhere in Florida, individual communities typically have two or three favorites upon which they rely exclusively. Among surveyed jurisdictions, there are no examples of raised junctions; only one example of full diverters; and only two examples each of chicanes and one-lane chokers. More importantly, there were no examples of combined measures at a single slow point nor of areawide traffic calming (though two areawide plans are in the works). Our final report will include tabulations of traffic calming measures for all surveyed jurisdictions.

[a] Associate Professor, Florida International University, ITE Associate Member

[b] Graduate Student, Florida International University

[c] President, Hall Planning & Engineering, ITE Member

(b) The jurisdictions outside Florida, all acknowledged leaders in traffic calming, have experimented with more measures. But with the exception of Seattle, they too are not taking advantage of the full range of options from continental Europe, Britain, and Australia.

(c) Engineers and planners interviewed tend to favor speed control measures over volume control measures. Volume controls divert through-traffic rather than simply slowing it down. Engineers and planners fear, rightly, that traffic diversion will negatively impact parallel streets. Several jurisdictions no longer permit street closures, and one, Sacramento, permits them only on a temporary basis for crime control.

(d) Boulder and Portland have general policies limiting how much traffic can be diverted to parallel streets. In Boulder, the policy is so strict it tends to preclude many traffic calming schemes, including speed controls that slow traffic enough to divert some of it. In Portland, the policy is less strict, and instead leads to traffic calming measures on parallel streets to maintain balanced traffic flows.

(e) Insofar as certain measures slow traffic without causing much diversion, they are preferred in cases where residential streets will experience the spillover. This is one of the advantages of traffic circles compared to, say, street closures, diverters, or even speed humps. Naples was considering a street closure but chose instead to install traffic circles along the street in question. During construction, thousands of cars a day were diverted to parallel streets, causing resident protests and proving that earlier fears were justified. Since construction ended, speeds on the traffic calmed street are way down but volumes have returned to normal. Naples' experience with circles, in terms of diversion, parallels experiences outside Florida.

(f) Many jurisdictions install traffic calming measures on a trial basis, at the end of which a decision is made to install them permanently or remove them. These jurisdictions have the choice of installing temporary measures, which cost less but are unaesthetic, or installing permanent measures, which look good but represent a bigger waste of money if ultimately removed. If they install temporary measures, such as construction barricades to simulate a traffic circle, they run the risk of public opposition solely due to aesthetics. As one respondent put it, criticism of appearance becomes criticism of effectiveness.

(g) On site visits, we came across a few traffic calming measures that were so clearly underdesigned that they compelled little or no reduction in speed. For speed control, there must be a sharp change in horizontal or vertical alignment. Even a dramatic narrowing may not bring speeds down appreciably unless it, one, leaves a single lane to be shared by two-way traffic and, two, carries traffic volumes heavy enough to create conflicts at the narrowing.

(h) The need for areawide planning is clear from several examples. In Gainesville, all-way stop signs were installed on one neighborhood street. They created a problem of cut-through traffic on another street as drivers sought to avoid the stops. Many drivers also ran the stop signs, always a problem when unwarranted stop signs are used simply to slow traffic. The cut-through problem was solved only by closing another street to create a circuitous route through the neighborhood.

2. *Do you have any before-and-after studies...?*

(a) Studies of traffic calming impacts on speeds and volumes were furnished by Boulder, Ft. Lauderdale, Naples, Orlando, Portland, Sarasota, Seattle, and Tampa. Additional studies have been promised by Arlington County, Bellevue, Berkeley, Gainesville, Gwinnett County, Lee County, Phoenix, and Tallahassee. In our final report, we will make an attempt to summarize the mass of data from such studies.

(b) The importance of spacing between measures is apparent. Where measures are spaced far apart, as are speed humps in Lee County and traffic circles in Ft. Myers (600-1,000 feet apart), speeding occurs in-between. Where measures are closely spaced, as are speed humps in Sarasota and traffic circles in Naples (200-300 feet apart), drivers have no time to speed up. In Sarasota, for example, midpoint speeds dropped from 34-39 mph to 26-27 mph, just over the citywide speed limit of 25 mph for local streets.

(c) We also requested data on accident rates before and after installation of traffic calming measures. One respondent commented that to her knowledge, before-and-after studies nearly always focus on speeds and volumes. She seems to be right. The value of accident studies was recognized by another respondent, who noted that Seattle's success in implementing traffic calming measures may be due to its public emphasis on traffic safety. It is hard to go head-to-head with the fire chief when he is threatening longer emergency response times and you, the engineer or planner, can only offer a nicer street environment. It is easier when you are arguing one safety impact versus another.

3. *Have you had problems implementing...?*

(a) The response of emergency services to traffic calming measures has varied from place to place. In many places, police and fire have not reacted at all. In others, police have supported traffic calming measures but fire and ambulance services have opposed them. In a few places, such as Sarasota and Seattle, police and fire have opposed traffic calming measures initially but, after some experience, have come to support them. From the standpoint of emergency services, street closures and speed humps seem to be the most problematic measures.

(b) The police often support traffic calming measures for their potential to control speeding and reduce accidents.

Engineering measures are self-enforcing, which takes some of the pressure off the police to enforce traffic laws. In four surveyed jurisdictions, Ft. Lauderdale, Gainesville, Tampa, and Sacramento, the police also support certain measures, those restricting access, for their potential to reduce crime.

(c) Fire chiefs (representing fire and paramedic interests) tend to be the most vocal critics of traffic calming. Traffic engineers almost everywhere try to keep traffic calming measures off emergency response routes. The problem is that many of the residential streets most in need of traffic calming, due to higher design speeds, make ideal emergency response routes.

(d) Two approaches have been tried to assuage fire department concerns. One is to conduct formal response time studies, as in Boulder, Portland, and Sarasota. Estimated delays are usually in seconds rather than minutes. The other approach is to design traffic calming measures around the needs of fire departments. Gwinnett County has switched from standard speed humps to longer Seminole County humps. Most jurisdictions design traffic circles with mountable outer curbs or aprons, and many use removable bollards on street closures or diverters.

(e) Even doing everything possible to assuage them, fire chiefs may still oppose traffic calming measures. One fire chief is fond of saying, "One minute is a long time when you're not breathing." In such cases, the traffic engineer or planner must make his or her case based on quality of life, traffic safety, and the unlikelihood of such emergencies (compared to the constant problems of speeding traffic). With good citizen support, some of those interviewed have prevailed over stiff opposition from fire departments.

(f) With few exceptions, public works and waste management departments have been neutral about traffic calming.

4. *Have any liability issues...?*

(a) The issue of government liability always surfaces in discussions of traffic calming. "What if we close a street and a fire rages on?" "What if we install speed humps and a motorcyclist goes flying?" The answer seems to be, "You have little or no exposure, provided your traffic calming measures are well-documented, well-signed, and well-lighted."

(b) The majority of surveyed jurisdictions have had no legal problems at all, and the remainder have mostly experienced threats rather than actions. The legal threats have more often arisen from access limitations than safety concerns. And the legal maneuvering has more often involved city attorneys, concerned about potential liability, than private attorneys, claiming actual damages. In this and earlier research, no case was uncovered in which a court found a traffic calming measure unsafe or a local government negligent in installing such a measure.

(c) Five respondents have had claims against them in the wake of traffic accidents. A claim was filed against Sarasota when a motorcyclist was injured on a speed hump still under construction. While unsigned and unstriped, the hump was marked by a construction barricade, and the claim was dropped without a settlement. Boulder was sued when a driver breached signage, flags, bumper blocks, and reflective pavement markers at a temporary traffic circle; the driver, injured by a sign through his windshield, ultimately dropped the suit without compensation. Portland was also sued, and in this case did pay a claim, when a contractor pulled warning signs too soon on a device that was still under construction.

(d) In two or three jurisdictions, opponents of traffic calming have challenged the legality of measures on the ground that they do not appear in the *Manual of Uniform Traffic Control Devices* nor in other national road design manuals. Berkeley, whose traffic calming program dates back the furthest (to a 1974 traffic management plan), was sued in the early years for installing diverters. The matter was settled when the California legislature declared them legal traffic control devices. Over time, as installations have become commonplace, arguments over the legality of traffic calming measures have become academic.

5. *How have neighborhood residents reacted...?*

(a) Most places surveyed report that traffic calming is a winner politically. While a few citizens always complain about traffic calming measures, they are usually far outnumbered by supporters. The supporters are from the traffic-calmed neighborhoods themselves, and are intense in their support. The opponents are from other neighborhoods, and are lukewarm in their opposition.

(b) Traffic calming entails some political risks. Neighbors care deeply about traffic on their streets, much more than they care about most other local issues. They have strong opinions about the nature and extent of traffic problems, and about appropriate solutions, opinions that are not always right. This is why it is so important that the nature and extent of problems be identified up-front via traffic counts, speed measurements, and accidents studies, and that staff be armed with good information on the effectiveness of different traffic calming measures for speed and cut-through traffic control.

(c) High levels of neighborhood support for traffic calming are, in a sense, inevitable given the structure of most traffic calming programs. The process typically begins with neighborhood residents passing petitions, and requires a strong show of support before anything can be installed. In some places, 50%, 60%, or even 75% of property owners must concur. It is no wonder that neighborhoods are very supportive of measures, once installed, having jumped through all the bureaucratic hoops.

(d) As an example of traffic calming's political appeal, Ft. Lauderdale gave each of 10 city neighborhoods $100,000 for physical improvements of their choice. To the surprise of city staff, neighborhoods spent their funds almost entirely on traffic calming, and Ft. Lauderdale ended up with more traffic calming measures than anywhere else in Florida. As another example, Tallahassee began installing Seminole County speed humps in 1996. Of citizens comments received since then, only 4% have opposed the humps; most have been inquiries from other neighborhoods wondering how they could get humps installed, too.

6. *Have you had to remove...?*

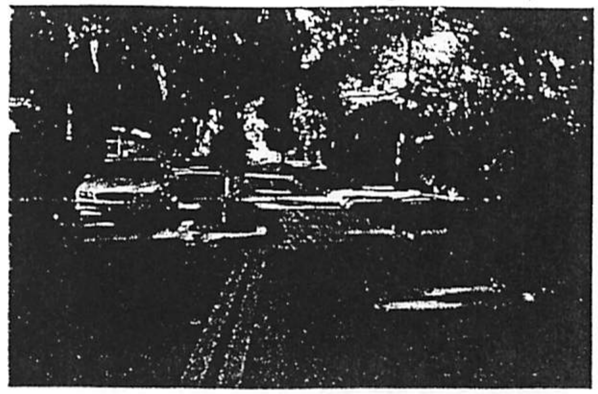
(a) Public support for traffic calming is also evidenced by the relatively few cases in which measures have been removed. The track record is all the more impressive due to the trial periods through which measures must go, ending with a decision to remove or install them permanently.

(b) In most jurisdictions, the need to remove measures has been limited to one or two isolated cases. Gainesville reports that 95% of all measures installed on a temporary basis become permanent. Of Seattle's 600-plus traffic circles, only two have been taken out at the request of neighbors. Of Portland's 100-plus speed humps, only two have been removed, both due to improper construction.

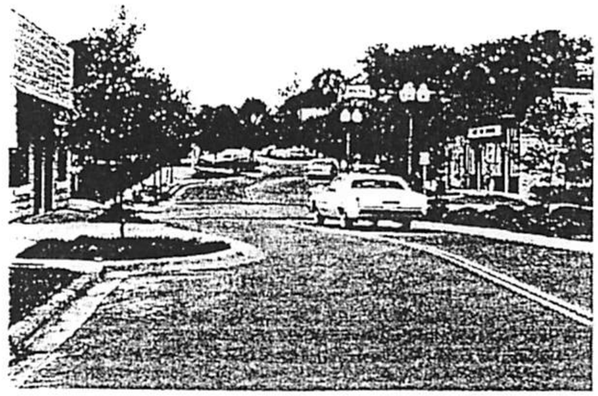
(c) One reason why so few measures are removed is, again, the show of neighborhood support usually required to install measures in the first place. This pre-screening seems to eliminate later problems. Before Phoenix adopted a 70% approval requirement in 1993, traffic calming measures had to be taken out occasionally. Since then, there have been no such cases.

(d) Only two places report having to remove significant numbers of traffic calming measures. In Charlotte, 60% of property owners must agree to test measures before they are installed on a trial basis. At the end of the test period, 70% of property owners must agree to permanent installation. Given the poor aesthetics of temporary measures, it is not surprising that many fail to garner the necessary support for permanent installation. In Berkeley, a fair number of diverters and traffic circles have been removed over the long history of their program. Neighborhoods have changed, and with them, the perceived need for traffic calming. Surprisingly, Berkeley has never had to remove any speed humps (though humps tend to be controversial elsewhere). One reason is simply longevity; diverters and circles have been around much longer than speed humps. Another reason, which relates to an earlier point about the advantages of pre-screening for neighborhood support, is the requirement of petition signatures only for speed humps, not for other traffic calming measures.

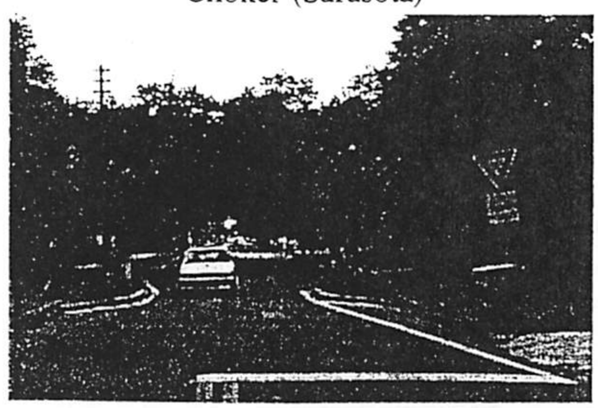
Center Island Narrowing (Orlando)



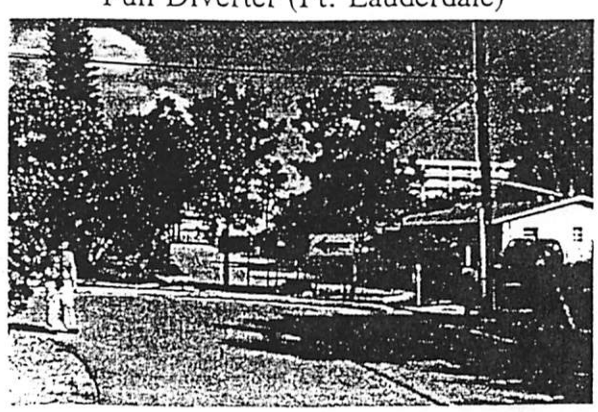
Chicane (Alachua)



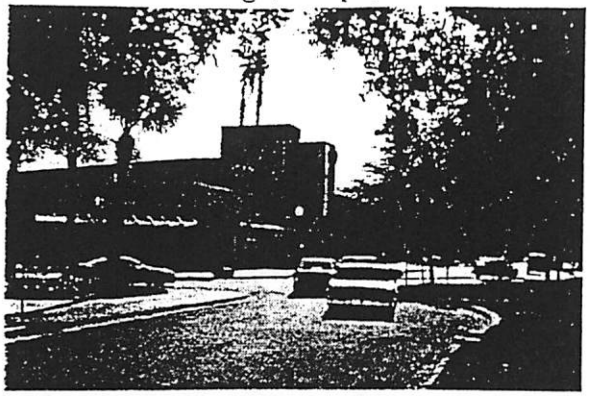
Choker (Sarasota)



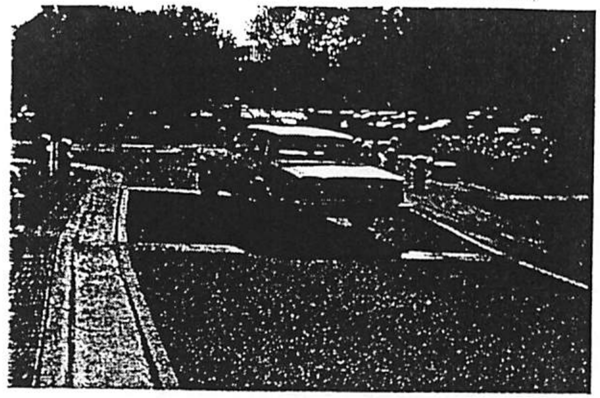
Full Diverter (Ft. Lauderdale)



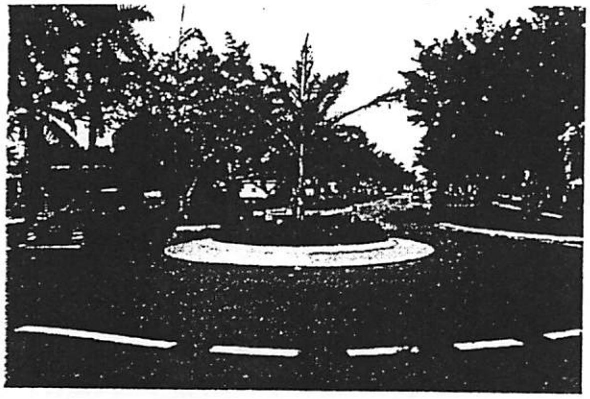
Jog (Tampa)



Raised Junction (West Palm Beach)



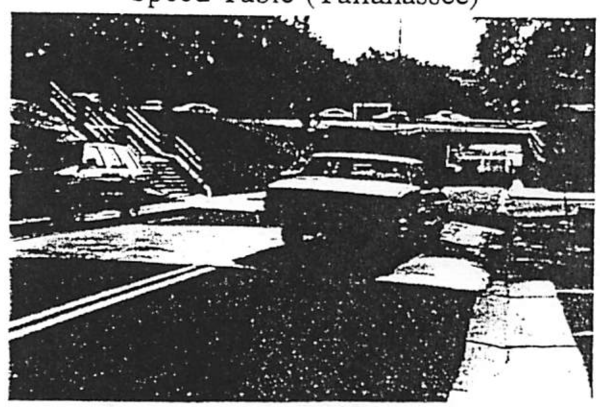
Mini-Traffic Circle (Naples)



Semi-Diverter (Gainesville)

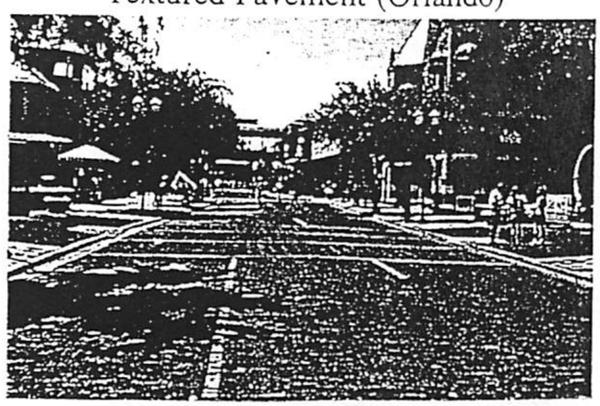
Nub (Jacksonville)

Speed Table (Tallahassee)



Raised Crosswalk (Palmetto)

Textured Pavement (Orlando)



Town of Belleair Traffic Volume Counts

Counter #1 — Druid Road
between Ambleside Place and Coe Road

Direction	Northbound	Southbound	Both Directions
24 Hour Count	1975	2067	4042
AM PK Hr. (begin)	7:45	11:15	8:15
AM PK Vol.	242	179	390
AM PK Hr. Factor	0.70	0.62	0.87
PM PK Hr. (begin)	13:15	16:45	16:45
PM PK Vol.	149	241	338
PM PK Hr. Factor	0.73	0.76	0.79

Counter #2 — Belleview Boulevard
between South Ft. Harrison Avenue and Orange Avenue

Direction	Eastbound	Westbound	Both Directions
24 Hour Count	4467	3737	8204
AM PK Hr. (begin)	7:30	11:30	8:00
AM PK Vol.	459	334	736
AM PK Hr. Factor	0.91	0.77	0.98
PM PK Hr. (begin)	13:45	17:00	16:15
PM PK Vol.	343	363	683
PM PK Hr. Factor	0.95	0.89	0.88

Counter #3 — Indian Rocks Road
between Overbrook Drive and Eastleigh Drive

Direction	Northbound	Southbound	Both Directions
24 Hour Count	5430	4898	10328
AM PK Hr. (begin)	7:30	11:30	7:45
AM PK Vol.	630	366	928
AM PK Hr. Factor	0.91	0.86	0.91
PM PK Hr. (begin)	13:45	16:45	16:45
PM PK Vol.	402	568	888
PM PK Hr. Factor	0.95	0.84	0.87

Counter #4 — Indian Rocks Road
between Osceola Road and Poinsettia Road

Direction	Northbound	Southbound	Both Directions
24 Hour Count	5728	4843	10571
AM PK Hr. (begin)	7:30	11:30	7:45
AM PK Vol.	619	357	888
AM PK Hr. Factor	0.92	0.88	0.93
PM PK Hr. (begin)	12:00	16:45	16:30
PM PK Vol.	421	549	916
PM PK Hr. Factor	0.95	0.89	0.89

Town of Belleair Traffic Volume Counts

Counter #5 — Indian Rocks Road
between Althea Road and Rosery Road

Direction	Northbound	Southbound	Both Directions
24 Hour Count	6024	5708	11732
AM PK Hr. (begin)	7:30	11:30	8:00
AM PK Vol.	638	422	967
AM PK Hr. Factor	0.86	0.85	0.89
PM PK Hr. (begin)	12:00	17:00	16:45
PM PK Vol.	455	629	1019
PM PK Hr. Factor	0.97	0.90	0.90

Counter #6 — Ponce de Leon Boulevard
east of Town Hall

Direction	Eastbound	Westbound	Both Directions
24 Hour Count	1533	1550	3083
AM PK Hr. (begin)	7:45	11:30	7:45
AM PK Vol.	178	118	290
AM PK Hr. Factor	0.86	0.80	0.87
PM PK Hr. (begin)	14:30	16:45	14:30
PM PK Vol.	141	156	289
PM PK Hr. Factor	0.93	0.85	0.93

Counter #7 — Poinsettia Road
between Cypress Avenue and Hibiscus Road

Direction	Eastbound	Westbound	Both Directions
24 Hour Count	1192	1291	2483
AM PK Hr. (begin)	10:00	11:15	10:45
AM PK Vol.	107	104	199
AM PK Hr. Factor	0.89	0.93	0.94
PM PK Hr. (begin)	16:15	16:30	16:45
PM PK Vol.	98	129	219
PM PK Hr. Factor	0.82	0.87	0.93

Counter #8 — Cypress Avenue
between Poinsettia Road and Mehlenbacher Road

Direction	Northbound	Southbound	Both Directions
24 Hour Count	475	523	998
AM PK Hr. (begin)	7:00	8:00	8:00
AM PK Vol.	51	46	91
AM PK Hr. Factor	0.71	0.68	0.78
PM PK Hr. (begin)	12:00	15:45	13:15
PM PK Vol.	45	57	83
PM PK Hr. Factor	0.66	0.89	0.94

Town of Belleair Traffic Volume Counts

Counter #13 Wildwood Way
between South Ft. Harrison and Orange Avenue

Direction	Eastbound	Westbound	Both Directions
24 Hour Count	244	374	618
AM PK Hr. (begin)	6:00	8:15	8:30
AM PK Vol.	30	50	76
AM PK Hr. Factor	0.75	0.60	0.70
PM PK Hr. (begin)	12:45	13:15	13:15
PM PK Vol.	22	42	59
PM PK Hr. Factor	0.79	0.81	0.78

Counter #15 Pineland Avenue
between Golf View Drive and Mehlenbacher Roa

Direction	Eastbound	Westbound	Both Directions
24 Hour Count	144	184	328
AM PK Hr. (begin)	7:30	11:15	11:00
AM PK Vol.	19	21	31
AM PK Hr. Factor	0.79	0.75	0.77
PM PK Hr. (begin)	17:15	16:45	17:00
PM PK Vol.	20	26	45
PM PK Hr. Factor	0.56	0.81	0.80

Counter #14 Pinellas Road
between Ocala Road and Park Avenue

Direction	Northbound	Southbound	Both Directions
24 Hour Count	159	65	224
AM PK Hr. (begin)	7:00	8:45	7:15
AM PK Vol.	21	9	24
AM PK Hr. Factor	0.75	0.75	0.67
PM PK Hr. (begin)	15:15	16:45	16:45
PM PK Vol.	16	11	24
PM PK Hr. Factor	0.67	0.46	0.75

Counter #16 Eagles Nest Drive
between South Pine Circle and North Pine Circle

Direction	Northbound	Southbound	Both Directions
24 Hour Count	483	416	899
AM PK Hr. (begin)	8:15	10:45	10:45
AM PK Vol.	49	39	81
AM PK Hr. Factor	0.82	0.81	0.92
PM PK Hr. (begin)	15:45	16:00	15:45
PM PK Vol.	47	40	85
PM PK Hr. Factor	0.84	0.67	0.76

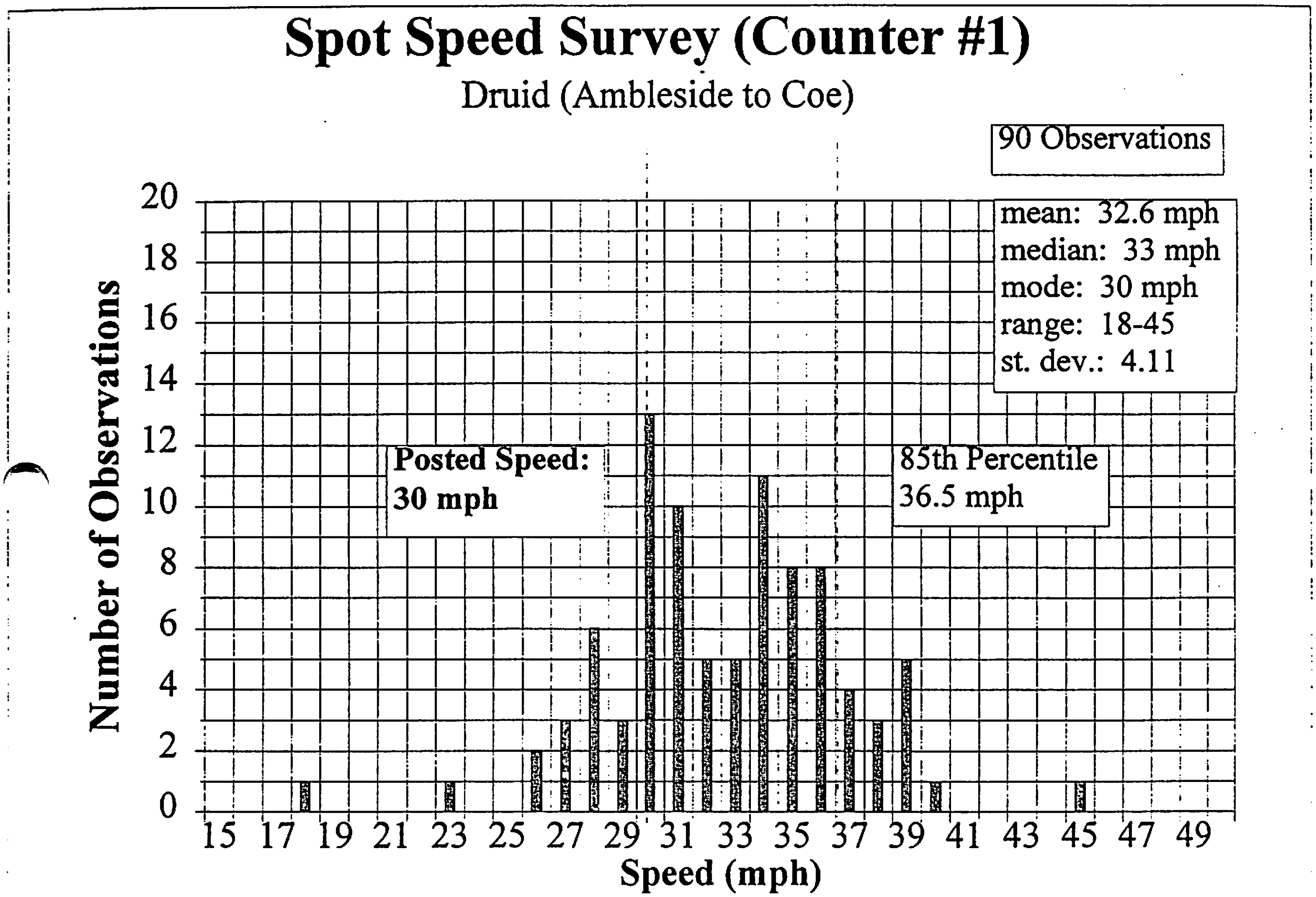
Town of Belleair Traffic Volume Counts

Counter #17 North Pine Circle
west of bridge

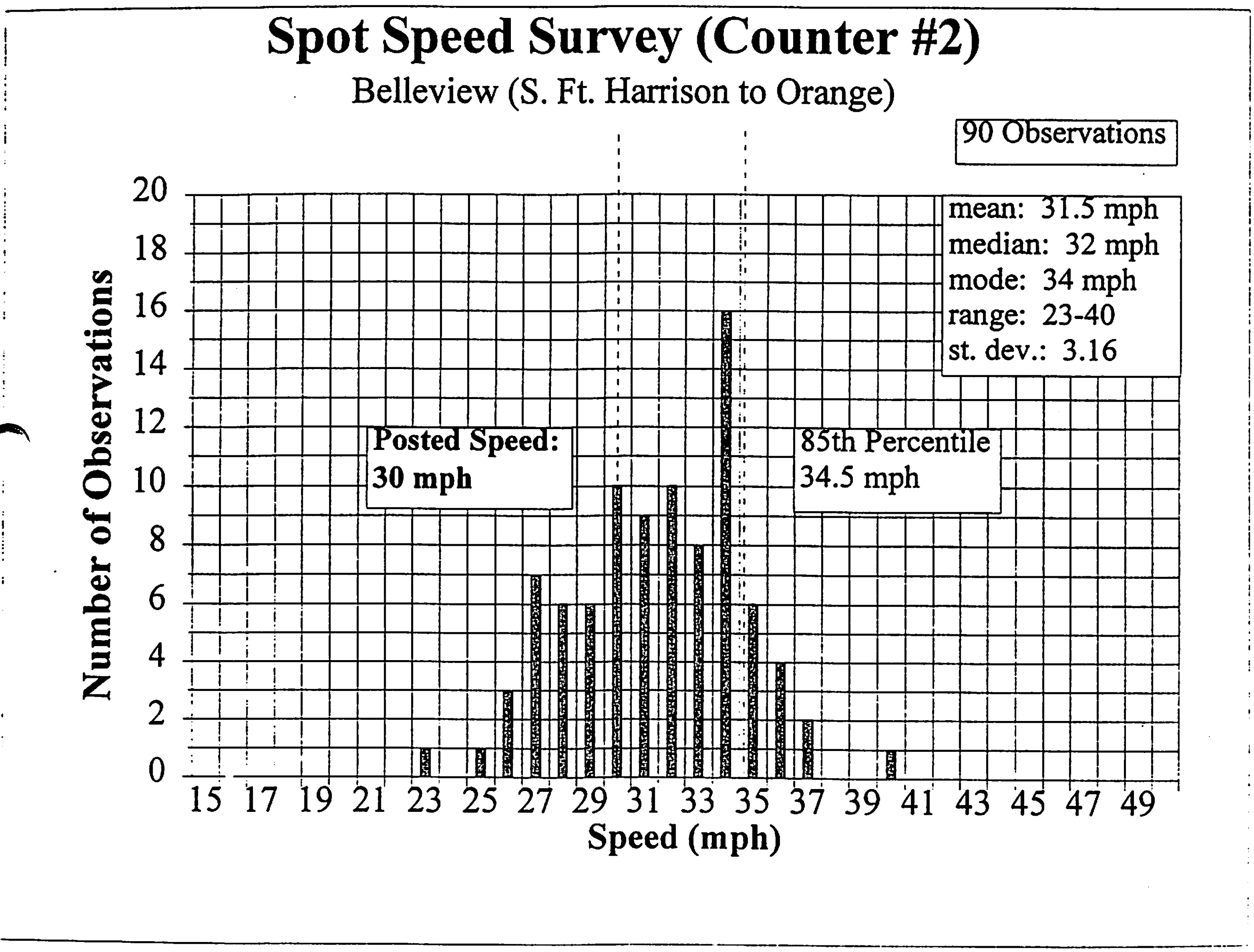
Direction	Eastbound	Westbound	Both Directions
24 Hour Count	294	295	589
AM PK Hr. (begin)	9:30	9:30	9:30
AM PK Vol.	26	35	61
AM PK Hr. Factor	0.81	0.73	0.90
PM PK Hr. (begin)	16:15	12:15	16:15
PM PK Vol.	44	36	70
PM PK Hr. Factor	0.85	0.75	0.63

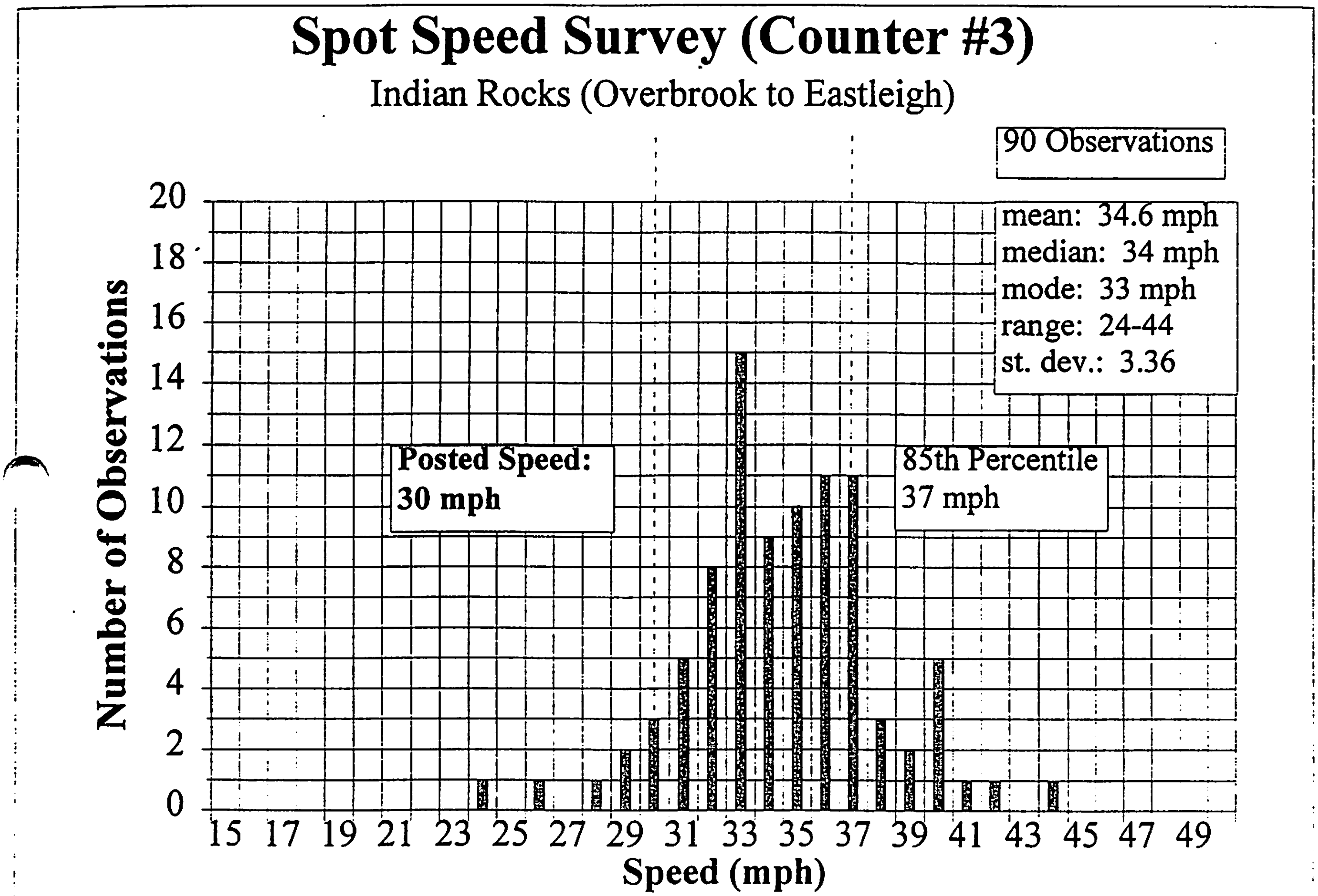
Counter #18 Sunset Bay Drive
east of Bluff View Drive

Direction	Eastbound	Westbound	Both Directions
24 Hour Count	328	357	685
AM PK Hr. (begin)	11:15	9:15	11:15
AM PK Vol.	40	41	79
AM PK Hr. Factor	0.67	0.54	0.68
PM PK Hr. (begin)	16:45	16:15	16:45
PM PK Vol.	33	30	62
PM PK Hr. Factor	0.59	0.75	0.70

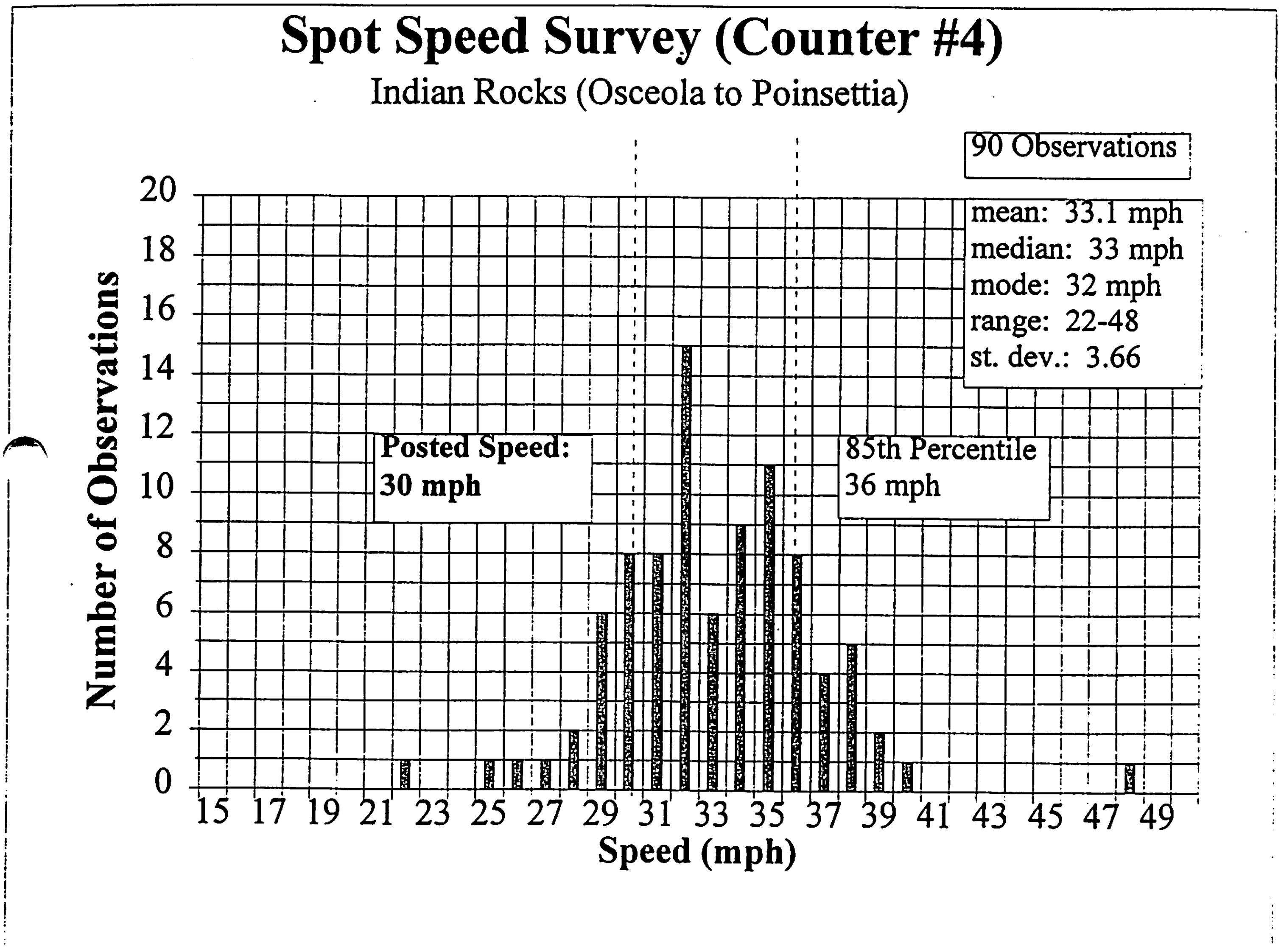


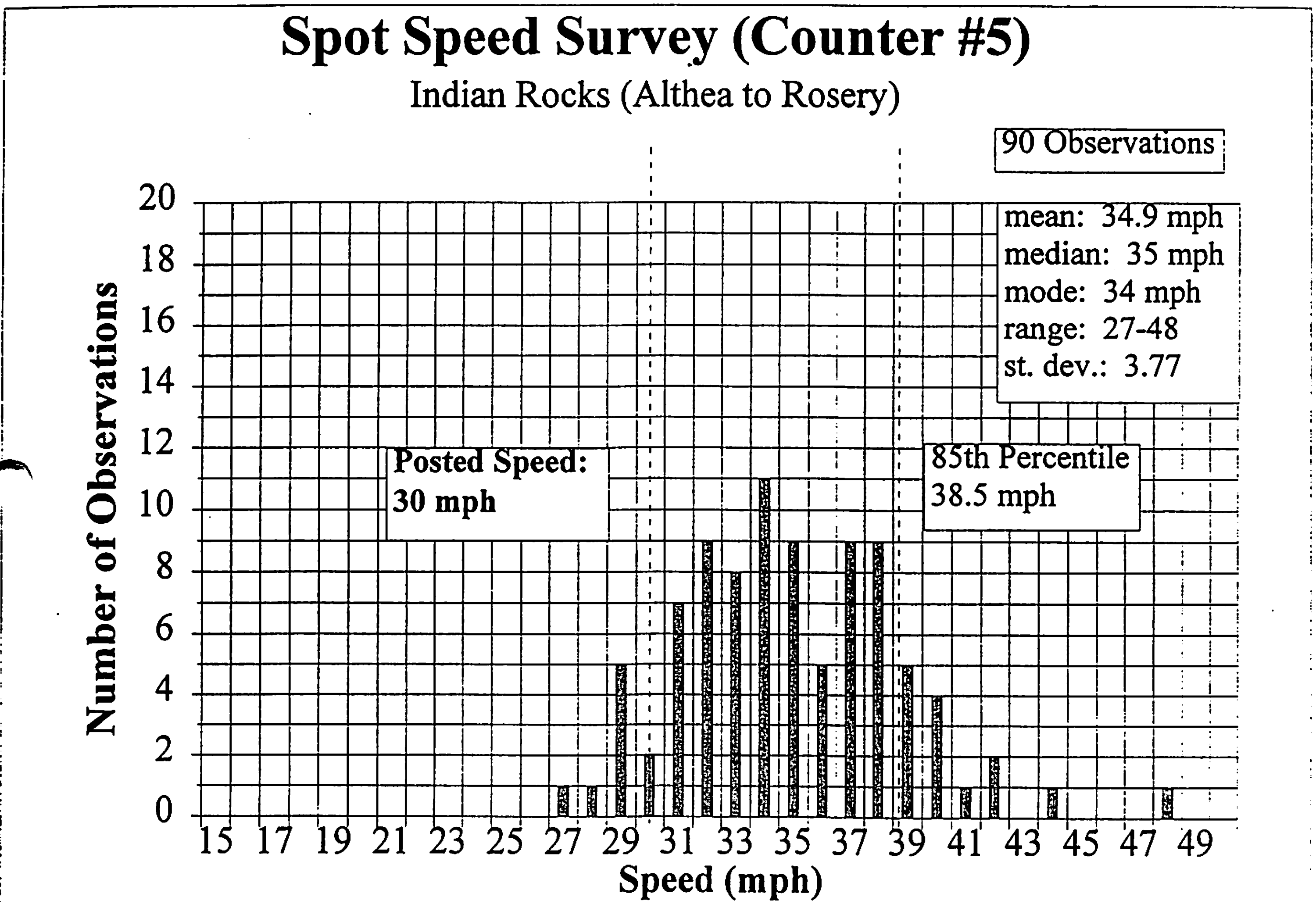
Spot Speed Survey (Counter #1)
Druid (Ambleside to Coe)
90 Observations
mean: 32.6 mph
median: 33 mph
mode: 30 mph
range: 18-45
st. dev.: 4.11
Posted Speed: 30 mph
85th Percentile 36.5 mph
Number of Observations
20
18
16
14
12
10
8
6
4
2
0
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

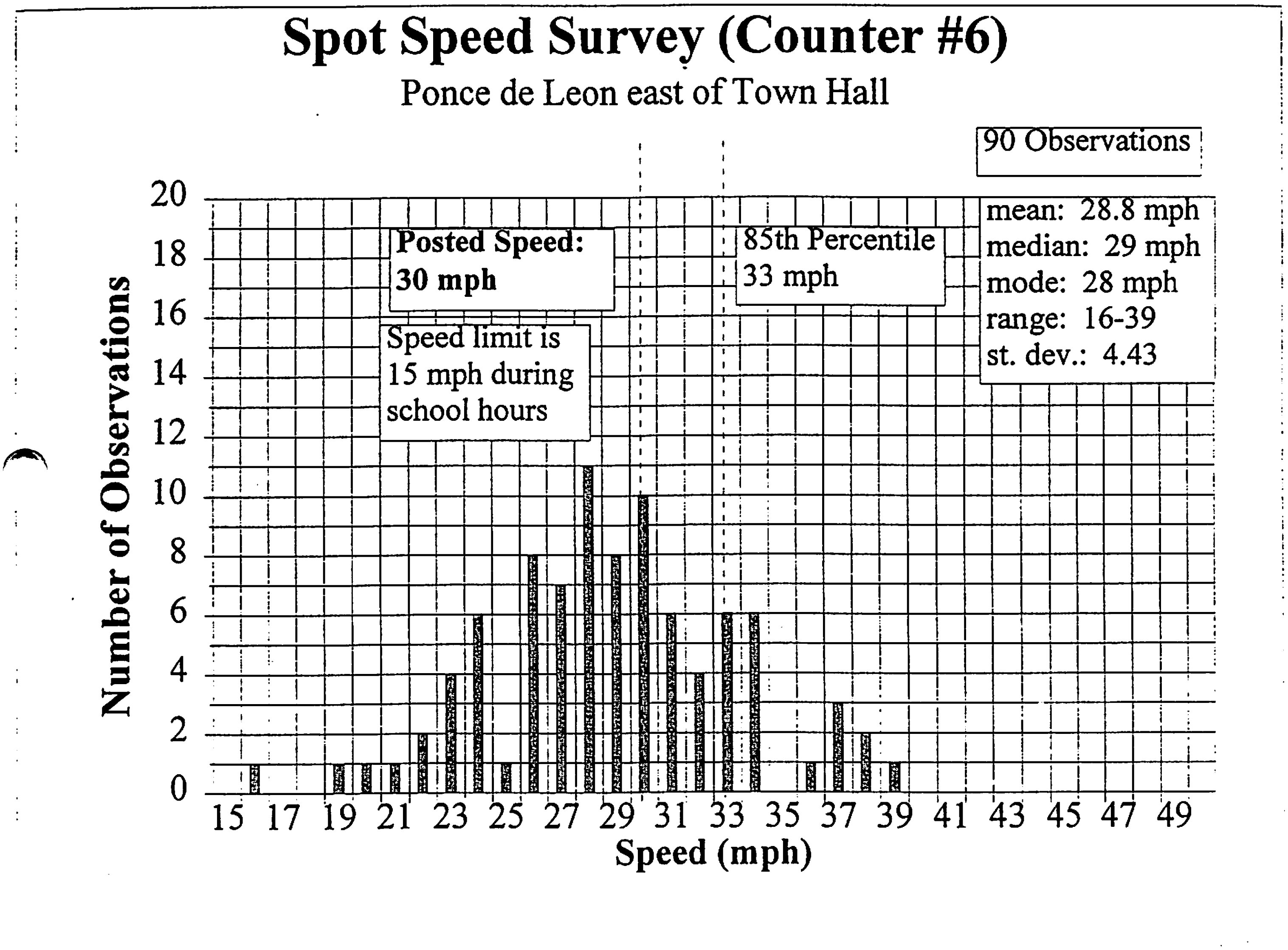

Spot Speed Survey (Counter #2)
Belleview (S. Ft. Harrison to Orange)
90 Observations
mean: 31.5 mph
median: 32 mph
mode: 34 mph
range: 23-40
st. dev.: 3.16
Posted Speed:
30 mph
85th Percentile
34.5 mph
Number of Observations
20
18
16
14
12
10
8
6
4
2
0
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)



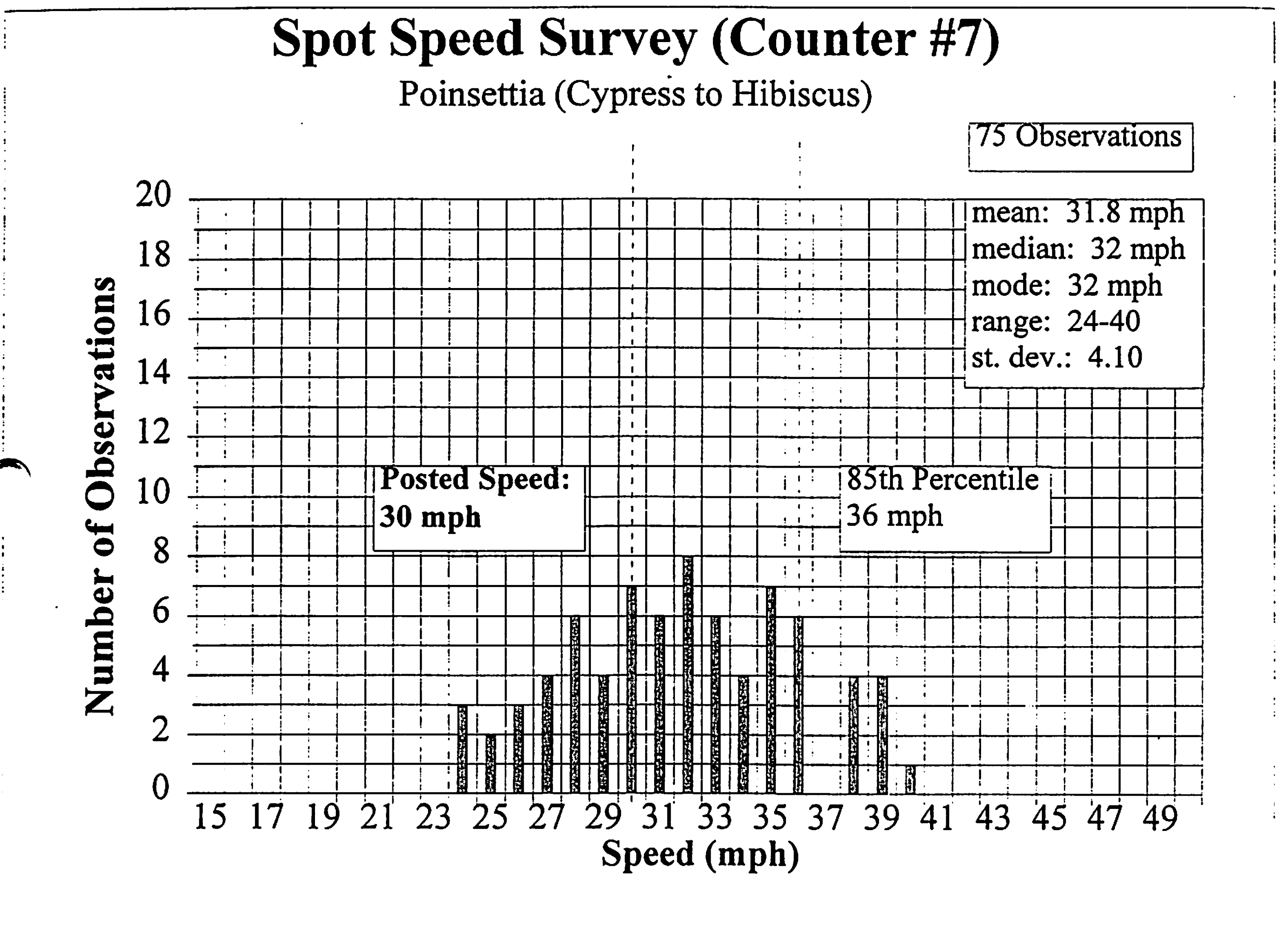
Spot Speed Survey (Counter #3)
Indian Rocks (Overbrook to Eastleigh)
90 Observations
mean: 34.6 mph
median: 34 mph
mode: 33 mph
range: 24-44
st. dev.: 3.36
Posted Speed:
30 mph
85th Percentile
37 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

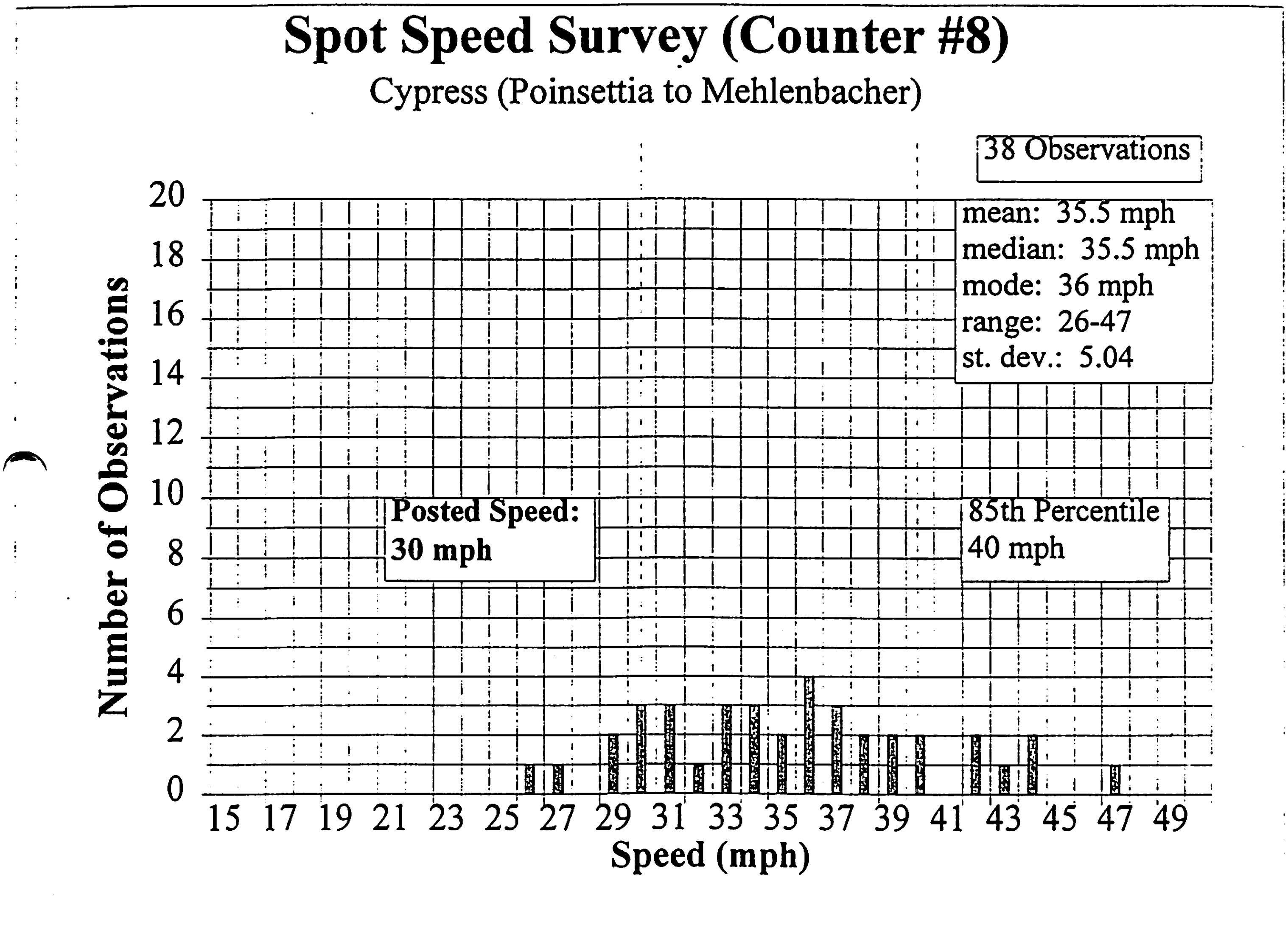

Spot Speed Survey (Counter #4)
Indian Rocks (Osceola to Poinsettia)
90 Observations
mean: 33.1 mph
median: 33 mph
mode: 32 mph
range: 22-48
st. dev.: 3.66
Posted Speed:
30 mph
85th Percentile
36 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

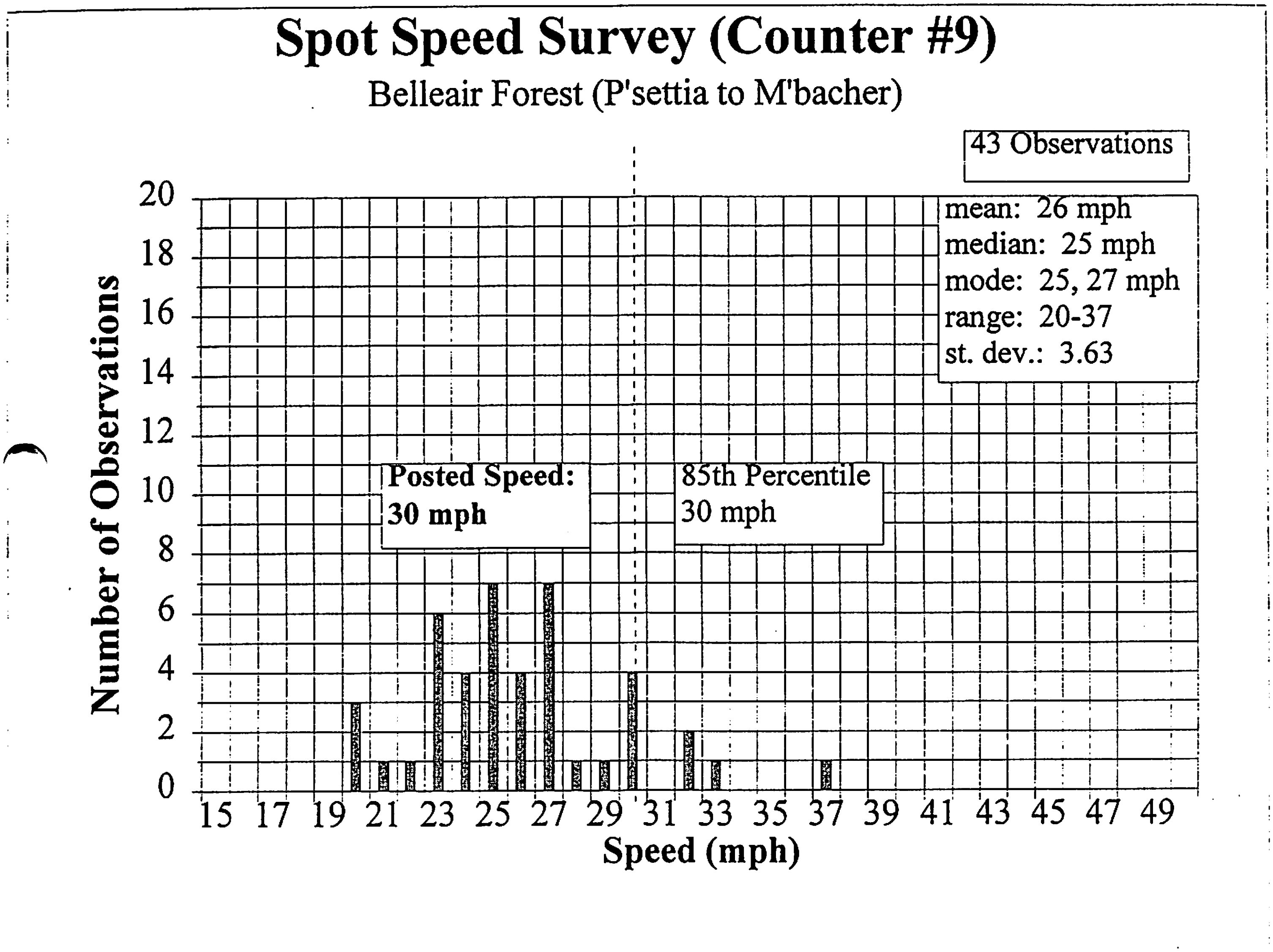

Spot Speed Survey (Counter #5)
Indian Rocks (Althea to Rosery)
90 Observations
mean: 34.9 mph
median: 35 mph
mode: 34 mph
range: 27-48
st. dev.: 3.77
Posted Speed:
30 mph
85th Percentile
38.5 mph
Number of Observations
20
18
16
14
12
10
8
6
4
2
0
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

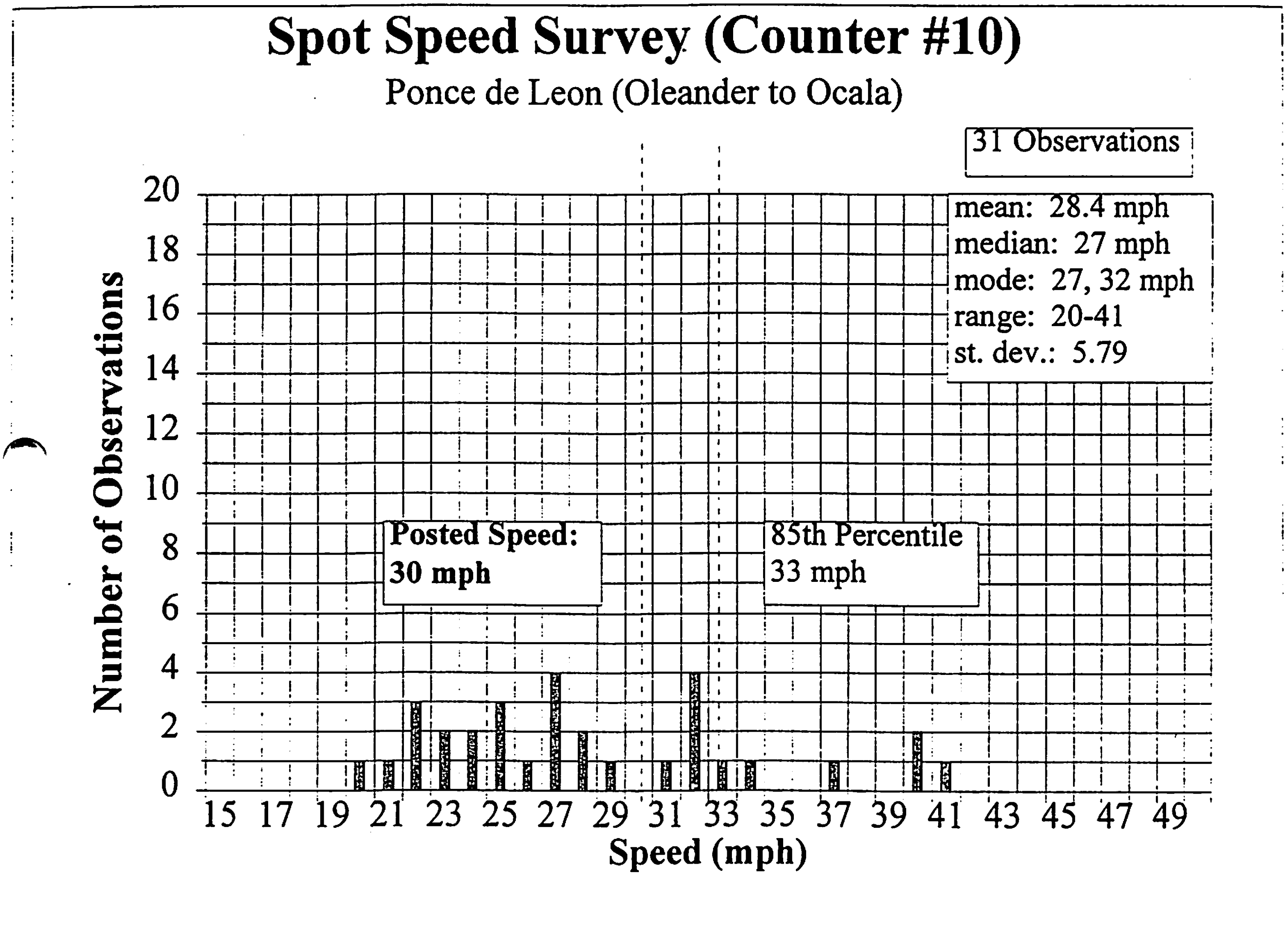


Spot Speed Survey (Counter #6)
Ponce de Leon east of Town Hall
90 Observations
mean: 28.8 mph
median: 29 mph
mode: 28 mph
range: 16-39
st. dev.: 4.43
Posted Speed: 30 mph
85th Percentile 33 mph
Speed limit is 15 mph during school hours
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

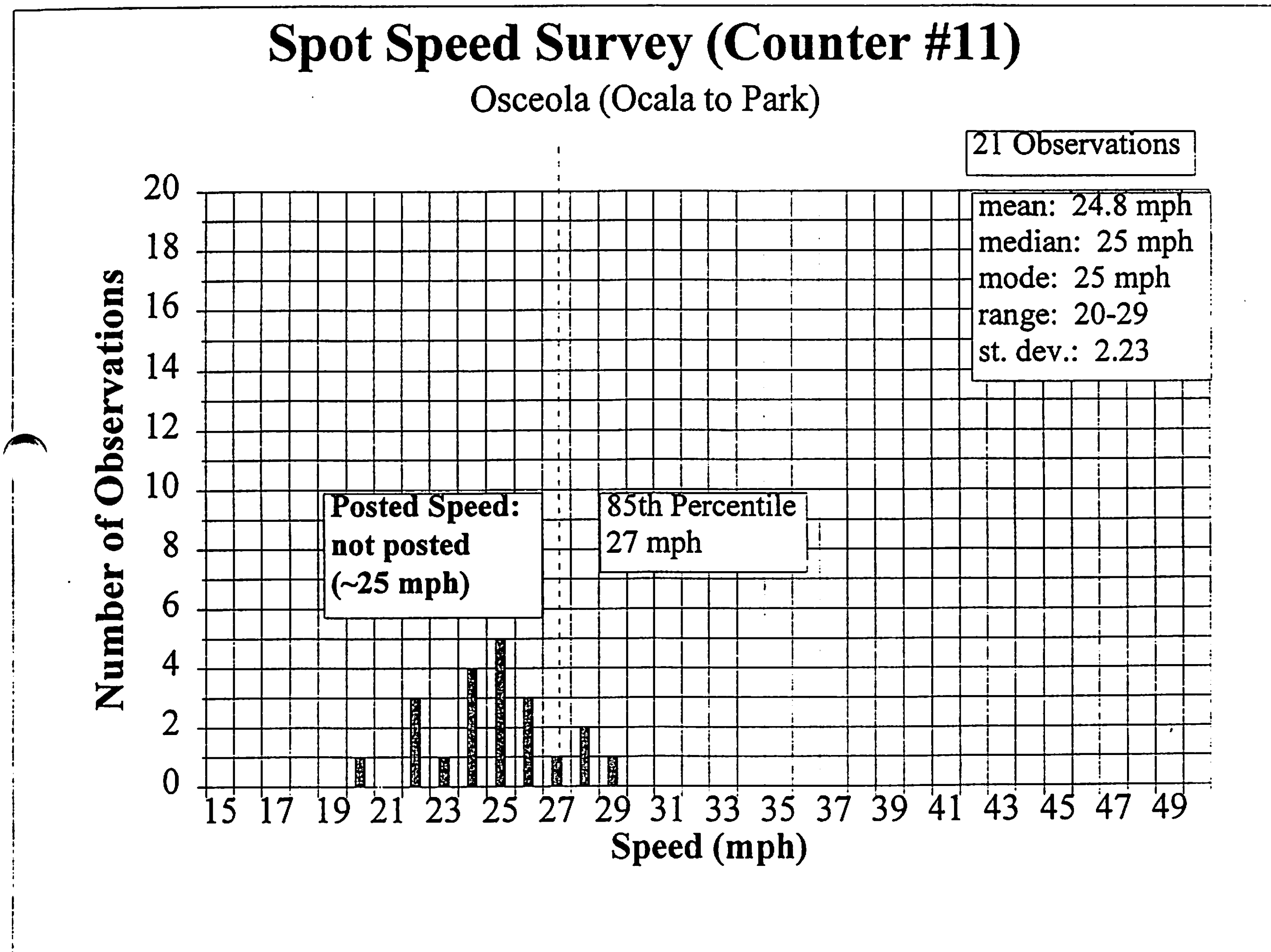

Spot Speed Survey (Counter #7)
Poinsettia (Cypress to Hibiscus)
75 Observations
mean: 31.8 mph
median: 32 mph
mode: 32 mph
range: 24-40
st. dev.: 4.10
Posted Speed:
30 mph
85th Percentile
36 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

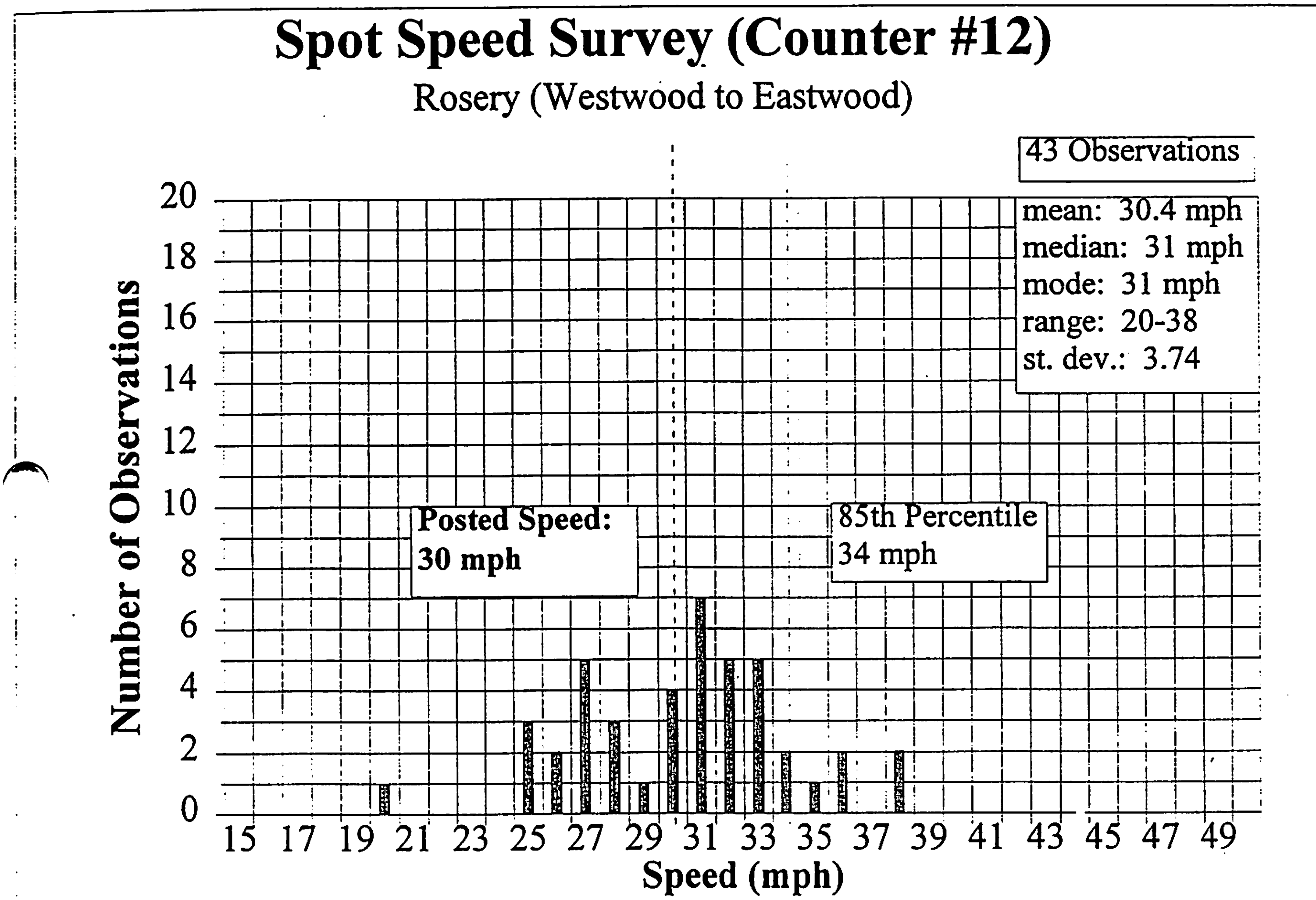

Spot Speed Survey (Counter #8)
Cypress (Poinsettia to Mehlenbacher)
38 Observations
mean: 35.5 mph
median: 35.5 mph
mode: 36 mph
range: 26-47
st. dev.: 5.04
Posted Speed:
30 mph
85th Percentile
40 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)


Spot Speed Survey (Counter #9)
Belleair Forest (P'settia to M'bacher)
43 Observations
mean: 26 mph
median: 25 mph
mode: 25, 27 mph
range: 20-37
st. dev.: 3.63
Posted Speed:
30 mph
85th Percentile
30 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

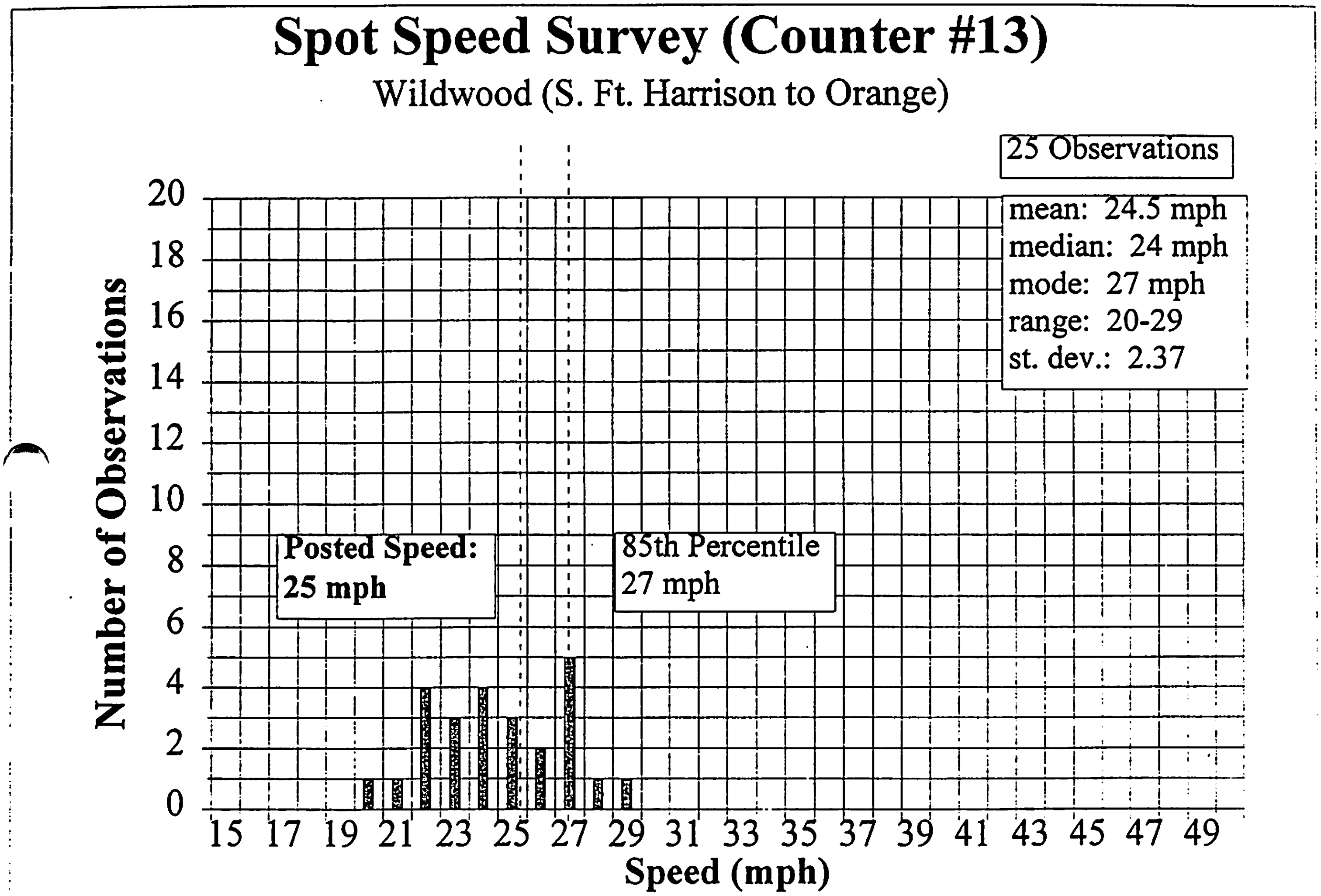


Spot Speed Survey (Counter #10)
Ponce de Leon (Oleander to Ocala)
31 Observations
mean: 28.4 mph
median: 27 mph
mode: 27, 32 mph
range: 20-41
st. dev.: 5.79
Posted Speed:
30 mph
85th Percentile
33 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

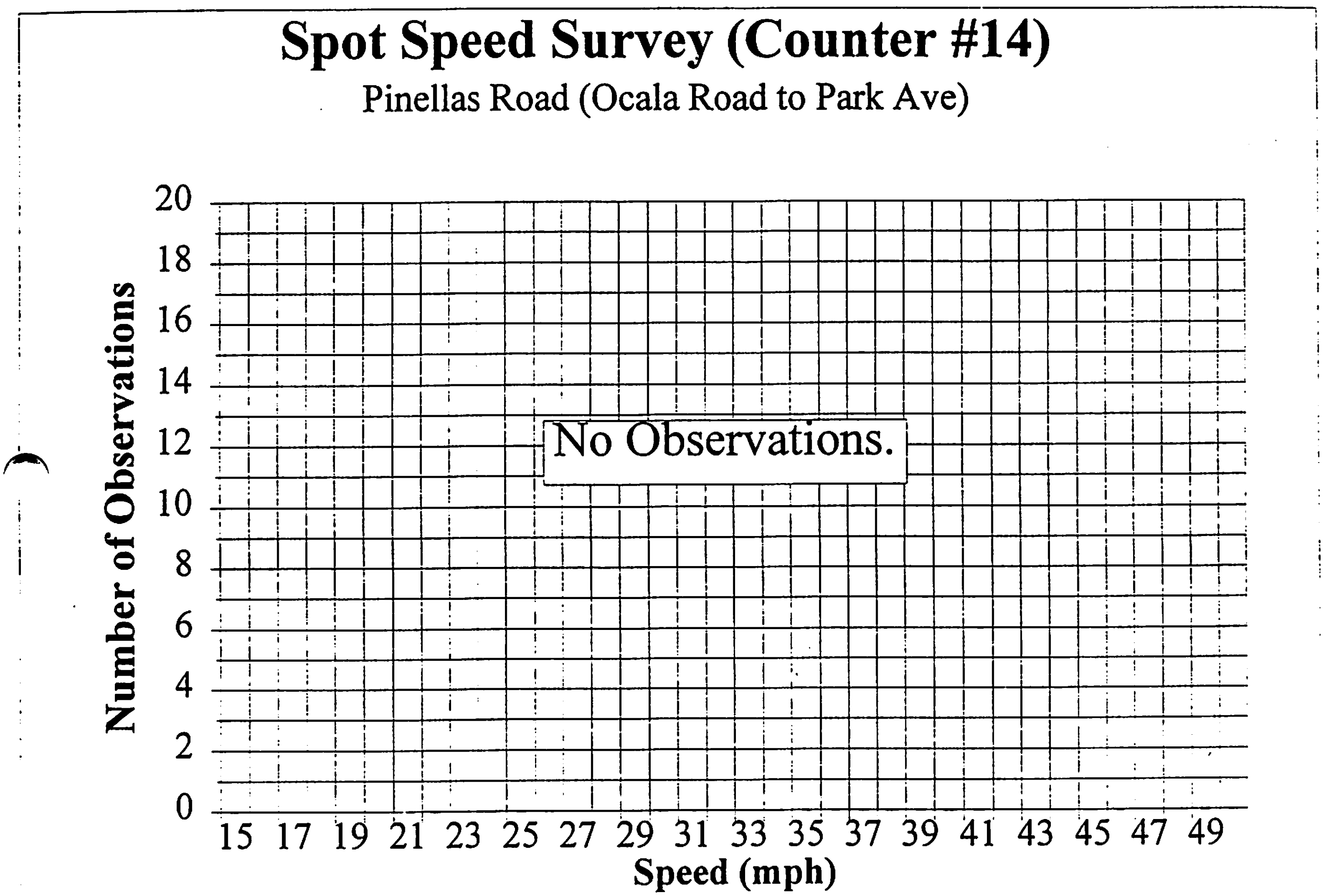

Spot Speed Survey (Counter #11)
Osceola (Ocala to Park)
21 Observations
mean: 24.8 mph
median: 25 mph
mode: 25 mph
range: 20-29
st. dev.: 2.23
Posted Speed:
not posted
(~25 mph)
85th Percentile
27 mph
Number of Observations
Speed (mph)
20
18
16
14
12
10
8
6
4
2
0
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49



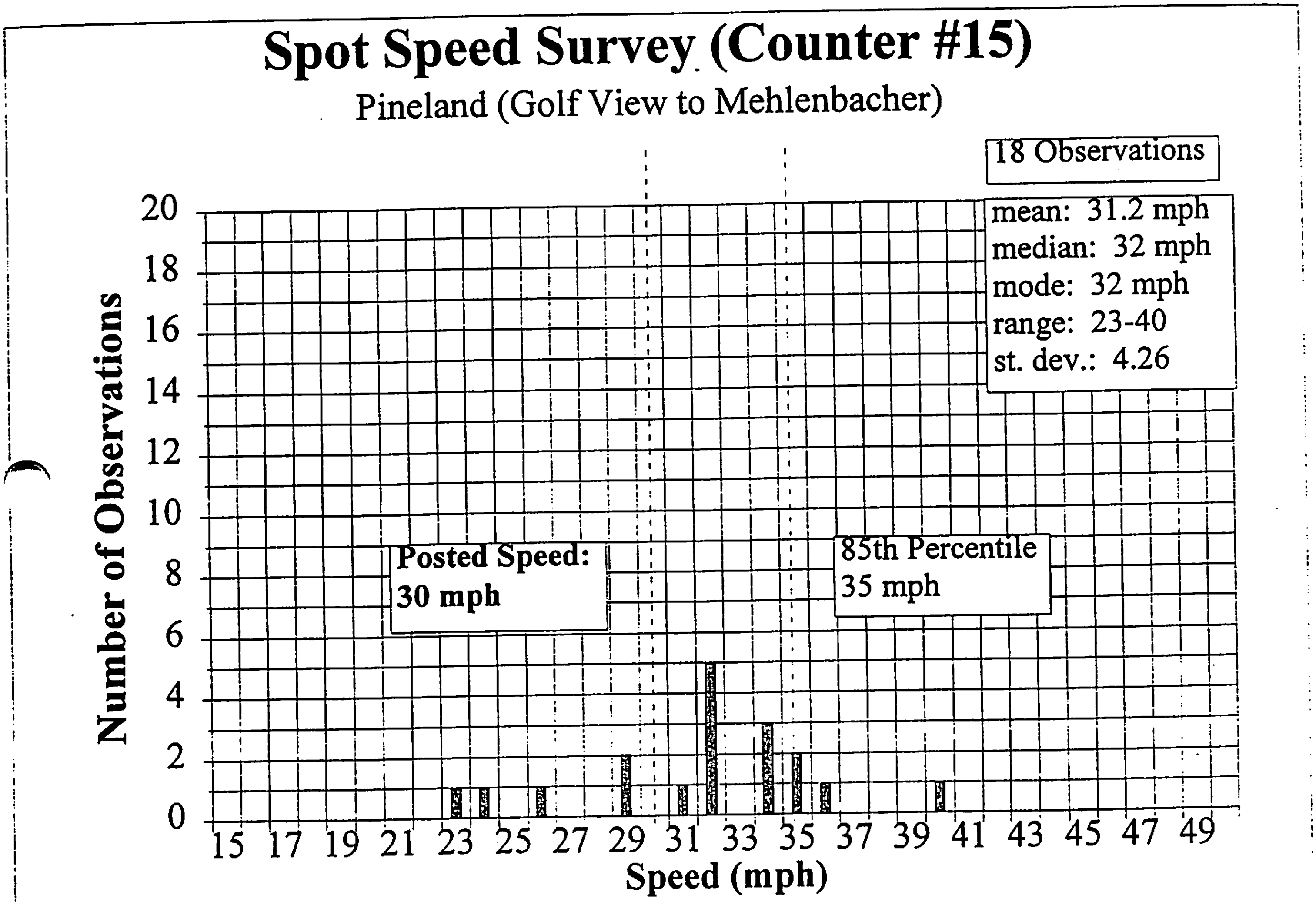
Spot Speed Survey (Counter #12)
Rosery (Westwood to Eastwood)
43 Observations
mean: 30.4 mph
median: 31 mph
mode: 31 mph
range: 20-38
st. dev.: 3.74
Posted Speed:
30 mph
85th Percentile
34 mph
Number of Observations
20
18
16
14
12
10
8
6
4
2
0
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

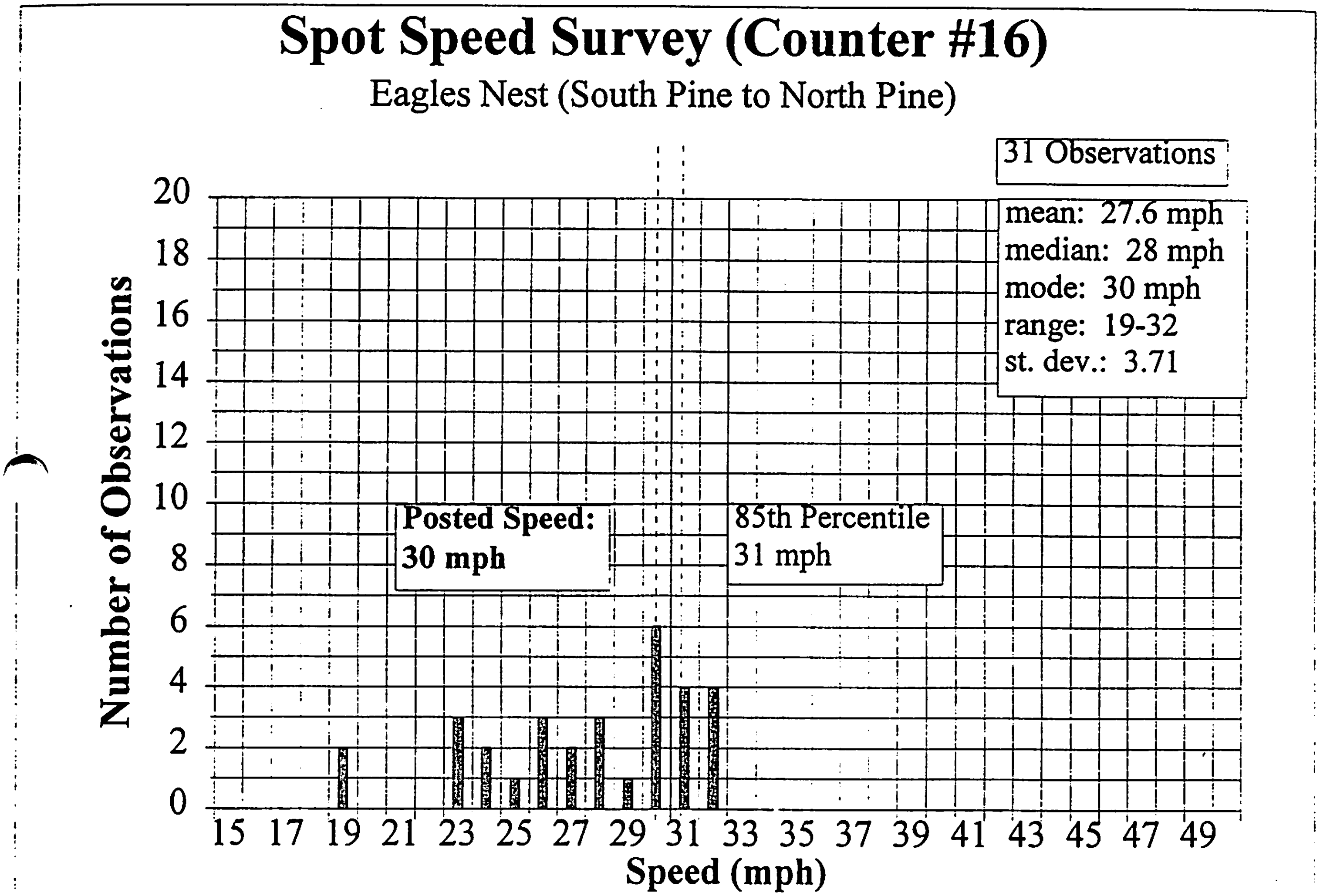


Spot Speed Survey (Counter #13)
Wildwood (S. Ft. Harrison to Orange)
25 Observations
mean: 24.5 mph
median: 24 mph
mode: 27 mph
range: 20-29
st. dev.: 2.37
Posted Speed:
25 mph
85th Percentile
27 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43
45
47
49
Speed (mph)

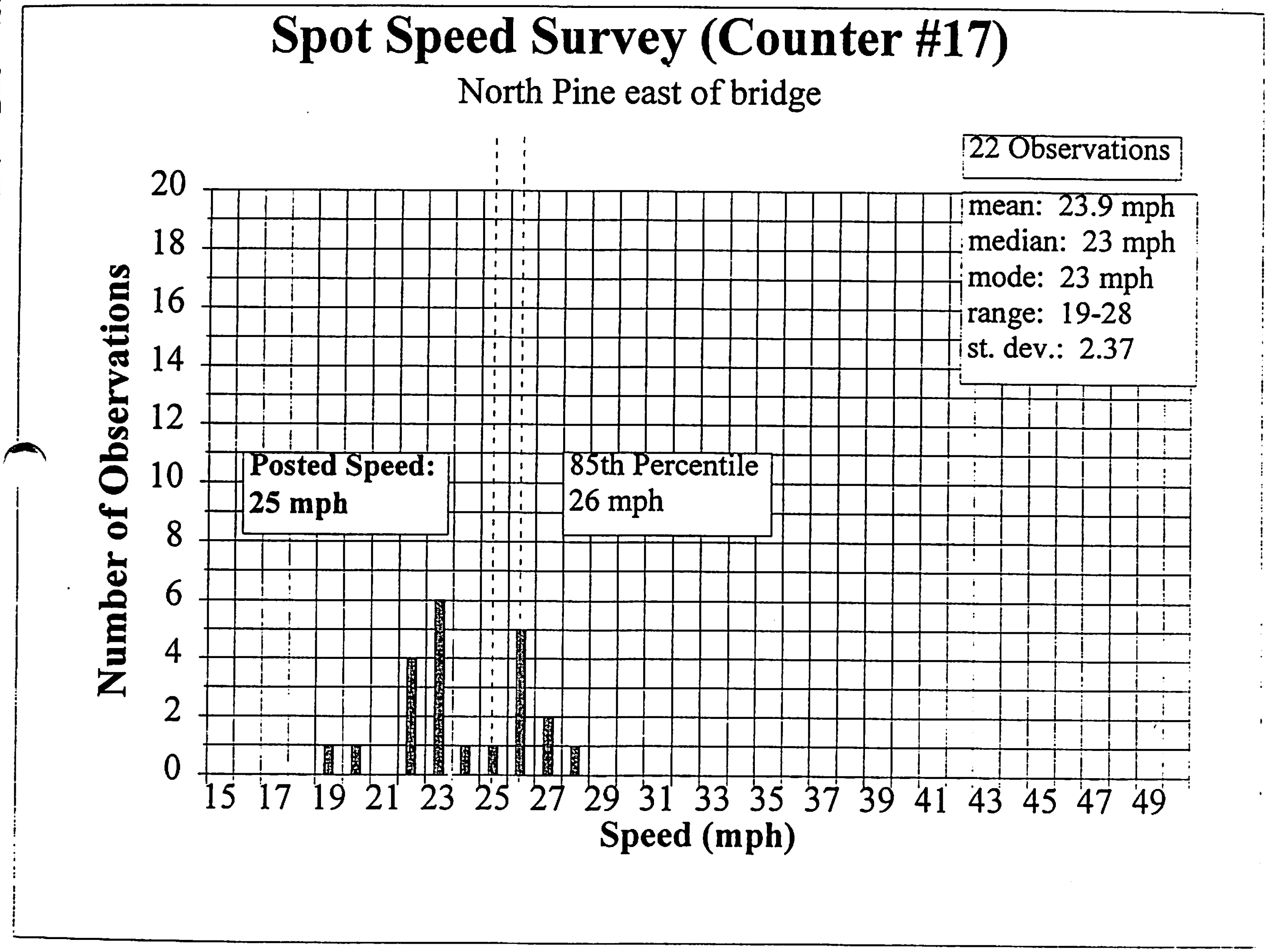


Spot Speed Survey (Counter #14)
Pinellas Road (Ocala Road to Park Ave)
Number of Observations
0 2 4 6 8 10 12 14 16 18 20
No Observations.
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)

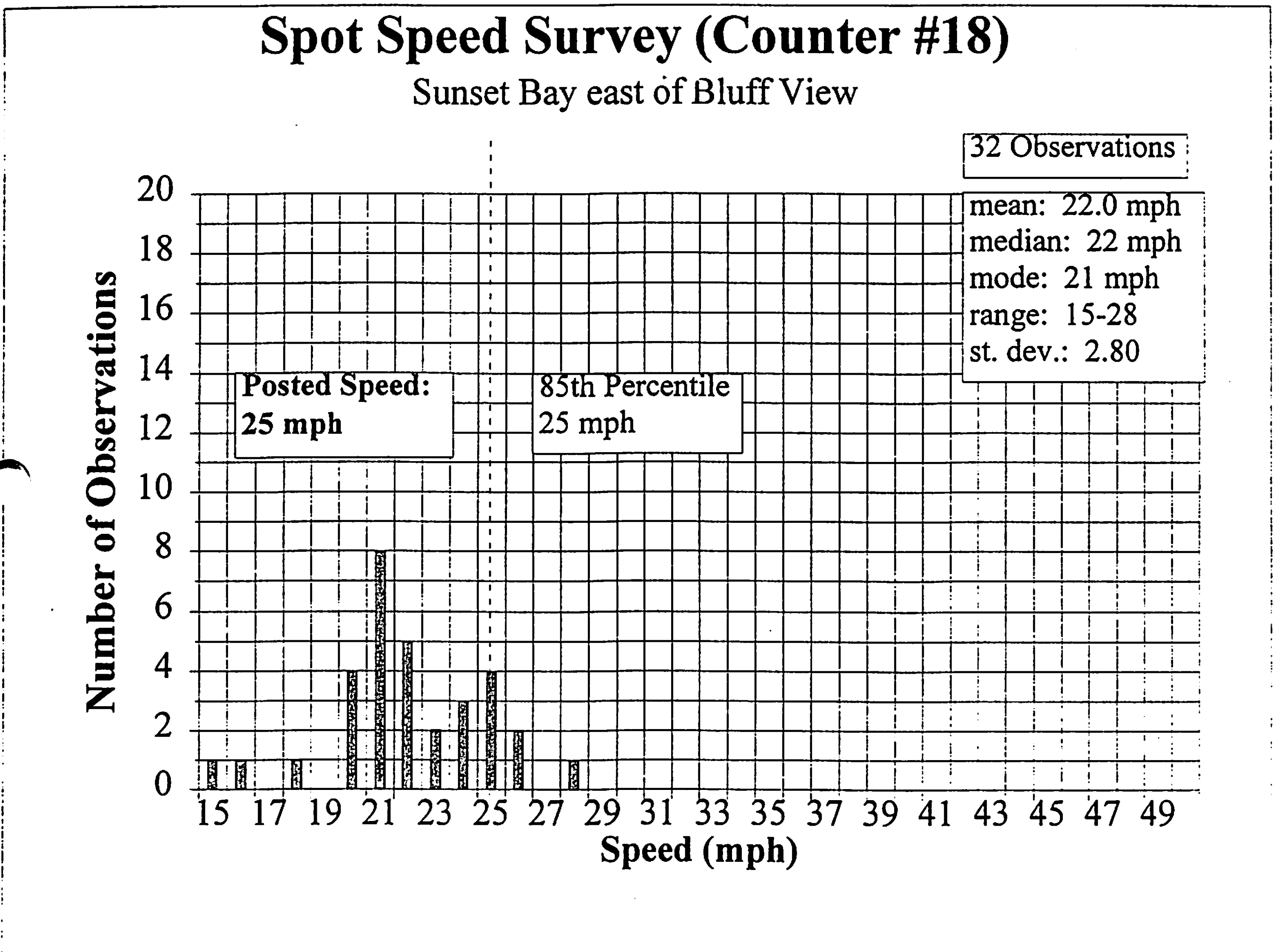

Spot Speed Survey (Counter #15)
Pineland (Golf View to Mehlenbacher)
18 Observations
mean: 31.2 mph
median: 32 mph
mode: 32 mph
range: 23-40
st. dev.: 4.26
Posted Speed:
30 mph
85th Percentile
35 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)



Spot Speed Survey (Counter #16)
Eagles Nest (South Pine to North Pine)
31 Observations
mean: 27.6 mph
median: 28 mph
mode: 30 mph
range: 19-32
st. dev.: 3.71
Posted Speed: 30 mph
85th Percentile 31 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)



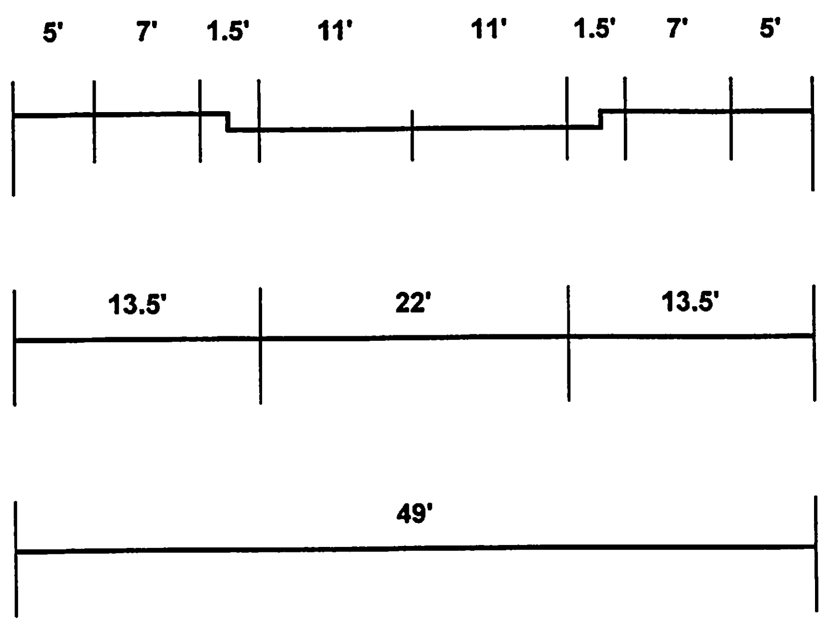
Spot Speed Survey (Counter #17)
North Pine east of bridge
22 Observations
mean: 23.9 mph
median: 23 mph
mode: 23 mph
range: 19-28
st. dev.: 2.37
Posted Speed:
25 mph
85th Percentile
26 mph
Number of Observations
0
2
4
6
8
10
12
14
16
18
20
15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
Speed (mph)


Spot Speed Survey (Counter #18)
Sunset Bay east of Bluff View
32 Observations
mean: 22.0 mph
median: 22 mph
mode: 21 mph
range: 15-28
st. dev.: 2.80
Posted Speed: 25 mph
85th Percentile 25 mph
Number of Observations
Speed (mph)

Counter: #1 **Druid Road between Ambleside Place and Coe Road**

Cross Section: 49 feet

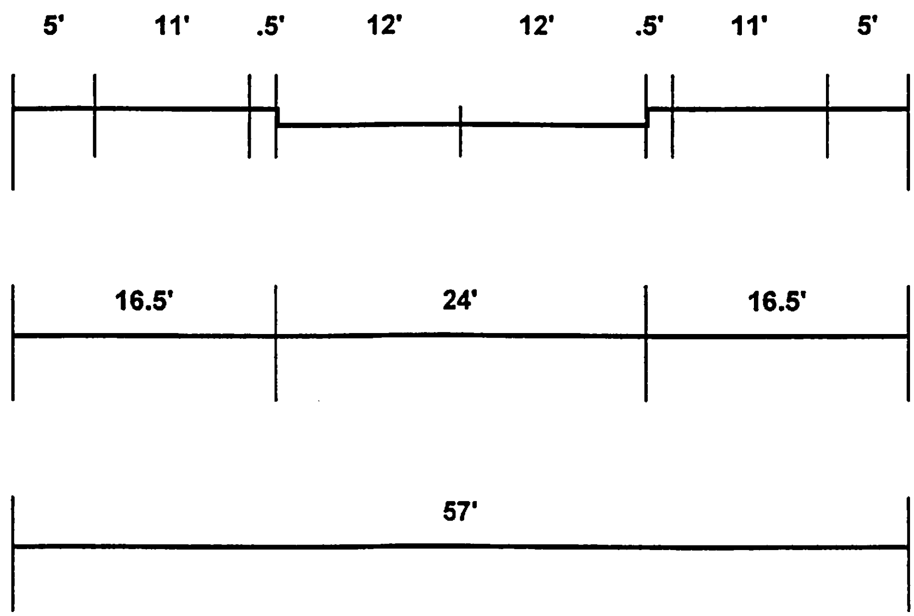
Sidewalks:	5.0 feet
Greenway:	7.0 feet
Curb:	0.5 feet
Gutter:	1.0 feet
Lane:	11.0 feet
Median:	N/A



Counter: **#2** **Belleview Boulevard between S. Ft. Harrison Avenue and Orange Avenue**

Cross Section: **57 feet**

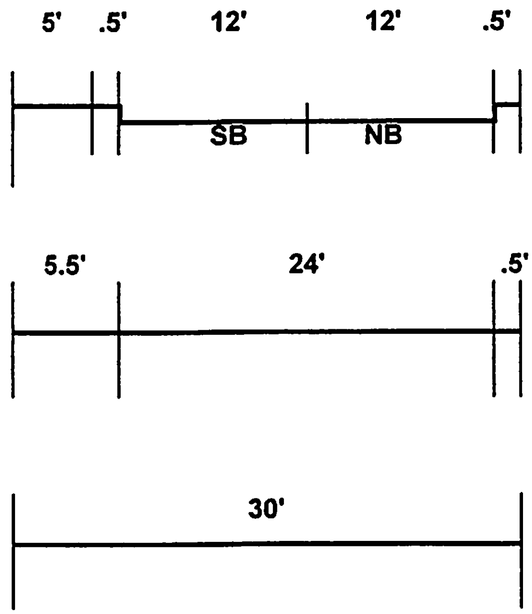
Sidewalks:	5.0 feet
Greenway:	11.0 feet
Curb:	0.5 feet
Gutter:	N/A
Lane:	12.0 feet
Median:	N/A



Counter: #3 Indian Rocks Road between Osceola Road and Poinsettia Road

Cross Section: 30 feet

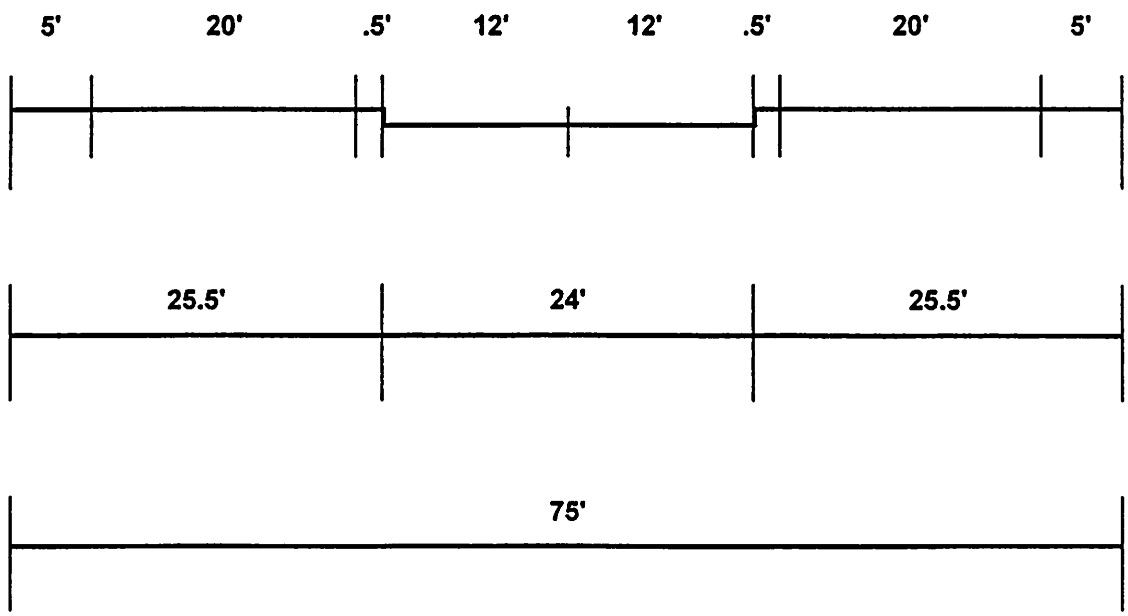
Sidewalks: 5.0 feet
Greenway: N/A
Curb: 0.5 feet
Gutter: N/A
Lane: 12.0 feet
Median: N/A



Counter: #4 **Indian Rocks Road between Osceola Road and Poinsettia Road**

Cross Section: 75 feet

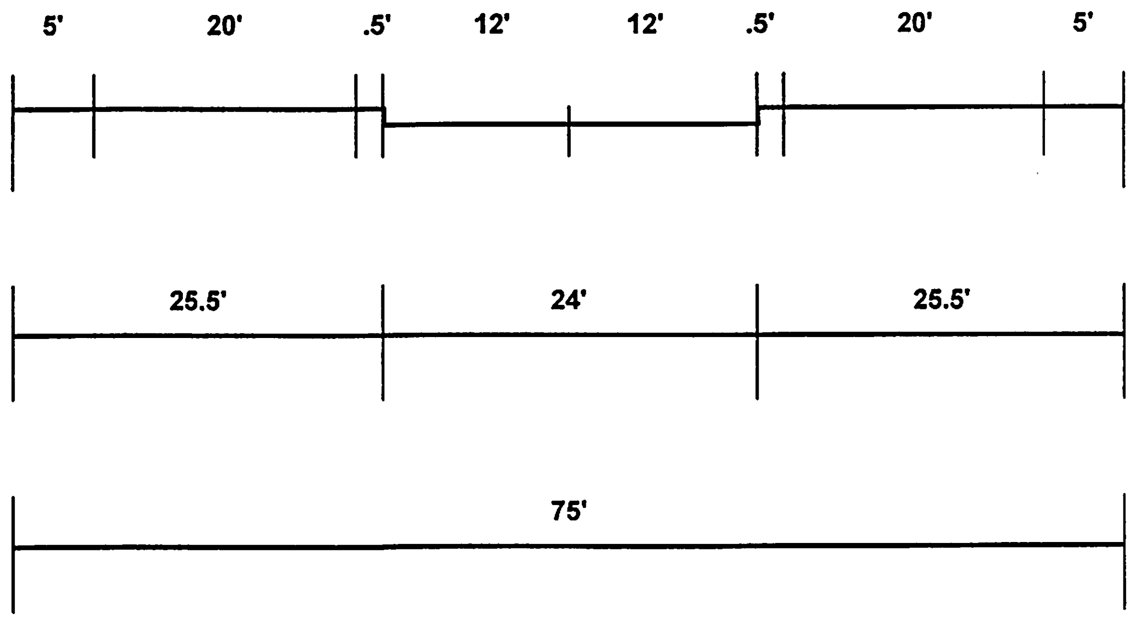
Sidewalks:	5.0 feet
Greenway:	20.0 feet
Curb:	0.5 feet
Gutter:	N/A
Lane:	12.0 feet
Median:	N/A



Counter: #5 **Indian Rocks Road between Althea Road and Rosery Road**

Cross Section: **75 feet**

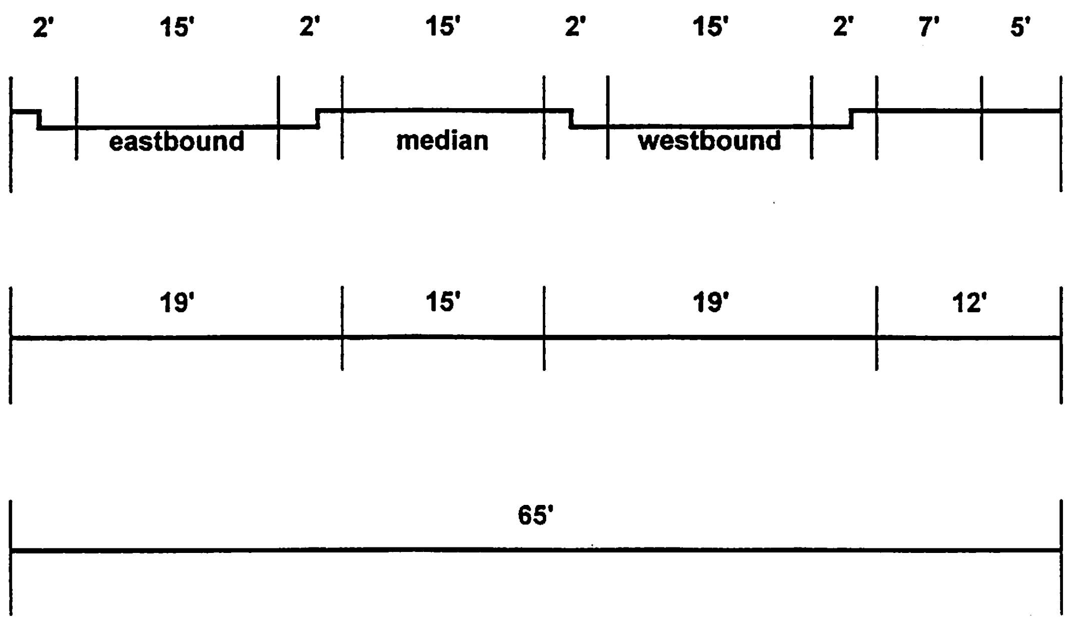
Sidewalks:	5.0 feet
Greenway:	20.0 feet
Curb:	0.5 feet
Gutter:	N/A
Lane:	12.0 feet
Median:	N/A



Counter: **#6** **Ponce de Leon Boulevard between The Mall and Varona Avenue (east of Town Hall)**

Cross Section: **65 feet**

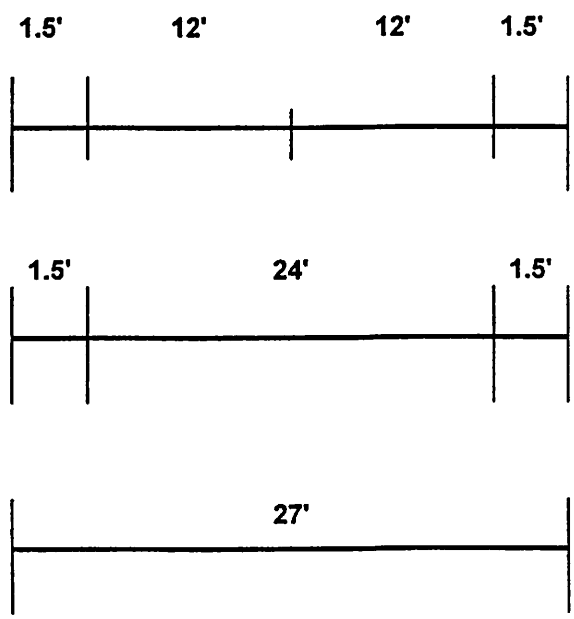
Sidewalks: 5.0 feet
Greenway: 7.0 feet
Curb: 0.5 feet
Gutter: 1.5 feet
Lane: 15.0 feet
Median: 15.0 feet



Counter: #7 **Poinsettia Road between Cypress Avenue and Hibiscus Road**

Cross Section: 27 feet

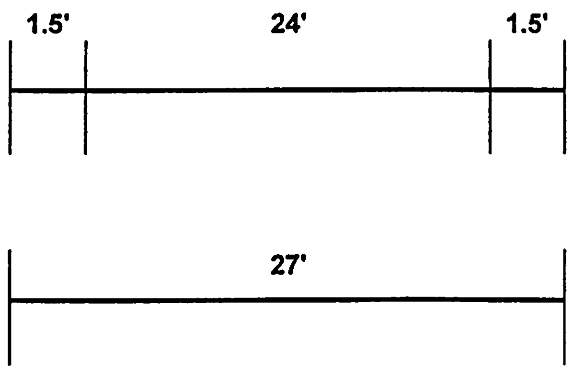
Sidewalks: N/A
Greenway: N/A
Curb: N/A
Gutter: 1.5 feet
Lane: 12.0 feet
Median: N/A



Counter: #8 **Cypress Avenue between Poinsettia Road and Mehlenbacher Road**

Cross Section: 27 feet

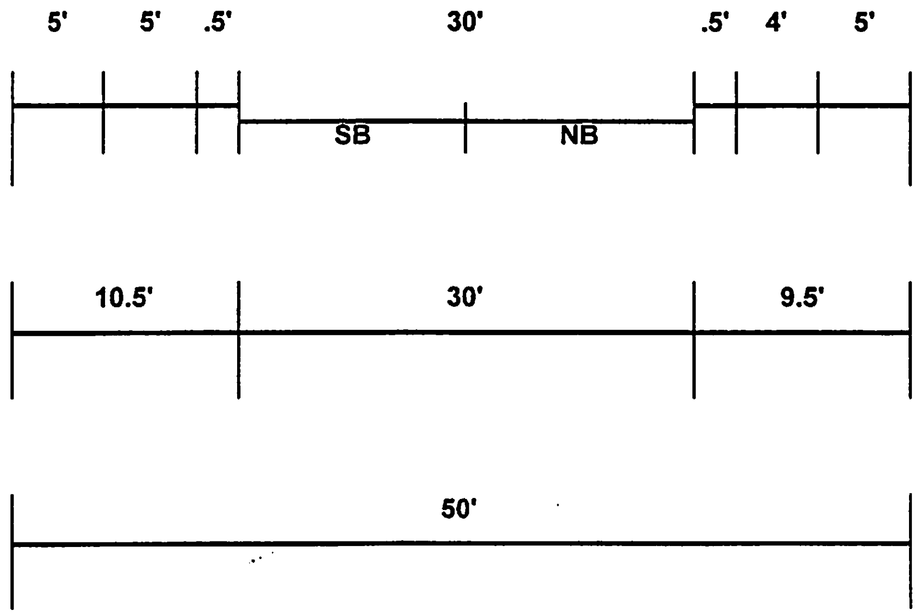
Sidewalks:	N/A
Greenway:	N/A
Curb:	N/A
Gutter:	1.5 feet
Lane:	24.0 feet
Median:	N/A



Counter: #9 **Belleair Forest Drive between Poinsettia Road and Mehlenbacher Road**

Cross Section: 50 feet

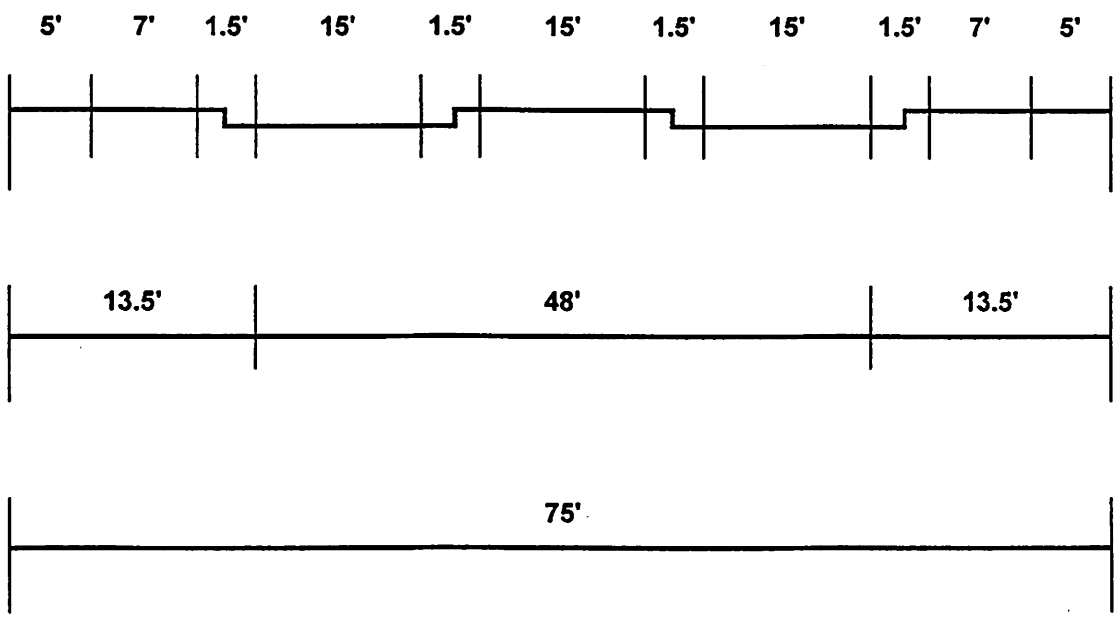
Sidewalks:	5.0 feet
Greenway:	5.0 and 4.0 feet
Curb:	0.5 feet
Gutter:	N/A
Lane:	30 feet
Median:	N/A



Counter: #10 Ponce de Leon Boulevard between Oleander Road and Ocala Road

Cross Section: 75 feet

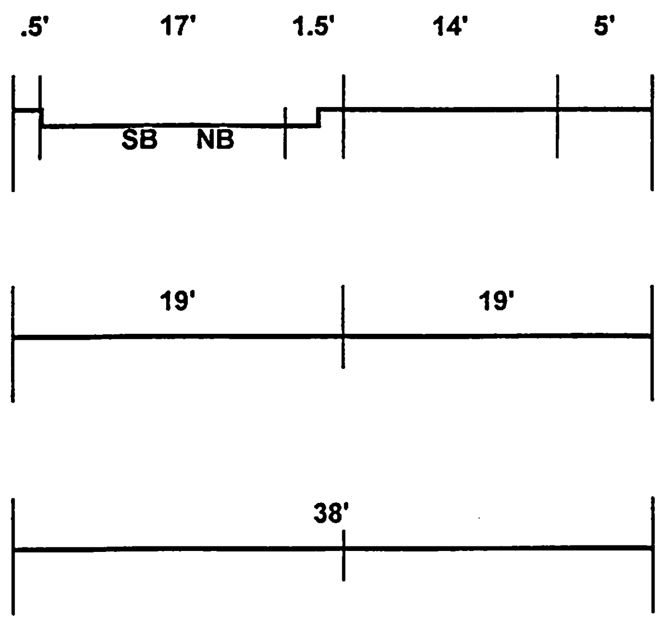
Sidewalks:	5.0 feet
Greenway:	7.0 feet
Curb:	0.5 feet
Gutter:	1.0 feet
Lane:	15.0 feet
Median:	15.0 feet



Counter: #11 Osceola Road between Park Avenue and Ocala Road

Cross Section: 38 feet

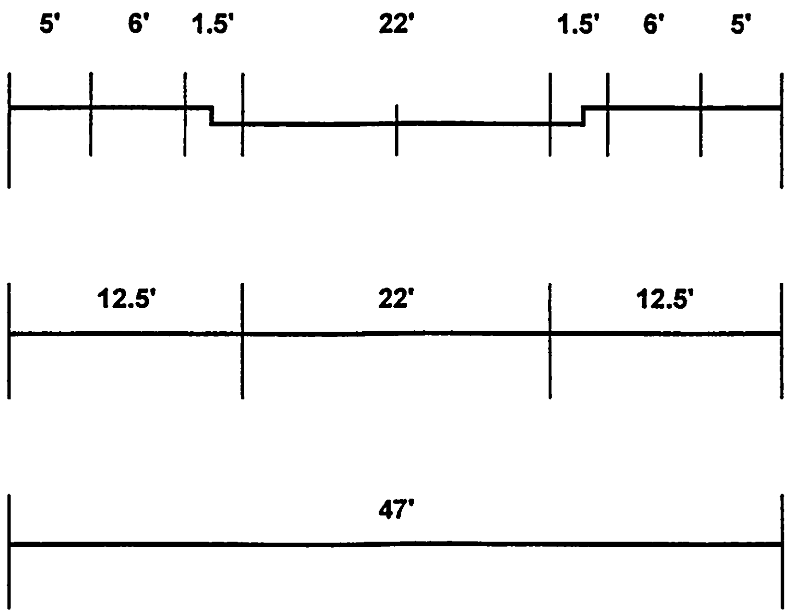
Sidewalks:	5.0 feet
Greenway:	14.0 feet
Curb:	0.5 feet
Gutter:	1.0 foot
Lane:	17.0 feet
Median:	N/A



Counter: #12 Rosery Road between Westwood Lane and Eastwood Lane

Cross Section: 47 feet

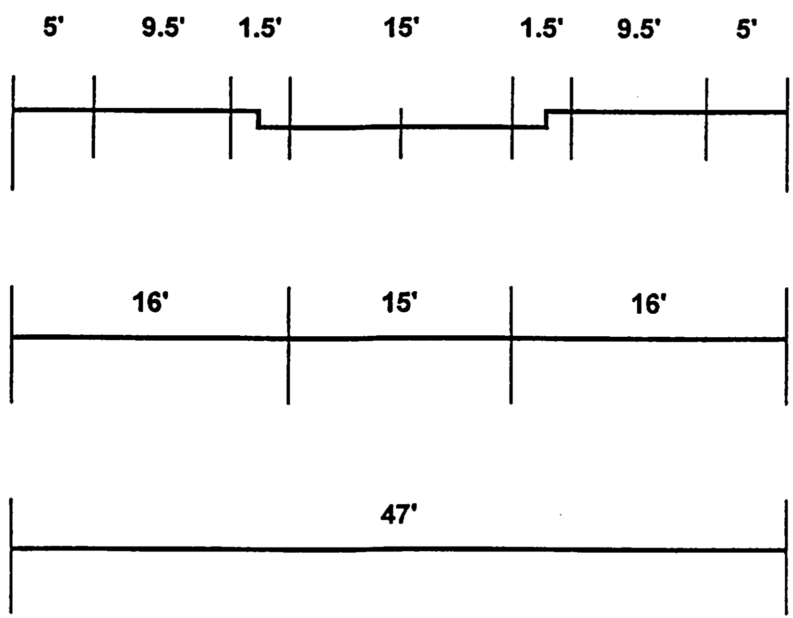
Sidewalks: 5.0 feet
Greenway: 6.0 feet
Curb: 0.5 feet
Gutter: 1.0 feet
Lane: 22.0 feet
Median: N/A



Counter: **#13** **Wildwood Way between S. Ft. Harrision Avenue and Orange Avenue**

Cross Section: **47 feet**

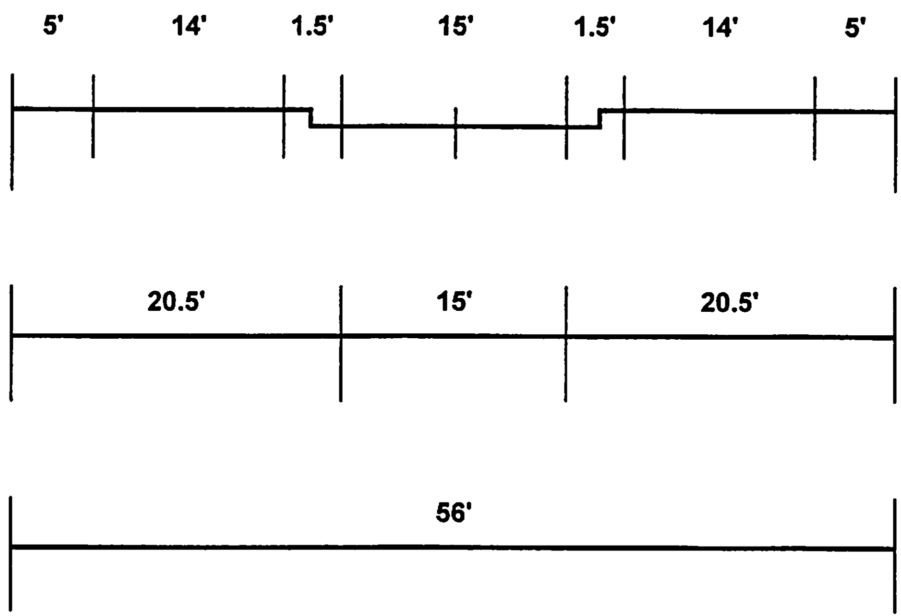
Sidewalks:	5.0 feet
Greenway:	9.5 feet
Curb:	0.5 feet
Gutter:	1.0 feet
Lane:	15.0 feet
Median:	N/A



Counter: #14 Pinellas Road between Poinsettia Road and Park Avenue

Cross Section: 56 feet

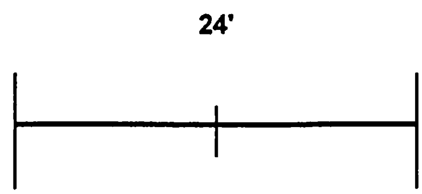
Sidewalks:	5.0 feet
Greenway:	14.0 feet
Curb:	0.5 feet
Gutter:	1.0 feet
Lane:	15.0 feet
Median:	N/A



Counter: #15 Pineland Avenue between Golf View Drive and Mehlenbacher Road

Cross Section: 24 feet

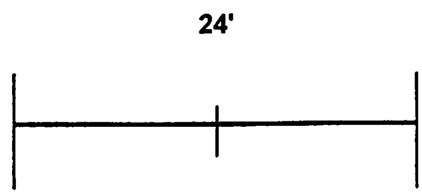
Sidewalks: N/A
Greenway: N/A
Curb: N/A
Gutter: N/A
Lane: 24.0 feet
Median: N/A



Counter: #16 **Eagles Nest Drive between North Pine Circle South Pine Circle**

Cross Section: 24 feet

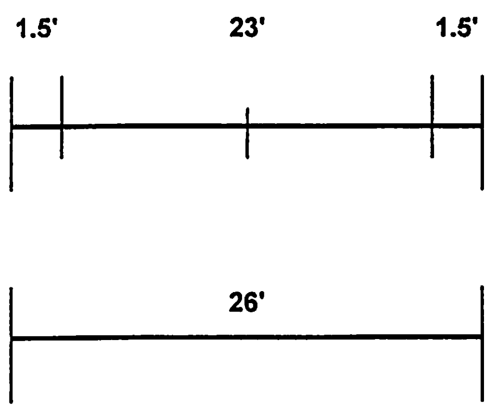
Sidewalks: N/A
Greenway: N/A
Curb: N/A
Gutter: N/A
Lane: 24.0 feet
Median: N/A



Counter: #17 North Pine Circle west of bridge

Cross Section: 26 feet

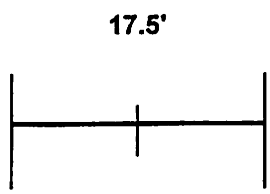
Sidewalks: N/A
Greenway: N/A
Curb: N/A
Gutter: 1.5 feet
Lane: 23.0 feet
Median: N/A



Counter: #18 Sunset Bay Drive

Cross Section: 17.5 feet

Sidewalks:	N/A
Greenway:	N/A
Curb:	N/A
Gutter:	N/A
Lane:	17.5 feet
Median:	N/A



TABULAR SUMMARY OF TURN MOVEMENT COUNTS

City Belleair, Florida **Date** October 29, 1996 **Observer** Ben Chandler

Intersection of Indian Rocks Road **and** Poinsettia Road

L = Left
T = Through
R = Right

Beginning Time	North Approach				South Approach				Total North South	East Approach				West Approach				Total East West	Total All
	L	T	R	Total	L	T	R	Total		L	T	R	Total	L	T	R	Total		
7:00	2	27	0	29	0	89	11	100	*129*	6	2	5	13	8	7	0	15	*28*	**157**
7:15	3	47	0	50	0	97	11	108	*158*	5	0	2	7	7	5	0	12	*19*	**177**
7:30	4	56	0	60	0	140	14	154	*214*	11	2	2	15	4	10	1	15	*30*	**244**
7:45	1	60	0	61	0	151	12	163	*224*	14	3	6	23	5	2	4	11	*34*	**258**
8:00	2	57	1	60	0	147	14	161	*221*	17	4	8	29	3	4	1	8	*37*	**258**
8:15	2	46	1	49	1	110	9	120	*169*	12	4	2	18	2	6	1	9	*27*	**196**
8:30	2	75	1	78	2	132	5	139	*217*	16	2	3	21	4	5	1	10	*31*	**248**
8:45	4	88	1	93	1	124	16	141	*234*	21	4	7	32	5	6	7	18	*50*	**284**
AM Totals				480				1,086	1,566				158				98	256	**1,822**
4:00	3	122	0	125	1	83	15	99	*224*	27	4	5	36	1	2	2	5	*41*	**265**
4:15	4	114	0	118	2	71	16	89	*207*	24	2	5	31	4	2	0	6	*37*	**244**
4:30	7	127	0	134	2	84	13	99	*233*	18	5	5	28	3	5	0	8	*36*	**269**
4:45	8	120	0	128	3	100	13	116	*244*	18	7	5	30	5	4	0	9	*39*	**283**
5:00	1	146	2	149	1	101	15	117	*266*	29	7	11	47	1	5	1	7	*54*	**320**
5:15	1	155	1	157	2	98	15	115	*272*	27	5	3	35	0	0	5	5	*40*	**312**
5:30	4	106	0	110	1	66	14	81	*191*	23	6	3	32	3	2	0	5	*37*	**228**
5:45	1	112	1	114	2	78	12	92	*206*	22	9	5	36	3	4	1	8	*44*	**250**
PM Totals				1,035				808	*1,843*				275				53	*328*	**2,171**

AM		PM	
Total Volume	1822	**Total Volume**	2171
Peak Hour (begins)	8:00	**Peak Hour (begins)**	4:30
Peak Hour Volume	986	**Peak Hour Volume**	1184
Peak Hour Factor	0.87	**Peak Hour Factor**	0.93