Residential Street Design: Do the British and Australians Know Something Americans Do Not?

REID EWING

American, British, and Australian street design guidelines governing geometrics, sidewalk warrants, intersection treatments, network design, and traffic-calming measures are compared. British and Australian guidelines provide for narrower pavement surfaces, sharper horizontal curves to control speeds, roundabouts and T-intersections, more efficient networks, and a wide array of traffic-calming devices. Americans have fallen behind the British and Australians in the conception of residential street functions and approaches to traffic management. British and Australian design guidelines appear to offer the best of the contemporary and the neotraditional, with European traffic calming thrown in for good measure.

In his classic *Livable Streets,* Appleyard calls streets the "most important part of our urban environment" (*1,* p. 243). It may sound like hyperbole, but just think about the effect on motorists, pedestrians, and residents of narrow, winding tree-lined streets versus wide gun-barrel designs. It almost does not matter what abuts the two road types in the way of structures, front yards, and driveways. The former will be more inviting to people and more calming to traffic.

Appleyard goes on to say:

> [W]e should raise our sights for the moment. What could a residential street—a street on which our children are brought up, adults live, and old people spend their last days—what could such a street be like? What are the rights of streetdwellers? (*1*)

In Florida the search for answers to these questions has led us to the design practices of Britain and Australia.

CURRENT DEBATE

Contemporary American street design has been much maligned recently, particularly by neotraditional planners (*2,3*). The geometrics of local streets, it is said, convert them into minifreeways. As a result of overdesign motorists travel too fast for public safety, walking and biking are discouraged, infrastructure and associated housing costs are inflated, land and energy are wasted, storm water runoff is increased, and a sense of community is lost.

The sparse network of branching streets, so common in the suburbs today, is said to force travelers up and down the local-collector-arterial hierarchy regardless of where they are going, lengthening trips and concentrating traffic at a few intersections on the collector and arterial road systems. A sparse network discourages walking trips, makes access difficult for emergency vehicles, and as much as doubles distances traveled by service vehicles.

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The curvature of streets in the suburbs, when topography does not demand it, is criticized as disorienting, unsafe because of limited sight distances, and counterproductive to the goal of getting people out of their automobiles. The slow speeds at which pedestrians move make direct routes preferable.

These criticisms have registered with the traffic engineering profession. ASCE, National Association of Home Builders (NAHB), and the Urban Land Institute (ULI) sound almost neotraditional at times in their design manual, *Residential Streets* (*4*). "Public officials and professional associations have often promulgated standards that, although reasonable for major thoroughfares, are inappropriate for local residential streets" (*4,* p.17). ITE has established a technical committee charged with developing new guidelines for traffic engineering in neotraditional neighborhoods.

Although fundamental change may be coming to the United States, it is not here yet. Americans have fallen behind the British and Australians in the conception of residential street functions and approaches to traffic management.

GUIDANCE FROM ABROAD

One hears from time to time that the Europeans, British, and Australians manage traffic better than Americans do. Much is made of Dutch *woonerf* designs (shared streets), Danish *stillevej* designs (quiet roads), German areawide traffic restraint, British environmental traffic management, and Australian local area traffic management. There is also growing interest in the United States in British and Australian roundabout design.

Thus, for the insights it might provide, this paper undertakes a comparison of American, British, and Australian residential street design guidelines. This is part of a larger effort to formulate community design guidelines for Florida.

The British and Australians use design vehicles similar to those used in the United States, and the Australians in particular are almost as automobile-dependent as Americans are (Figure 1). The following comparison therefore illustrates basic differences in street design philosophy and professional judgment as opposed to differences in street conditions.

Representing American design practice are

- *A Policy on Geometric Design of Highways and Streets* (by AASHTO),
- *Guidelines for Residential Subdivision Street Design* (by ITE), and
- *Residential Streets* (co-published by ASCE, NAHB, and ULI).

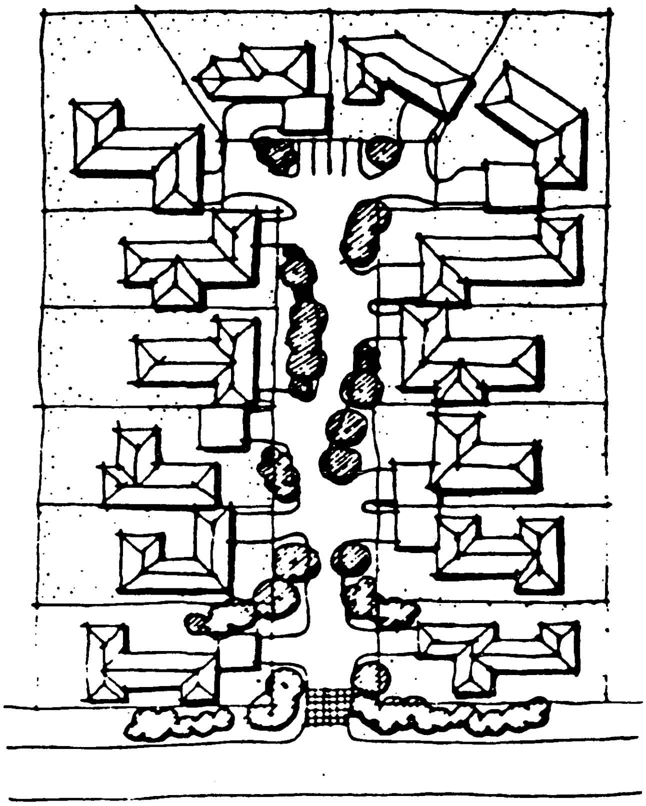

FIGURE 1 Australian subdivision with American-like density (Source: *Australian Model Code for Residential Development*, p. 30).

For purposes of comparison, two British manuals are used.

- *Residential Roads and Footpaths—Layout Considerations, Design Bulletin 32* (prepared jointly by the Department of the Environment and Department of Transport), and
- *Roads and Traffic in Urban Areas* (by the Institution of Highways and Transportation with the Department of Transport).

The first British manual provides guidelines for residential access roads (roughly equivalent to local roads in the American functional hierarchy). This is the second edition of *Design Bulletin 32,* updated in 1992 to reflect the discovery of European traffic-calming measures. The other manual, *Roads and Traffic in Urban Areas,* offers guidelines for roads at all levels in the British functional hierarchy, but most important for the present purposes are the guidelines for distributor roads (roughly equivalent to U.S. collectors).

Australian practice is harder to capture in a single set of guidelines because of differences among the Australian states. The *Australian Model Code for Residential Development,* developed under the auspices of the Commonwealth's Department of Health, Housing and Community Services, is taken to be most representative. The model code has been adopted, with some modifications, by the states of Victoria and Tasmania and is similar to South Australia's *Guidelines for Planning and Road Design for New Residential Sub-Divisions.* The central government hopes that core elements will eventually be adopted by all states after ongoing revisions are completed. The model code and supporting materials are contained in

- *Australian Model Code for Residential Development* (prepared by the Model Code Task Force of the Green Street Joint Venture),
- *AMCORD URBAN—Guidelines for Urban Housing,* Vol. 1. *Planning and Implementation Approaches,* and
- *AMCORD URBAN—Guidelines for Urban Housing,* Vol. 2. *Draft Code for Urban Housing.*

DIFFERENT VIEWS OF STREET FUNCTIONS

To help illustrate differences in design philosophy, consider the functions of local roads, collectors, and arterials as depicted by AASHTO. In the well-known hierarchy local roads mostly provide access to land, whereas arterials mostly provide mobility for through traffic. Collectors fall functionally halfway between (Figure 2).

In practice street systems in most suburban communities function more as illustrated in Figure 3. Much of the local street system consists of cul-de-sacs and loops that afford only land access, not mobility for through traffic. On the other hand many arterials are so

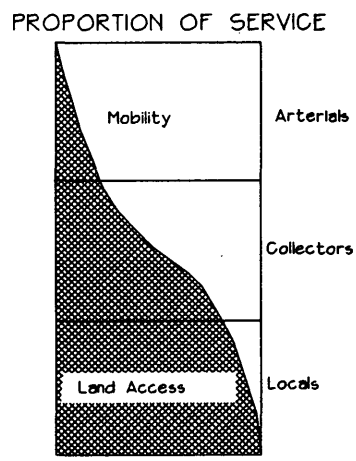

FIGURE 2 American road hierarchy (in theory).

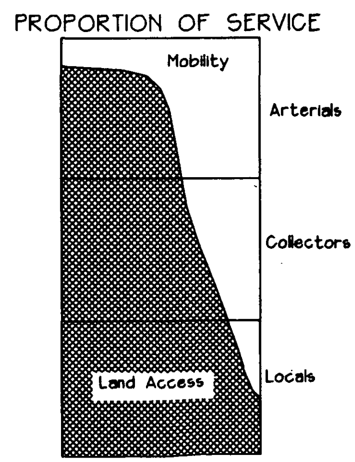

FIGURE 3 American road hierarchy (in practice).

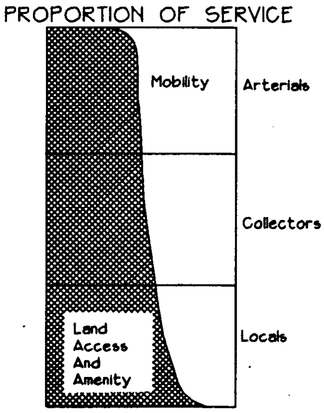

FIGURE 4 Neotraditional road hierarchy.

cluttered with driveways along commercial strips that they function more like collectors or even local roads. Freeways, of course, are the exception.

Neotraditional Road Hierarchy

Neotraditional planners tend to blur functional distinctions among local roads, collectors, and arterials in what one practitioner has called a *reduced* or *nonexistent hierarchy* of streets (*5*). They favor a return to a gridded street system, not an endless gridiron of parallel streets crossing at right angles but instead an "interrupted grid" of mostly straight streets terminating at T-intersections, Y-intersections, traffic circles, and town squares. They are adamant that local roads should carry some of the through traffic.

Neotraditional planners also emphasize the *social* and *amenity* functions of roads. The access function, acknowledged in the standard road hierarchy, relates to roads as channels of movement (albeit movement to or from an area rather than through it). In contrast, the social and amenity functions of roads relate to streets as public places and open spaces where people can commune, engage in people-watching, and the like. Given these views, a neotraditional road hierarchy would look like that in Figure 4.

British and Australian Road Hierarchy

From their writings and design manuals the British and Australians appear to embrace neither the contemporary American road hierarchy nor the neotraditional road network. Like the neotraditionalists, they acknowledge functions of local streets other than land access. Australians distinguish between access-service functions and social-amenity functions (*6*,p.1; *7*,pp.11–13; *8*,pp.136–137). They leave no doubt about which set of functions they consider more important, noting that people spend 90 percent of their time on the street "staying and playing" and only 10 percent "coming and going" (*7*,pp.13–14; *8*,pp.137–138).

However, unlike the neotraditionalists the British and Australians strive to keep through traffic out of neighborhoods. Indeed, they may differentiate the functions of arterials, collectors, and local roads even more than American traffic engineers do, leaning toward a two-class hierarchy in which roads either afford mobility or access, but ideally not both. Quoting Brindle of the Australian Road Research Board:

> Networks that avoid traffic/access ambiguity conform to the so-called "two-class" (or "separate functions") model, where roads are depicted as either traffic routes or local streets. The "two class" concept underlies British and Scandinavian practice. . . . In new street and road networks, the "intermediate" street should be avoided to the maximum degree possible.(*9*)

Brindle's two-class hierarchy is embraced to a degree by the Australian model code, which distinguishes between the mobility function of *roads* and the land access function of *streets*. One Australian engineer has redrawn the functional hierarchy as shown in Figure 5 (*10*).

INTERNATIONAL COMPARISONS

It is not in words that American, British, and Australian design manuals differ notably. The American manuals (even ITE's recommended practice, the most conservative of the three) pay homage to notions of livability and economy in residential street design. They call for a minimum of paved surface area and avoidance of excessive speeds.

Instead it is in deeds (that is, the specific guidelines set forth) that the manuals differ. What follows is an international comparison of geometrics, sidewalk warrants, intersection treatments, network design, and traffic-calming measures. Space permits discussion only of the high points.

More details are provided in Tables 1 through 3. For the sake of comparison British and Australian street dimensions have been converted from meters into feet and from kilometers per hour into miles per hour.

Geometrics: Local Streets

Design speeds are about the same for American, British, and Australian local and access roads (excluding Australian "access places"). Yet minimum pavement widths and maximum curve radii are so much greater for American than British or Australian streets

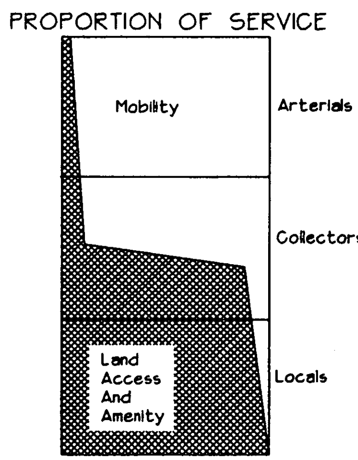

FIGURE 5 Australian-British hierarchy.

TABLE 1 Design Guidelines for Local and Access Roads

	British Design Guide 32	Australian Model Code	American AASHTO	American ITE	American ASCE/NAHB/ ULI
Design Speed	30 mph (major access roads) 20 mph (minor access roads) below 20 mph (shared surface streets)	24.8 mph (major access streets) 18.6 mph (minor access streets) 9.3 mph (access places)	20-30 mph	30 mph (level) 25 mph (rolling) 20 mph (hilly)	20 mph (access street and subcollector)
Pavement Width	12.0-18.0' (9.8' with passing bays)	18.0-21.3' (major access streets) 16.4-18.0 (minor access streets) 11.5-16.4' (access places)	26' standard (less when ROW is severely limited)	22-28' (low density) 28-34' (medium density) 36' (high density)	22-24' (access street) 26' (subcollector)
Minimum Curve Radius	32.8-98.4'	no minimums specified - maximum radius specified for traffic calming at each design speed (e.g., 98' curve to slow to traffic to 18.6 mph)	100' (as large as possible)	300' (level) 175' (rolling) 110' (hilly) (50' when street makes right angle turn)	100-150' (access streets) 150-300' (subcollector)
Curb (Corner) Radius	13.1-19.7' (depending on road width and volumes)	13.1'	15' (minimum of 25' is desirable)	20'	15-20'
Sidewalks	normally on both sides	not required on access places at least one side of access streets	at least one side	only at medium and high densities	not required on access streets at least one side of subcollectors
Minimum Sidewalk Width	4.4-6.6'	3.9'	4'	4-6'	4'

that one suspects that design speeds, in practice, are not all that similar (particularly when British and Australian traffic-calming measures are factored in).

Wider American streets result not from wider individual lanes but from a three-lane cross section, an unobstructed traffic lane, and parking on both sides (Figure 6). Americans assume the worst case (parked cars across from each other), which leaves Americans with very wide, high-speed cross sections for the common case (light traffic and no parked cars).

In contrast, the British and Australians allow one- and two-lane cross sections on local roads and deal with the worst case by requiring adequate off-street parking for residents (as Americans do almost always), banning parking on one or both sides (as Americans do sometimes), and providing frequent parking or passing bays on the narrowest streets (Figure 7).

As for curve radii, Americans strictly limit centerline curvature to extend sight distances. AASHTO's policy, for example, requires a minimum radius of 100 ft but recommends "as large a radius curve as feasible." British and Australians, on the other hand, use sharp curvature to slow down traffic to design speeds. Sight distances may be limited on such curves, but so are travel speeds.

One respect in which British and Australian guidelines do not differ much from American guidelines is in minimum curb (corner) radii at intersections. Large curb radii are not pedestrian friendly be-

TABLE 2 Design Guidelines for Collectors and Distributors

	British Roads and Traffic	Australian Model Code	American AASHTO	American ITE	American ASCE/NAHB/ ULI
Design Speed	37.5-43.8 mph (30-40 mph speed limits)	31 mph (collectors) 37.2 mph (trunk collectors)	30 mph or higher	35 mph (level) 30 mph (rolling) 25 mph (hilly)	25-35 mph
Pavement Width	20.0-32.8' (2 lane) 40.4-47.9' (4 lane)	21.3-24.6' (collectors) 32.8' plus a median (trunk collectors)	20-44' (if practical, build four lanes and use the extra two for parking until needed)	24-36' (low and medium densities) 40' (high densities)	36'
Minimum Curve Radius	197-295'	no minimums specified - maximum radius of 197' specified for traffic calming at a design speed of 31 mph		350' (level) 250' (rolling) 150' (hilly)	300-500'
Curb Radius	32.8'		25-30' (where feasible)	25-30'	25-30'
Sidewalks	both sides	both sides of collectors both sides of trunk collectors when part of pedestrian network	both sides of roads used for access to schools, etc.	both sides	both sides
Minimum Sidewalk Width	5.9-6.6' (wider where larger flows)	3.9'	4'	4-6'	4'

cause they add to crossing distances and allow motorists to negotiate turns at high speeds. The British and Australian radii are larger than might be expected, given the pedestrian orientations of their other guidelines. They reflect a desire to avoid any encroachment of turning vehicles into opposing lanes.

Geometrics: Collectors

Unlike local roads, American, British, and Australian designs are similar for collectors. Apparently, the three countries have a common perception of collectors' function in the road hierarchy. They are perceived as channels of movement instead of extensions of the residential environment. (The Australians classify collectors as *residential streets* instead of *traffic routes,* implying an access function. However, the Australian design guidelines for collectors make them more like arterials than access streets.) The one respect in which the British and Australian guidelines differ significantly from the American guidelines is in their acceptance of relatively tight horizontal curves (Figure 8). As with local streets, curves are used on British and Australian collectors to enforce design speeds.

Sidewalk Warrants

Pedestrians appear better accommodated by the British and Australians than the Americans. It is not a matter of differing warrants for sidewalks. American manuals require sidewalks on higher-volume streets, and British and Australian manuals make exceptions to sidewalk requirements on lower-volume streets.

Rather, the difference among the countries is this: when sidewalks are not required, the British and Australians take extraordinary measures to slow down traffic. Both countries have incorporated *shared surface* street designs into their guidelines (Figure 9). These are streets with design speeds below 20 mph and special pavements, gateways, islands, and other measures to enforce the low design speeds. These streets differ from Dutch *woonerven* only in the avoidance of the "obstacle course" effect associated with *woonerf* designs.

Intersection Treatments

Ourston (*11*) contrasts British and American intersection designs and traffic controls. Americans usually opt for crossroads and traf-

TABLE 3 Other Design Guidelines

	British Design Guide 32	Australian Model Code	American AASHTO	American ITE	American ASCE/NAHB/ULI
Intersection Treatments	Ts or roundabouts (crossroads only with raised junctions)	Ts or roundabouts (uncontrolled crossroads should be avoided)		T-intersections (crossroads also acceptable)	T-intersections (4-way intersections and rotaries also acceptable)
Network Designs	see narrative	see narrative		curvilinear designs/ interconnections as direct as possible	linear or curvilinear designs/short distances to collectors
Traffic Calming Devices	raised junctions chicanes speed tables narrowings gateways islands bends	chicanes bends islands narrowings humps thresholds roundabouts		curves	curves islands

fic signals or stop signs, whereas the British favor roundabouts or T-intersections with yield signs. The result, according to Ourston, is constant stop-and-go driving in the United States, whereas traffic in Britain keeps "moving safely with few stops and little sacrifice of land" (*11*).

Consistent with this characterization, the British and Australian manuals call for T-intersections or roundabouts within residential areas (Figure 10). In contrast, the American manuals, with one exception, fail to even acknowledge roundabouts. And although two American manuals recommend T-intersections for safety reasons, they still find crossroads acceptable under all circumstances.

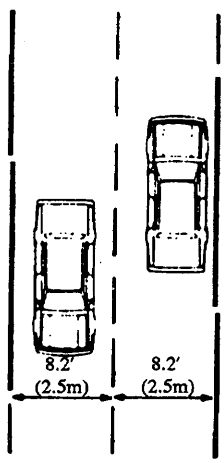

FIGURE 7 Access street in Australia (Source: *Australian Model Code for Residential Development*, p. 50).

Network Design

As a subject, road network design has slipped through the cracks between planning and engineering. Yet network design can have a profound effect on traffic congestion, vehicle miles traveled, accident rates, and fuel consumption (*12–16*).

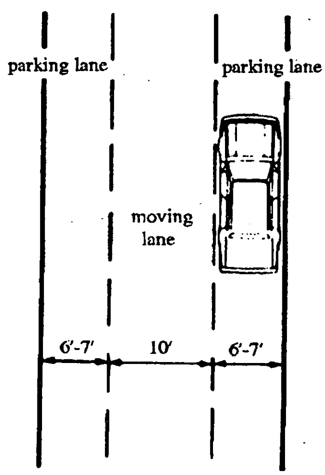

FIGURE 6 Access street in United States (*4*, p. 38).

Because of the general neglect of the subject, the design manuals provide only limited guidance regarding network design. British *Design Bulletin 32* is an exception.

Whereas the first edition of *Design Bulletin 32* (released in 1977) promoted a tree-like hierarchy of roads (relying on cul-de-sacs to avoid through traffic), the 1992 edition promotes what Noble, the principal author, calls a *hierarchical network* of traffic-calmed streets. The introduction of traffic calming gives traffic engineers the ability to design more street connections into the local network, while still discouraging through traffic and moderating impacts of local traffic.

Through traffic should be kept off residential streets, but not primarily (as in the United States) through the design of dead-end

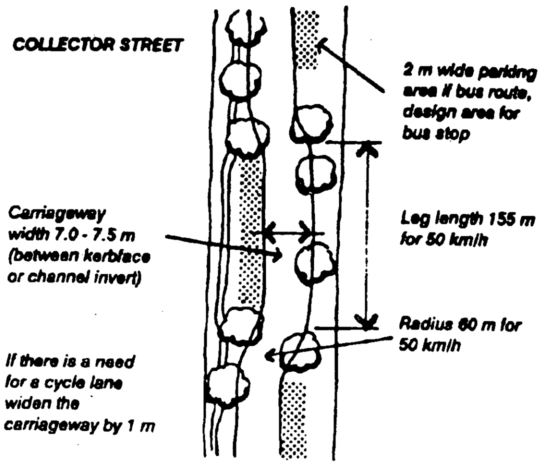

FIGURE 8 Horizontal curves on Australian collector (Source: *Australian Model Code for Residential Development,* p. 58).

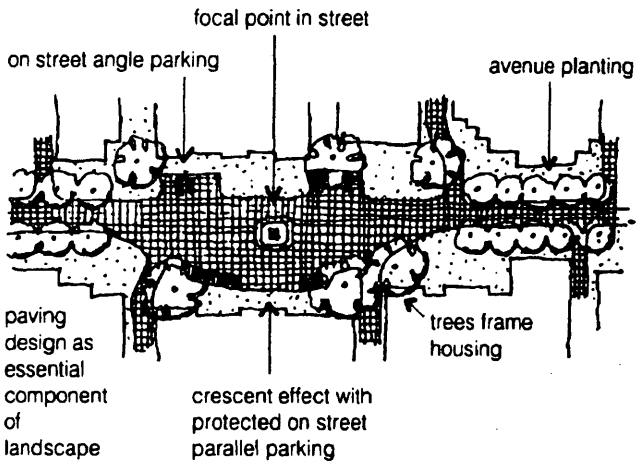

FIGURE 9 Shared surface street in Australia (Source: *AMCORD URBAN, Guidelines for Urban Housing, Draft Code for Urban Housing,* p. 2–45).

streets. Instead, the British favor circuitous through streets or loop roads (Figure 11). Cul-de-sacs are reserved for very small housing clusters. Compared with cul-de-sacs, through streets and loops are said to reduce the nuisance of reversing and turning, distribute vehicles more evenly across the network, and halve the distances traveled by service vehicles.

This is one area where the British and Australians part company. Although a cadre of Australian traffic engineers is calling for more permeability (connectivity) in local road networks and the model development code of one state—Victoria—embraces the idea, the weight of professional opinion still favors branching networks that exclude through traffic from residential streets. As a concession to network efficiency, the Australian model code limits to 1 min the amount of time required to reach a collector from any residential address. In other words, drivers must move up and down the hierarchy to get anywhere, but local streets are short enough and routes are direct enough to keep the access trip tolerable (Figure 12).

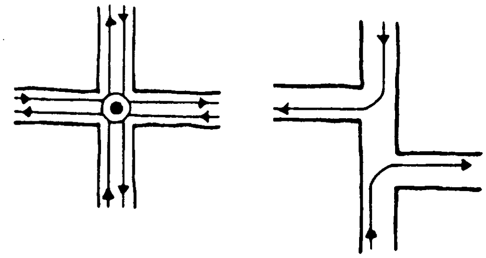

FIGURE 10 Preferred British intersection treatments (Source: *Residential Roads and Footpaths, Layout Considerations, Design Bulletin 32,* p. 45).

Traffic-Calming Measures

One of the imponderables of life in America is why engineers design roads for one speed and then promptly post much lower speed limits. When drivers exceed the speed limit, going speeds that are safe for given road widths, curvatures, and sight distances, one should not be surprised.

When the British and Australians set low speed limits, they mean it. In Britain, for example, the Department of Transport will approve low (20 mph) speed limits on residential streets only when drivers are alerted to the fact and engineering measures are taken to enforce the speed limit. Speed limits on local streets must be self-enforcing, there being minimal police presence on low-volume residential streets.

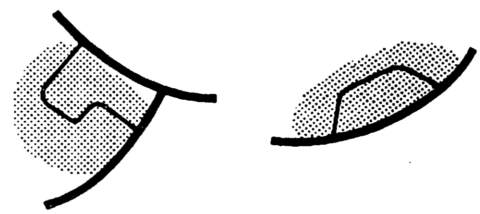

FIGURE 11 British road layouts favored over cul-de-sacs (Source: *Roads and Traffic in Urban Areas,* p. 261).

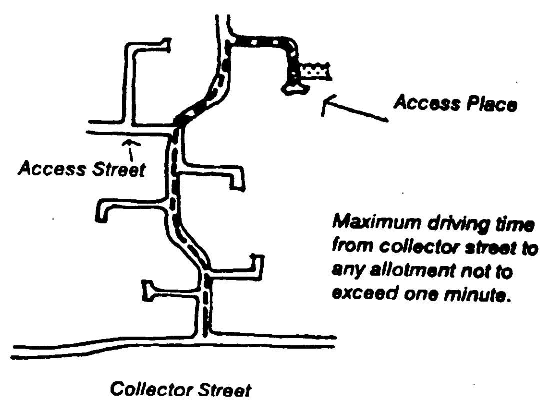

FIGURE 12 Maximum driving time out of a subdivision (Source: *Australian Model Code for Residential Development,* p. 48).

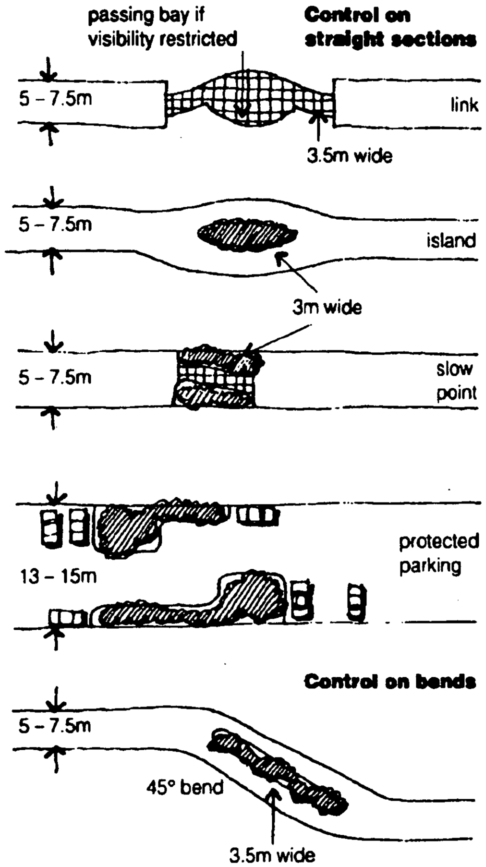

FIGURE 13 Australian traffic-calming devices (Source: *AMCORD URBAN, Guidelines for Urban Housing, Draft Code for Urban Housing,* p. 2-39).

Americans may use horizontal curvature to slow traffic or perhaps place an island at the entrance to a subdivision to create a gateway effect. But the British and Australians control speeds holistically, through European-like traffic calming. They use road network design, road geometrics, pavement texture and materials, edge treatments, roadside development, landscaping, and traffic-calming devices to create a protected environment (*17*). A host of traffic-calming devices is recommended in the design manuals of these countries (Table 3 and Figure 13).

CONCLUSION

This paper has compared American, British, and Australian geometrics, sidewalk warrants, intersection treatments, network designs, and traffic-calming measures. British and Australian guidelines provide for narrower pavement surfaces, sharper horizontal curves to control speeds, roundabouts and T-intersections, more efficient networks, and a wide array of traffic-calming devices.

Americans have fallen behind the British and Australians in the conception of residential street functions and approaches to traffic management. British and Australian design guidelines appear to offer the best of the contemporary and the neotraditional, including European traffic calming.

ACKNOWLEDGMENTS

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