CHAPTER 10

Traffic Calming in New Developments

Contemporary suburbs might appear to be traffic calmed from the outset, because the tree-like structure of suburban networks keeps through traffic off local access streets. Yet, as noted in "From Volume to Speed Controls" in chapter 3, this does not prevent speeding on longer cul-de-sacs or on residential subcollectors and collectors leading from those cul-de-sacs to the regional road network.

The problem is exemplified by the acclaimed Laguna West development, outside Sacramento, CA (see figure 10.1). Residents living on the many short cul-de-sacs are protected from speeding and cut-through traffic (see figure 10.2). Those living on the through streets are not so fortunate (see figure 10.3). The traffic problems are so serious on the axial roads to the town center that they have been walled off from some of the abutting residences, a practice that runs counter to the New Urbanist philosophy.[1]

Relatively little has been written about traffic calming in new developments, and experience is limited, too. The first section of this chapter reviews efforts of featured communities to calm traffic in new developments and identifies regulatory mechanisms that have been used to influence development decisions.

The second section outlines street network design principles from the State of Florida's *Best Development Practices*.[2] The principles are intended to produce a roadway network within which traffic is dispersed and slowed naturally (i.e., without the need of physical traffic calming measures). The result is potentially narrower street cross sections and shorter access trips to the regional road network, leaving drivers less inclined to speed.

The third section presents alternative street geometric standards developed for the Wilmington Area Planning Council in Delaware. These standards offer a traffic calming alternative to the more conventional standards of the American Association of State Highway and Transportation Officials (AASHTO).

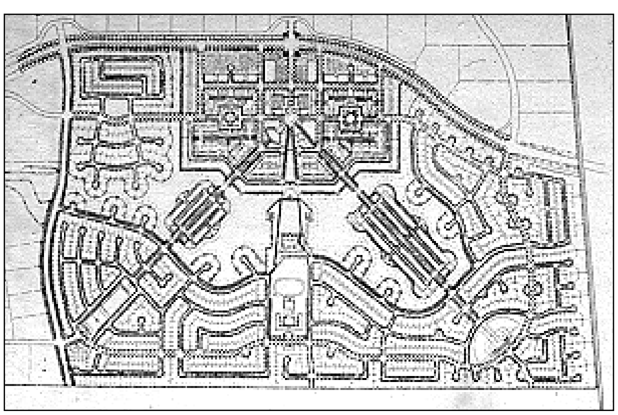

Figure 10.1. New Urbanist Network. (Laguna West, CA)

Figure 10.2. Short Cul-de-Sac Protected from Traffic. (Laguna West, CA)

Figure 10.3. Axial Road with a Traffic Problem. (Laguna West, CA)

Regulations of Featured Communities

Perhaps because they spend so much time on retrofits, the featured communities are more sensitive than most to the need to calm traffic in new developments. Table 10.1 summarizes their efforts in new developments to date. Communities not listed are largely built-out. Following the table, a few exemplary efforts are highlighted.

Subdivision Regulations—Phoenix, AZ

Phoenix has adopted policies to discourage cut-through traffic in new developments. These policies are administered through the subdivision process. The ordinance states:

> Local streets should be discontinuous and generally should be interrupted with jogs and offsets. Four-way intersections should be avoided.[3]

Table 10.1. Efforts to Calm Traffic in New Developments in Featured Communities.

Community	Measures
Austin, TX	Code requires neighborhood traffic analyses where commercial developments have direct access to residential streets; mitigation is required if more than 300 vehicles are added to daily volumes—one large residential development will include traffic calming measures as a result of a design charrette
Bellevue, WA	Heightened awareness by design engineers—in one case, curb extensions required at a connection to new development
Berkeley, CA	In three cases, calming measures were required as conditions of development approval—an office developer paid for reconstruction of an entire street as a "slow street"
Boulder, CO	Reduced street standards
Charlotte, NC	During subdivision review, T-intersections and circuitous routes are suggested to avoid cut-through traffic on local streets—in one case, a closure was allowed at interface with new development
Eugene, OR	Code provides for narrow streets, alternating parking, etc.—subdivision plans are reviewed for speeding and cut-through traffic problems
Gainesville, FL	In several cases, developers have been encouraged to install and pay for traffic circles—done voluntarily because circles were popular
Gwinnett County, GA	Developers occasionally have been advised to install humps voluntarily—county code may be amended to make humps mandatory
Howard County, MD	New subdivision road standards are proposed to calm traffic naturally—narrowing streets, adding roundabouts at intersections, and requiring slow points at regular intervals
Montgomery County, MD	New town will be test case—raised crossings, humps, chokers, and neckdowns are to be required
Phoenix, AZ	Subdivision regulations and design review standards discourage cut-through traffic—guidance to developers contained in *Calming Phoenix Traffic**
San Diego, CA	During development review, staff refers to *Transit-Oriented Development Design Guidelines***
San Jose, CA	During site plan review, developers are asked to address potential for cut-through traffic—traffic study is required if more than 100 vehicles per peak hour will result from the development
Seattle, WA	In one redevelopment project, circles required to prevent speeding when grid reestablished
Tallahassee, FL	Comprehensive plan is being amended to encourage traffic calming in new developments—in one case, unspecified measures are required at intervals of 400 to 600 feet
West Palm Beach, FL	Large infill project was required to construct narrow streets with on-street parking, neckdowns, raised intersections, and raised crosswalks

*City of Phoenix Traffic Calming Committee, January 1997. **Calthorpe Associates, City of San Diego, CA, 1992.

Source: Interviews with traffic calming staffs; supplemental documents supplied.

A policy supplement goes on to state:

> Local streets should not exceed 600–900 feet in length. They may, however, extend to $^1/_4$ mile if the street is curved (100–200 foot radius) for an adequate length (minimum curve length equals the curve radius) and the cut-through traffic potential is minimal.[4]

Transit-Oriented Development Manual—San Diego, CA

When reviewing development proposals, San Diego now refers to a manual prepared by a leading New Urbanist, Peter Calthorpe. Calthorpe's transit-oriented development guidelines are 1 of about 50 sets nationally that are intended to make land development more friendly to pedestrians and transit users.[5] While Calthorpe's guidelines focus on land use mix, density, urban design, and pedestrian amenities, they offer general guidance related to street width, connectivity, and edge treatments (see figure 10.4).

New Street Standards—Howard County, MD

New subdivision street standards were recently adopted by the Howard County Council. They were adopted over the objections of the county department of education, which worried about schoolbus operation on narrow streets. It was pointed out that schoolbuses already travel up narrow driveways to pick up special education students and travel on narrow streets in older subdivisions.

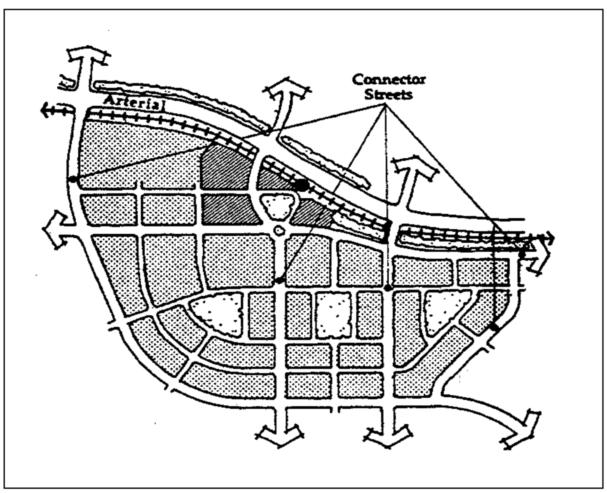

Figure 10.4. Collectors Should be Designed as "Connectors." (San Diego, CA)

Source: Calthorpe Associates, *Transit-Oriented Development Design Guidelines*, City of San Diego, CA, 1992, p. 63.

The code reads:

> It is the intent of these road standards to design roadways that do not encourage speeding. Typical past practices that encouraged long tangent sections of road, long sweeping curves and wide pavement only serve to invite speeding.[6]

The new standards narrow streets, require roundabouts at higher volume, four-legged intersections, and provide for sharp bends and other "slow points" at regular intervals (see figure 10.5). While the new standards may reduce speeds, it is not clear that they improve safety for motorists or bicyclists.

Local Street Plan—Eugene, OR

In an effort to reduce reliance on the automobile, Eugene adopted the *Eugene Local Street Plan*. The plan requires interconnectedness of local streets and replaces the city's old hierarchy of wide streets with a new hierarchy of narrower streets, starting with access lanes 21 feet wide (see figure 10.6) and moving up to medium-volume residential streets 27–34 feet wide. The plan contains an entire section on traffic calming. One of the principles articulated in that section is particularly germane: "A successful [street] design will result in traffic calming and reduce the need for future installation of traffic calming measures."[7]

In addition to guidance on street network design and street geometrics, the plan specifies which traffic calming measures are appropriate as design features of new subdivision streets as well as add-ons to existing local streets (see table 10.2).

The Eugene plan was implemented in 1996 through changes in the city code. City staff reviews subdivision plans for street connectivity, bicycle and pedestrian access, and block and cul-de-sac length. Traffic calming measures may be required. In one recent case, a developer whose property is adjacent to a new public school was required to put in raised crosswalks along the main access route. A raised crosswalk can be seen, with the school in the distance, in figure 10.7.

Street Network Design—The Florida Principles

The previous section identifies some of the regulatory mechanisms that may be used to implement traffic calming policies and standards for new developments. This section and the next summarize policies and standards that are being used to encourage development practices that produce or enable calmed streets. This section covers principles of street network design. The next focuses on geometric details of traffic-calmed streets.

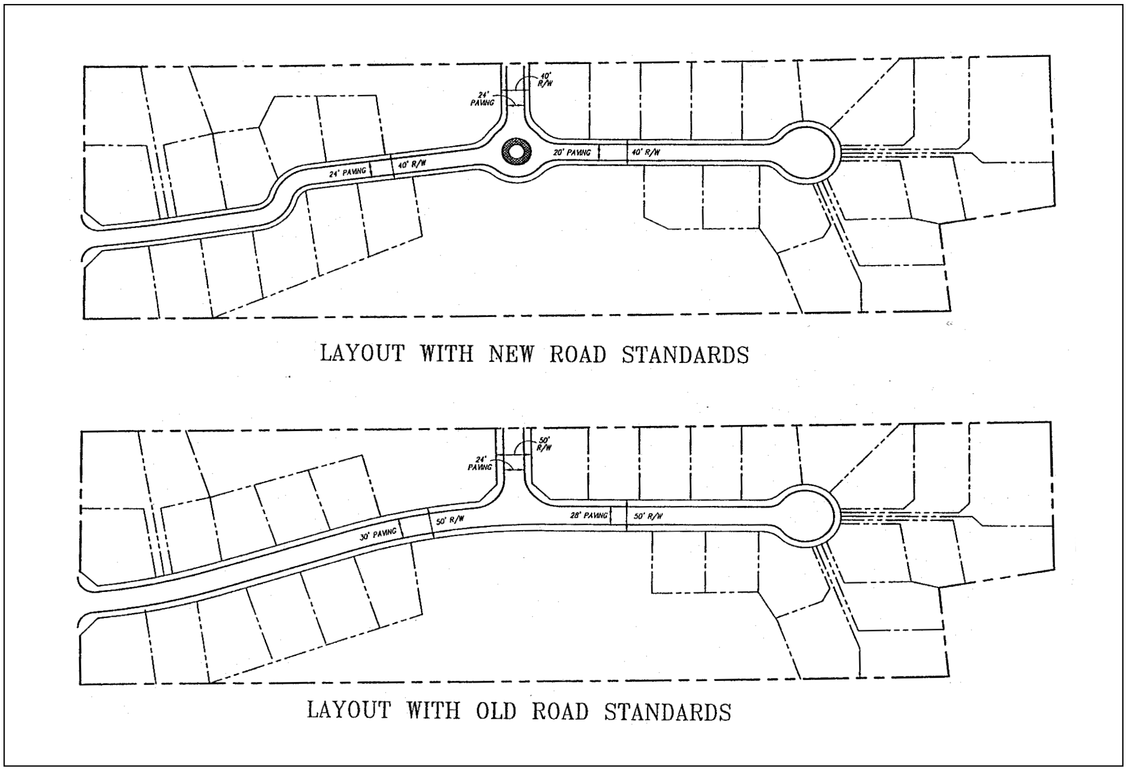

Figure 10.5. Subdivision Street Design Under Old and New Standards. (Howard County, MD)

Source: Howard County, MD, "Revised Subdivision Road Standards," undated, selected sections from chapter 2.

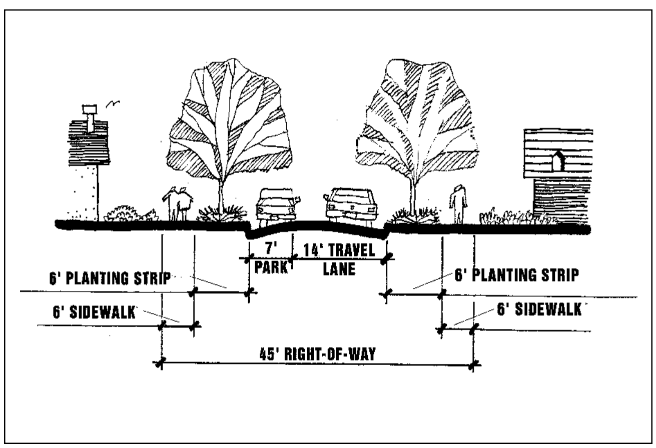

Figure 10.6. Low-Volume Residential Street. (Eugene, OR)

Source: City of Eugene, *Eugene Local Street Plan*, 1996, p. 71.

Table 10.2. Application of Traffic Calming Measures to Old and New Streets. (Eugene, OR)

TRAFFIC CALMING DEVICE	EXISTING STREET	NEW STREET
TRAFFIC CIRCLES	■	■
SPEED HUMPS	■	■ *
RAISED CROSSWALKS	■	■
CURB EXTENSIONS	■	■
CHICANES	■	■
TRAFFIC DIVERTERS	■	
FULL DIVERTER - STREET CLOSURE		
HALF DIVERTER		
DIAGONAL DIVERTER		
MEDIAN BARRIERS	■	■
FORCED TURN CHANNELIZATION	■	■
PARKING BAYS	■	■
PAVEMENT SURFACE MODIFICATION	■	■
SPEED ACTUATED SIGNING	■	

**New speed humps are to be installed only at the direction of the City Traffic Engineer.*

Source: City of Eugene, *Eugene Local Street Plan*, 1996, p. 71.

Figure 10.7. Raised Crosswalk Providing Safer Access to School. (Eugene, OR)

Florida's state planning agency included a set of traffic calming guidelines in its comprehensive land development guide, *Best Development Practices*.[8] The examples in this section are taken from that guide.

Street Networks with Multiple Connections and Relatively Direct Routes

The traditional urban grid has short blocks, straight streets, and a crosshatched pattern (see figure 10.8). The typical contemporary suburban street network has large blocks, curving streets, and a branching pattern (see figure 10.9).

Both network designs have advantages and disadvantages for the purposes of traffic calming. Traditional grids disperse traffic rather than concentrating it at a handful of intersections. They offer more direct routes and hence generate fewer vehicle-miles of travel than do contemporary networks.[9] They encourage walking and biking with their direct routing and their options to travel along high-volume streets.[10] The most pedestrian-oriented cities in the world are those with the densest, web-like street networks.[11]

On the other hand, contemporary networks have some obvious advantages over grids. By keeping through traffic

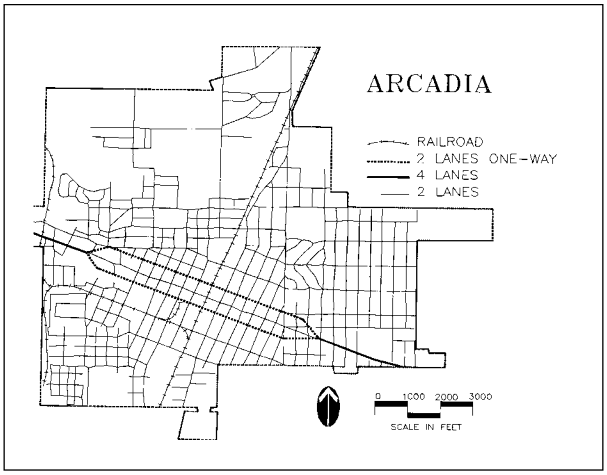

Figure 10.8. Traditional Urban Grid. (Arcadia, FL)

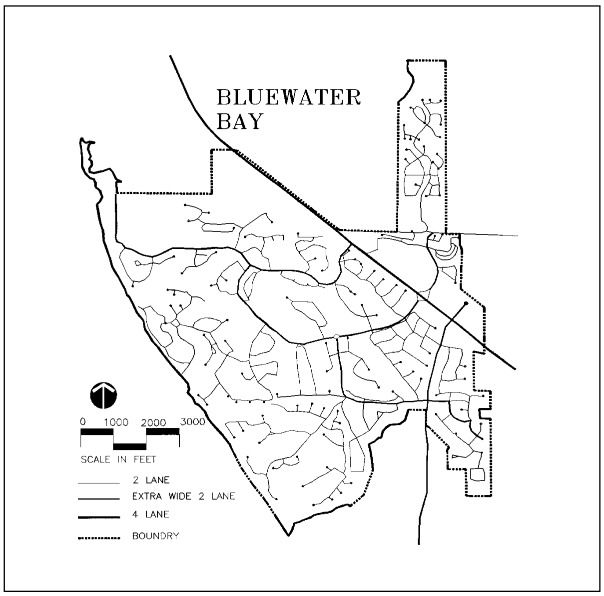

Figure 10.9. Contemporary Suburban Network. (Bluewater Bay, FL)

out of neighborhoods, contemporary networks keep neighborhood street traffic volumes and accident rates down and, usually, property values up.[12] They may also discourage crime by making entry and escape relatively difficult for would-be offenders.[13] Cul-de-sacs, the ultimate in disconnected streets, have even lower volumes, encourage more casual interaction among neighbors, and often command a premium in real estate markets.[14]

Hybrid networks (see figure 10.10) have been developed in an attempt to garner the advantages of both traditional and contemporary residential street networks (i.e., combining the mobility of the traditional grid and the safety, security, and topographic sensitivity of the contemporary network). Short, curved stretches that follow the lay of the land or contribute to good urban design are used, as are short loops and cul-de-sacs, as long as they leave the higher order street network intact (i.e., arterials, collectors).

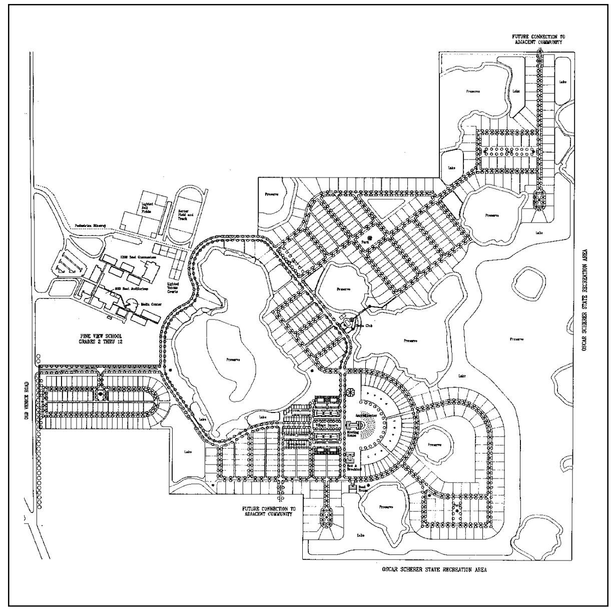

Figure 10.10. Hybrid Network. (Sarasota, FL)

Short stretches ending in T-intersections have been shown to be particularly effective in reducing speeds and accidents.[15] Even cul-de-sacs are typically kept short, in part to discourage speeding. National authorities disagree on maximum cul-de-sac lengths, with recommendations ranging from 400 to 1,500 feet.[16] If traffic calming is a primary object, the lower end of the range is preferable.

There are various ways to measure the extent to which this practice is followed. From the literature on networks, a simple measure of connectivity is the number of street links divided by the number of nodes or link ends (including cul-de-sac heads).[17] The more links there are relative to nodes, the more connectivity within the network. It should be noted that this discussion does not consider bike/pedestrian paths and nodes as measures of connectivity.

This index of connectivity has been computed for several traditional towns and contemporary developments in Florida (see table 10.3). Note in the table the relatively lower level of connectivity found in contemporary street networks. Apalachicola and Arcadia (with near-gridirons) have the highest indices. Bluewater Bay and Haile Plantation (designed around cul-de-sacs) have the lowest indices.

Table 10.3. Network Connectivity Indices for Traditional Towns and Contemporary Developments in Florida.

Traditional Towns		Contemporary Developments	
Apalachicola	1.69	Bluewater Bay	1.19
Arcadia	1.69	Haile Plantation	1.19
Dade City	1.49	Hunter's Creek	1.23

Source: R. Ewing, *Best Development Practices*, American Planning Association, Chicago, 1996, p. 57.

Spacing of Higher Order Streets

The shift away from gridded streets in the contemporary street network is often accompanied by a loss of capacity to handle through traffic. Spaced far apart, arterials and collectors generate long access trips and require multilane cross sections to handle traffic from their catchment areas (see figure 10.11).

Calls for closely spaced through streets come from three sources. First, transit operators advocate closely spaced arterials and collectors.[18] If transit users are to have an easy walk to transit lines, the streets with service are preferably not spaced too far apart. Second, New Urbanists advocate dense networks of through streets. Their goal is to disperse traffic and avoid the need for multilane roads.[19] Third, a group of experts, primarily Australians, advocates that access trips to a higher order street be no more than a minute or two at restrained speeds (see figure 10.12).[20] If access trips are much longer, motorists may be tempted to speed through neighborhoods.

Considering all factors, half-mile spacing of higher order streets (i.e., collectors and above) has been used by communities as a reasonable target for suburban network density. For curvilinear networks, the equivalent network density is 4.0 centerline miles (of higher order streets) per square mile of land area.

The street networks of traditional towns meet, or at least approach, this network density. Contemporary developments tend to fall short (see table 10.4). At buildout in a contemporary development, most residents will live beyond a 1-minute driving time and beyond practical walking distance of an arterial or collector (see figure 10.13). Arterials and collectors may eventually need to be four- or even six-laned to handle traffic.

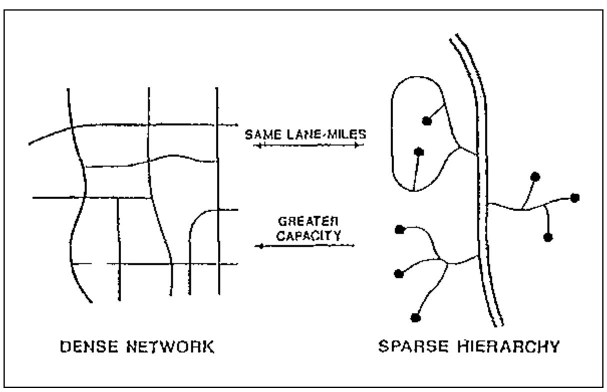

Figure 10.11. Narrower Cross Sections and More Capacity with a Dense Street Network.

Source: W. Kulash, "Neotraditional Town Design—Will the Traffic Work?" Workshop on Neotraditional Town Planning, American Institute of Certified Planners, Washington, DC, 1991.

Narrow Streets

"The tendency of many communities to equate wider streets with better streets and to design traffic and parking lanes as if the street were a 'microfreeway' is a highly questionable practice." These words come from the American

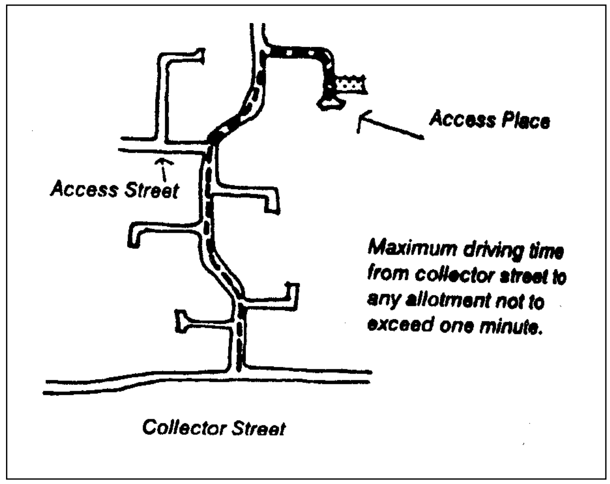

Figure 10.12. Maximum Driving Time Out of a Subdivision—1 Minute (Australian Model Code).

Source: Model Code Task Force, *Australian Model Code for Residential Development*, Australian Government Publishing Service, Canberra, ACT, Australia, 1990, p. 48.

Traditional Towns		Contemporary Developments	
Apalachicola	3.19 miles	Bluewater Bay	2.20 miles
Arcadia	4.15 miles	Haile Plantation	2.64 miles
Dade City	4.14 miles	Hunter's Creek	2.25 miles

Table 10.4. Street Network Densities for Traditional Towns and Contemporary Developments in Florida. (miles of higher order streets per square mile of land area)

Source: R. Ewing, *Best Development Practices*, American Planning Association, Chicago, 1996, p. 60.

Society of Civil Engineers, the National Association of Home Builders, and the Urban Land Institute.[21] There is growing sentiment that many local streets, and even some collector streets, are overdesigned, at substantial cost to society.

Relative to wide streets, narrow streets may calm traffic. Vehicle operating speeds decline somewhat as individual lanes and street sections are narrowed (but only to a point).[22] Drivers also seem to behave less aggressively on narrow streets, running fewer traffic signals, for example.[23] Further, one study reports higher pedestrian volumes on narrow streets than on wide streets.[24] More elderly users, more people out walking pets, and more pedestrians crossing back and forth all attest to a level of comfort with traffic on narrow streets that is missing on wide ones. However, all other things being equal, bicyclists may prefer a wide street to a narrow street that has speeds 10 mph slower.[25]

Why, then, do streets continue to be designed with such wide cross sections? Part of the reason is the lack of adequate route connectivity and density in contemporary networks. Beyond that, design typically strives to accommodate the worst case—the occasional service vehicle, emergency vehicle, or parked car on an access street.[26]

Many communities have reached the conclusion that it would be acceptable to design local streets for the everyday case (i.e., actual needs and intended use, rather than with blind adherence to agency design standards).[27] Communities that have opted for narrow streets report that they perform well.[28] Localities around the United States are amending their ordinances to permit narrower local streets than would have been imaginable a few years ago.[29]

Subdivision Street Standards—The WILMAPCO Alternative

Lessons from *Best Development Practices* and a companion document, *Pedestrian- and Transit-Friendly Design*, have been combined into a single set of subdivision standards for the Wilmington Area Planning Council (WILMAPCO). They have been adopted by Middletown, DE, and Chesapeake City, MD, and are currently under review by the Delaware Department of Transportation (DelDOT) for possible statewide adoption.

The sample design standards for residential streets are set forth in table 10.5 for local streets and in table 10.6 for collectors. They illustrate how traffic calming principles can be incorporated into planning/design criteria. Three key policy decisions shape these standards and cause them to deviate in places from conventional standards:

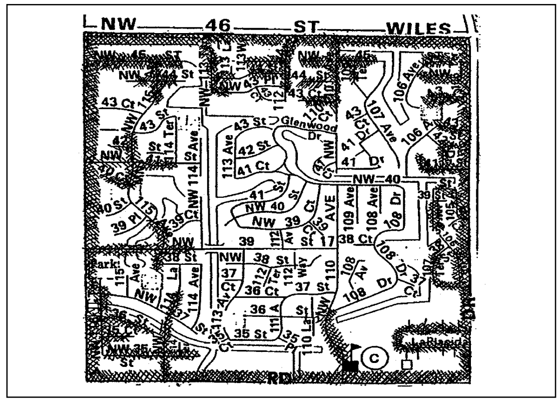

Figure 10.13. Poor Access With 1-Mile Superblocks (shaded areas within 1/4 mile of through streets).

- The choice of design speeds: 20 mph for local streets and 25 mph for residential collectors
- The choice of design vehicle: a 266-inch wheelbase schoolbus, the largest vehicle to use subdivision streets routinely
- The priority given to pedestrians over motor vehicles

The far-right columns in tables 10.5 and 10.6 indicate *how* and *why* the proposed DelDOT standards deviate from AASHTO guidelines.[30] The streets to which they apply are subdivision streets at the bottom of the functional hierarchy, not streets that will typically be on either Federal or State highway systems. Unless a design exception is granted by FHWA, roads on the National Highway System (NHS) are subject to AASHTO guidelines, which have been adopted as national standards. Unless design exceptions are granted by State departments of transportation, non-NHS roads on State systems are usually subject to State standards not too different from AASHTO's. But off the Federal and State systems, local governments usually have a degree of design flexibility.

In one respect, the proposed standards may appear to encourage speeding. When the decision was made to recommend local streets as narrow as 18 feet and residential collectors as narrow as 22 feet, it had implications for curb return radii at corners. To accommodate the design vehicle, corners need to be rounded off more than otherwise ideal for traffic calming and pedestrianization. But after considering that most street crossings by pedestrians in subdivisions are probably at midblock anyway, the many advantages of narrow streets (e.g., human-scale streetscapes, cost savings to homeowners, reduced runoff) were deemed to outweigh the advantages of sharp corners. If a single-unit truck is adopted as the design vehicle instead of a large schoolbus, corner radii can be reduced by 10 to 15 feet.

Table 10.5. Sample Set of Design Standards for Local Residential Streets.

Design Feature	AASHTO Local Urban Street Standard	DelDOT Proposed Local Street Standard	Rationale Given for DelDOT Proposed Standard
Design speed	20–30 mph	20 mph	Less than AASHTO guideline—20 mph is safe for pedestrians and is acceptable to most residents—30 mph is not
Right-of-way width	50 feet common (with 26-foot section)	41 feet (18-foot roadway + 6-inch curbs + 5-foot planting strips + 5-foot sidewalks + 1-foot offsets from backs of sidewalks)	Less than AASHTO guideline—41-foot right-of-way width is consistent with individual cross-sectional elements
Pavement width	26 feet typical (less when right-of-way is severely limited)	18 feet (9-foot travel lane + 7-foot parking lane on one side + 1-foot offsets to curb faces)	Less than AASHTO guideline—one clear travel lane is sufficient on streets carrying fewer than 500 vpd—on-street parking on only one side is sufficient in modern subdivisions with ample off-street parking—the recommendation provides for the narrowest possible pavement width in order to cut infrastructure cost, reduce runoff, and create human-scale streetscapes
Travel lane width	9–12 feet (9 feet where right-of-way severely limited, 11 feet preferred)	9 feet (plus 1-foot offset to curb —whether right-of-way is limited or not)	Equals AASHTO minimum—9-foot travel lane width is consistent with proposed design speed
Parking lane width	7-foot minimum (may include gutter pan)	7 feet (plus 1-foot offset)	Equals AASHTO minimum—7-foot parking lane width is sufficient when occupied by a parked car, and when unoccupied, leaves the minimum clear width to discourage speeding
Pavement edge treatment	Normally 4-inch to 9-inch vertical curb (1-foot offset required with curb of 6 inches or more)	6-inch or 8-inch vertical curb	Greater than AASHTO guideline—higher curb discourages parking on planting strips and enhances pedestrian comfort and safety
Horizontal curve radius (measured at centerline of street)	100-foot minimum (less with super-elevation—as large as possible preferred)	90-foot minimum when curve is unsigned—45-foot minimum when curve is signed as a traffic calming measure	Less than AASHTO guideline—assuming a side-friction factor of 0.30 (AASHTO's own value) and no superelevation, a 90-foot curve radius corresponds to a turning speed of just over 20 mph—a 45-foot radius corresponds to a turning speed of 15 mph, 5 mph under the speed limit and appropriate as a traffic calming measure—a 45-foot radius is sufficient for the design vehicle to make a turn at a crawl speed without encroaching on the opposing lane

Table 10.5. Sample Set of Design Standards for Local Residential Streets (continued).

Design Feature	AASHTO Local Urban Street Standard	DelDOT Proposed Local Street Standard	Rationale Given for Proposed DelDOT Standard
Vertical curve length	60-foot minimum at a design speed of 20 mph (or for larger grade changes, see AASHTO figures III-41 for crest curves and III-43 for sag curves)	Same as AASHTO when curve is unsigned—when a short vertical curve is signed and marked as a traffic calming measure, AASHTO minimum is waived	Proposed standard simply exempts traffic calming measures from minimum vertical curve requirements
Sidewalks	On both sides of streets used for access to schools, parks, etc.—on at least one side of all other local streets	On both sides of streets at densities of 2-plus units per acre—on one side of streets at densities of 1–2 units per acre	Sidewalks represent a small cost increment that is justified at all but the lowest residential densities—proposed standards are similar to those promoted by the Federal Highway Administration and Institute of Transportation Engineers
Sidewalk width	4-foot minimum	5 feet with planting strip 8 feet without planting strip	Greater than AASHTO guideline—5-foot sidewalk width is comfortable for pedestrians walking in pairs and occasionally passing other pedestrians—the extra 3 feet provides a small buffer from traffic when no planting strip is provided
Planting strip width	2-foot minimum (12 feet desirable)	5-foot minimum	Greater than AASHTO guideline—5-foot planting strip is a normal minimum for street trees and provides an adequate buffer for pedestrians on low-speed streets
Tree/Obstacle clearance	1.5-foot minimum with vertical curb	2.5 feet with vertical curb (from curb to centerline of tree)	2.5 feet places street trees along centerline of planting strip—provides for about 1.5-foot clearance when trees mature
Corner radius	15-foot minimum (25 feet desirable)	25 feet (local-local) 30 feet (local-collector with parking lane) 40 feet (local-collector without parking lane)	Equal or greater than AASHTO guideline—recommended curb radii are sufficient for a large schoolbus to make turns if allowed to encroach on opposing lanes of minor streets—the low traffic volumes on minor streets (less than 50 vehicles per hour during peak period) make encroachment a low-risk event
Alleys	Alleys allowed (right-of-way widths of 16–20 feet)	Alleys recommended with lots less than 50 feet wide—alleys should have 12-foot paved width, 20-foot right-of-way	Alleys are encouraged to create streetscapes unbroken by driveways—recommended alley width provides for landscaping on either side so alleyway "reads" like a narrow street

Table 10.5. Sample Set of Design Standards for Local Residential Streets (continued).

Design Feature	AASHTO Local Urban Street Standard	DelDOT Proposed Local Street Standard	Rationale Given for DelDOT Proposed Standard
Traffic calming measures	None specified	Full array of horizontal and vertical measures allowed, consistent with 20-mph design speed	Traffic calming may be required in order to maintain 20-mph operating speeds
Spacing of slow points	None specified	200 to 300 feet between traffic calming measures, T-intersections, or other	Slow points must be closely spaced to maintain 20-mph operating slow points
All-way STOPS	References *MUTCD*	Generally inappropriate as a method of speed control at low-volume intersections	Equal to *MUTCD* warrants

AASHTO = American Association of State Highway and Transportation Officials; DelDOT = Delaware Department of Transportation
MUTCD = Manual on Uniform Traffic Devices for Streets and Highways

Source: R. Ewing (in cooperation with RK & K Consulting Engineers, Baltimore, MD, and LDR International, Inc., Columbia, MD), 1998.

Table 10.6. Sample Set of Design Standards for Residential Collector Streets.

Design Feature	AASHTO Urban Collector Street Standard	DelDOT Proposed Collector Street Standard	Rationale Given for DelDOT Proposed Standard
Design speed	30 mph or higher	25 mph	Less than AASHTO guideline— 25 mph is safer for pedestrians and more acceptable to residents than is 30 mph
Right-of-way width	40 to 60 feet	53 or 61 or 69 feet (20-foot roadway + 6-inch curbs + 10-foot planting strips +5-foot sidewalks + 1-foot offsets from backs of sidewalks—parking may be on neither side, one side, or both sides)	Greater than AASHTO guideline—extra right-of-way width provides for planting strips wide enough to buffer pedestrians and residents from higher speeds and volumes of traffic on collectors
Pavement width	28-foot minimum with one parking lane (if practical, build four lanes and use the extra two for parking until needed)	22 or 29 or 36 feet (10-foot travel lanes in both directions, 7-foot parking lanes, and 1-foot offsets to curb faces)	Varies depending on the number of parking lanes provided—the recommended standard provides for the narrowest possible roadway width in order to cut infrastructure cost, reduce runoff, and create human-scale streetscapes—two different cross-sections are envisioned, appropriate to different residential densities with different demands for on-street parking
Travel lane width	10 to 12 feet (10 feet where right-of-way imposes severe limitations)	10 feet (plus 1-foot offset to curb)	Equal to AASHTO minimum—10-foot travel lane width is consistent with proposed design speed
Parking lane width	7 to 10 feet (may include gutter pan)	7 feet (plus 1-foot offset)	Equal to AASHTO minimum—7-foot parking lane width is sufficient when occupied by a parked car, and when unoccupied, leaves the minimum clear width to discourage speeding
Pavement edge treatment	6-inch vertical curb with1- to 2-foot offset (except on low-volume streets, where lower curb is sufficient)	8-inch vertical curb	Greater than AASHTO guideline—higher curb discourages parking on planting strips and enhances pedestrian comfort and safety
Medians or center islands	On multilane roads whenever practical	On all multilane roads	A median or center island provides refuge for pedestrians, reducing crossing delay and enhancing pedestrian safety—medians or islands are particularly important in suburban areas where long blocks encourage midblock crossings

Table 10.6. Sample Set of Design Standards for Residential Collector Streets (continued).

Design Feature	AASHTO Urban Collector Street Standard	DelDOT Proposed Collector Street Standard	Rationale Given for Proposed Standard
Median/Island width	2 to 6 feet when raised	4-foot minimum—6 feet preferable Always raised	Greater than AASHTO minimum—recommended median/island width can be landscaped and is consistent with *MUTCD*
Horizontal curve radius (measured at centerline of street)	Not specified	170-foot minimum when curve is unsigned—90-foot minimum when curve is signed as a traffic calming measure	No AASHTO guideline—assuming a side-friction factor of 0.25 (AASHTO's own value) and no superelevation, a 170-foot curve radius corresponds to a turning speed of slightly more than 25 mph—a 90-foot radius corresponds to a turning speed of 20 mph, 5 mph under the speed limit and appropriate as a traffic calming measure
Vertical curve length	75-foot minimum at a design speed of 25 mph (or for larger grade changes, see AASHTO figures III-41 for crest curves and III-43 for sag curves)	Same as AASHTO when curve is unsigned—when a short vertical curve is signed and marked as a traffic calming measure, AASHTO minimum is waived	Proposed standard simply exempts traffic calming measures from minimum vertical curve requirements
Sidewalks	Both sides of roads used for access to schools, parks, etc.—elsewhere on at least one side	Both sides	Sidewalks represent a small cost increment that is justified on all residential collectors—proposed standards are consistent with those promoted by the Federal Highway Administration and Institute of Transportation Engineers
Sidewalk width	4-foot minimum	5 feet with planting strip 8 feet without planting strip	Greater than AASHTO guideline—5-foot sidewalk width is comfortable for pedestrians walking in pairs and occasionally passing other pedestrians—the extra 3 feet provides a small buffer from traffic when no planting strip is provided
Planting strip width	3 to 6 feet (deduced from border width requirements)	10-foot minimum	Greater than AASHTO guideline—10-foot planting strip provides an adequate buffer for pedestrians and residents along collector streets with higher traffic speeds and volumes—residential collectors should have residences fronting on them, not backing up to them in reverse lotting arrangements—a 10-foot-plus planting strip increases the setback of houses from the street, thus mitigating traffic impacts

Table 10.6. Sample Set of Design Standards for Residential Collector Streets (continued).

Design Features	AASHTO Urban Collector Street Standard	DelDOT Proposed Collector Street Standard	Rationale Given for DelDOT Proposed Standard
Tree/Obstacle clearance	1.5-foot minimum with vertical curb (2 feet desirable with parking lane to avoid interference with car doors)	5 feet with vertical curb (from curb to centerline of tree)	Greater than AASHTO minimum—5 feet places street trees along centerline of planting strip—provides for about 3–4 feet of clearance when trees mature
Street tree location	Preferably outside sidewalk	Preferably between street and sidewalk	Street trees between street and sidewalk enclose street space, possibly calming traffic—they also provide pedestrians with a buffer from traffic and protection from the weather
Corner radius	10–15 feet with curbside parking 30 feet without curbside parking	30 feet (local-collector with parking lane) 25 feet (collector-collector with parking lanes) 40 feet (local-collector without parking lane) 50 feet (collector-collector without parking lanes)	Equal to or greater than AASHTO guideline—recommended curb radii are sufficient for a large school bus to make a turn without encroaching on opposing lanes of collector streets—encroachment would occur on local streets
Traffic calming measures	None specified	Full array of horizontal and vertical measures allowed, consistent with 25-mph design speed, except where emergency response considerations impose limitations	Traffic calming measures may be required in order to maintain 25-mph operating speeds
Spacing of slow points	None specified	300 to 400 feet between traffic calming measures, STOP signs, or other slow points	Slow points must be closely spaced to maintain 25-mph operating speed
All-way STOPS	References *MUTCD*	Unwarranted STOP signs permitted when engineering study shows unusually high cut-through traffic volume or accident rate	*MUTCD* warrants are too stringent for residential collectors—all-way STOPS can reduce cut-through traffic and accidents

AASHTO = American Association of State Highway and Transportation Officials; DelDOT = Delaware Department of Transportation;
MUTCD = Manual on Uniform Traffic Control Devices for Streets and Highways

Source: R. Ewing (in cooperation with RK & K Consulting Engineers, Baltimore, MD, and LDR International, Inc., Columbia, MD), 1998.

Endnotes

1. New Urbanism is a development strategy that seeks to integrate life components—home life, work, school, shops, businesses, recreation facilities—in compact, walkable, mixed-use neighborhoods linked by transit. The approach arose in North America in the 1980's as an alternative to the low-density, suburban sprawl typical of development during the 1960's and 1970's. Initially called "neo-traditional planning" because it was based on development patterns used prior to World War II, New Urbanist designs promote lower use of automobiles, land, and natural resources. Information is available from Congress for the New Urbanism, 5 Third Street, Suite 500A, San Francisco, CA 94103 (http://www.cnu.org).
2. 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), 1996, pp. 53–93.
3. City of Phoenix, Subdivision Ordinance, Section 32–26 (f).
4. City of Phoenix, Subdivision Policy, Paragraph 2.2.
5. Calthorpe Associates, *Transit-Oriented Development Design Guidelines,* City of San Diego, CA, 1992. The many other transit-oriented development manuals fall into two categories. Some are *land planning/urban design manuals* with a transit orientation. Others are *transit facility design manuals* with implications for urban design. The former emphasize the needs of transit users accessing the system, the latter, the needs of the transit operator running the system. R. Cervero, "Design Guidelines as a Tool to Promote Transit-Supportive Development," *Transit-Supportive Development in the United States: Experiences and Prospects, Technology Sharing Program,* U.S. Department of Transportation, Washington, DC, 1993, pp. 27–40; and D. Everett, T. Herrero, and R. Ewing, *Transit-Oriented Development Guidelines: Review of Literature,* background paper prepared for the Florida Department of Transportation, Tallahassee, FL, 1995.
6. Howard County Revised Subdivision Road Standards, Section 2.14.
7. City of Eugene, *Eugene Local Street Plan,* 1996, p. 59.
8. Ewing, 1996, op. cit.
9. F.A. Curtis, L. Neilsen, and A. Bjornsor, "Impact of Residential Street Design on Fuel Consumption," *Journal of Urban Planning and Development,* Vol. 110, 1984, pp. 1–8; M.G. McNally, "Regional Impacts of Neotraditional Neighborhood Development," in *1993 Compendium of Technical Papers,* Institute of Transportation Engineers, Washington, DC, 1993, pp. 463–467; and M.G. McNally and S. Ryan, "Comparative Assessment of Travel Characteristics for Neotraditional Designs," *Transportation Research Record 1400,* 1993, pp. 67–77.
10. Grids also offer less tangible benefits: what urban designers refer to as "contextual continuity" and "legibility," which are thought to be important to pedestrians.
11. Short blocks make trips feel shorter to pedestrians because progress is judged against the milestones of intersections. San Francisco has 300 intersections per square mile; Santa Monica, 180; and Irvine, 15. The walkability of these places, by all accounts, is in the same rank order. See A.B. Jacobs, "City Streets and Their Contexts," in *A Decade Reviewed—Commitment Renewed,* 10th Annual Pedestrian Conference, Boulder, CO, 1989, pp. 41–61.
12. H. Marks, "Subdividing for Traffic Safety," *Traffic Quarterly,* Vol. 11, 1957, pp. 308–325; M.A. Wallen, "Landscaped Structures for Traffic Control," *Traffic Engineering,* Vol. 31, January 1961, pp. 18–22; P.C. Box, "Accident Characteristics of Non-Arterial Streets," *Traffic Digest and Review,* March 1964, pp. 12, 17–19; G.T. Bennett and J. Marland, *Road Accidents in Traditionally Designed Residential Estates,* Supplementary Report 394, Transportation Road Research Laboratory, Crowthorne, England, 1978; D.G. Bagby, "The Effects of Traffic Flow on Residential Property Values," *Journal of the American Planning Association,* Vol. 46, 1980, pp. 88–94; and U. Henning-Hager, "Urban Development and Road Safety," *Accident Analysis & Prevention,* Vol. 18, 1986, pp. 135–145. For general perspectives, see R. Brindle, "Residential Area Planning for Pedestrian Safety," Joint ARRB/DOT Pedestrian Conference, Australian Road Research Board, VIC, Australia, 1978; J.H. Kraay, M.P.M. Mathijssen, and F.C.M. Wegman, *Toward Safer Residential Areas,* Institute of Road Safety Research SWOV/Ministry of Transport, Leidschendam, Switzerland, 1985; and S.O. Gunnarsson, "Urban Traffic Network Design—A Spatial Approach," in *Effecting Change Step-by-Step, Proceedings of the 9th Annual Pedestrian Conference,* Boulder, CO, 1988, pp. 199–218.
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