

Annotated Bibliography: Smart Growth Streets and Emergency Response Workshop

This annotated bibliography was prepared for an April 1-2, 2008, workshop sponsored by the Congress for the New Urbanism and the U.S. Department of Environmental Protection (EPA) as part of a collaborative initiative on smart growth streets and emergency response. Nineteen sources are summarized here. The publications noted with an asterisk may be downloaded at no cost from the following website established for the CNU-EPA April 2008 Smart Growth Streets and Emergency Response Workshop: <www.cuesfau.org/cnu/cnu-epa.asp>. The other publications are available for purchase from the cited websites.

***Bray, Terrence L., and Victor Rhodes (1997). "In Search of Cheap and Skinny Streets." Berkeley, CA: *Places*, 1:2 (summer), 32-39.**
<http://repositories.cdlib.org/ced/places/vol11/iss2/TerrenceLBray_VictorFRhodes>

In 1991 the Portland City Council authorized new "skinny" street standards for local service streets, which generally serve either commercial-industrial districts or residential neighborhoods. The new standards for local residential streets are either 26 or 20 feet wide, depending on neighborhood parking needs. The 26-foot street standard allows parking on both sides. Specifically, this establishes a street with two 7-foot-wide parking lanes and a single 12-foot-wide travel lane. The 20-foot street standard allows parking on one side, creating a street with one 7-foot-wide parking lane and a single 13-foot-wide travel lane. The standards are approved for use on local through streets and on cul-de-sacs up to 300 feet in length.

Two-way travel is allowed on these local streets. As the article explains, under these standards, "One of the more intriguing ideas involves building two-way streets with only a single travel lane. If the street is built with a single travel lane, requiring one opposing vehicle to pull over while the other passes by, then you have a queuing street (which we subsequently dubbed a 'skinny street'). It was easy to see how, as *Residential Streets* suggests, 'designs that encourage this kind of cautious driver behavior result in reduced speed, greater attention on the part of drivers to conflict, and, thus, safer streets.'"

As a result of the new standards, Bray and Rhodes observe, the city has gone from "the aircraft runway standard to what we and our neighborhood customers believe are much more people-friendly streets." The new standards responded to public complaints that the city's previous standards were leading to streets that "were too costly, wide and invasive" and encouraged "shortcut high-speed traffic through their neighborhoods." (Portland residents have a vested interest in the cost of neighborhood streets; they share in those costs through local improvement districts.) The city noted that while it had been building three to four miles of local street improvements each year according to the previous standards for wider streets (up to 32 feet wide with parking on both sides), the city was simultaneously spending approximately one million dollars of traffic management funds each year to retrofit streets with devices to reduce speeding in and shortcuts through residential neighborhoods.

The revised standards were supported by tests (described at length in the article) by the city's traffic engineers and the fire bureau, with its engines and ladder trucks, on existing skinny streets in Portland's older neighborhoods. The first step was to examine the streets in established neighborhoods, with the

conclusion that the many miles of 26- and 24-foot streets with parking on both sides were working for residents and for large city vehicles such as dump trucks. To ensure that streets enabled the safe movement of fire emergency vehicles, the city asked the fire bureau (which had historically required 20-foot-wide unobstructed fire lanes) to demonstrate how the city's narrower streets (26-, 24-, and 20-foot wide) did or did not work. The conclusion of the fire bureau was that those streets did work, with the proviso that cul-de-sacs be limited in length to 300 feet or less.

Burden, Dan, with Paul Zykofsky (2000). *Emergency Response: Traffic Calming and Traditional Neighborhood Streets*. Sacramento, CA: Local Government Commission Center for Livable Communities. <www2.lgc.org/bookstore/list.cfm?categoryId=1>

According to the authors, this publication is designed to provide fire departments and other emergency responders with a working understanding of traffic calming and traditional neighborhood street design "so that they can play a partnership role in discussion and implementation of these measures." On the converse side, the publication is intended to inform planners, local government officials, and citizens about the needs of emergency responders. The goal is to help address firefighters' concerns about the move toward taming traffic (slowing it down and reducing congestion and noise) through traffic calming and re-instituting traditional narrower streets (versus the wider, higher-speed streets that characterize most suburban developments of the last 50 years).

The publication is divided into four illustrated sections.

Introduction – Highlights the reasons behind the growing popularity of traffic calming and a return to narrower, traditional neighborhood streets and the importance of having fire officials, as well as other key road users, at the table when those options are discussed.

Part One – Outlines what the authors see as the facts and myths of traffic calming, particularly as they relate to emergency responders. When well-selected and well-placed, traffic calming, the authors contend, should not adversely impact emergency response times, hinder site operation, or damage fire equipment.

Part Two – Describes the 14 most common traffic calming tools and their impact on emergency responders. Each tool description includes an analysis of average delays and offers comments on appropriate and inappropriate locations and designs. Curb extensions, the authors note, are effective in places such as downtowns or around a school where there are a high number of pedestrians and a shortage of parking and a 20-foot-wide space is needed for fire operations.

Part Three – Provides a useful description of traditional neighborhood streets and street networks and their advantages (when compared to conventional streets, especially those with long cul-de-sacs) to emergency responders. As illustrated in two side-by-side diagrams, highly connected traditional street networks offer more direct routes and more points of access to each street and each property than conventional street networks with many long cul-de-sacs (which only provide a few access points to major arterial streets). The design improves emergency vehicle access and response times and helps responders travel longer on main streets. Part Three also includes a traditional neighborhood travelway vocabulary (trails, alleys, lanes, streets, avenues, boulevards, and parkways). Each travelway description includes notes on appropriate designs and uses and the effects, if any, on emergency responders. Other techniques for improving emergency response are also discussed (for example, the practice in some

historic towns with tighter street geometry of purchasing equipment that gives the fastest response times).

Dan Burden, with Paul Zykofsky (2000). *Walkable Streets and Fire Departments* (VHS format). Sacramento, CA: Local Government Commission Center for Livable Communities. <www2.lgc.org/bookstore/detail.cfm?itemId=29>

This 30-minute video was prepared as a follow-up to the Local Government Commission's 1999 publication *Street Design Guidelines for Healthy Neighborhoods* and a companion to *Emergency Response: Traffic Calming and Traditional Neighborhood Streets*. The video provides a helpful starting point for communities seeking to build traditional neighborhoods with more people-friendly, safe streets. Interviews and demonstrations with fire departments from Portland, Oregon, and Chico and Mountain View, California, are featured. Fire chiefs discuss what their needs are and how they can be accommodated in traditional neighborhoods with narrow streets. The video, the authors note, also shows how fire trucks maneuver on those streets and provides practical advice on how to design pedestrian-friendly, narrower streets and streets with calmed traffic that address the needs of emergency responders. A theme throughout the video is the importance of putting in place a collaborative planning process that involves all the affected parties. When fire departments, developers, traffic engineers, and citizens work together, the tape concludes, communities can result that work for everyone. The video includes a review of the need for narrower new streets and calming traffic on existing streets in town centers and residential neighborhoods. (Narrow streets are defined as 24 to 26 feet curb-to-curb with parking on both sides of the street, or narrower with parking on one side of the street or in parking bays.) "Good neighborhoods begin with well-designed streets," the video concludes.

Burden, Dan, with Michael Wallwork, P.E., Ken Sides, P.E., Ramon Trias, and Harrison Bright Rue (1999, Rev. 2002). *Street Design Guidelines for Healthy Neighborhoods*. Sacramento, CA: Local Government Center for Livable Communities. <www2.lgc.org/bookstore/detail.cfm?itemId=13>

This publication was written by Dan Burden with a team of experts in traffic engineering, transportation planning, and community design. According to the authors, it shows how to "understand, preserve and resurrect characteristics of older neighborhood streets and how to build them again with urban infill and new development." The guide notes that real estate studies reveal those streets to be the top preference when individuals are purchasing a home. Such streets are not a new idea, the authors observe: they are the "streets that our grandparents lived on" and, as such, should help us understand the streets we need to design today as a component of healthy neighborhoods and livable communities. The publication begins with a concise review of how the current wider, higher-speed street standards became the norm; the safety, access, and mobility problems they created; and the features and benefits of what the authors call healthy (narrower, pedestrian-friendly) streets.

The descriptions of healthy neighborhood street design principles, the authors note, are useful for those seeking to understand, design, or measure the success of healthy streets that are safe, efficient, and aesthetically pleasing for cars and people. The design principles for Emergency Vehicles (pages 38-39) are intended to demonstrate the benefits of healthy neighborhood design and address common misconceptions about the national fire code and insurance carrier requirements. The benefits for emergency vehicles noted by the authors include:

- The ability to reach a destination by more direct routes at moderate speeds with minimum or no delays because of more frequent entry points.
- Fewer stop signs and traffic signals.
- At least two means of access to each property.

(A brochure entitled *Designing Safe Streets and Neighborhoods* is also available for free download from the Local Government Center for Livable Communities at www.lgc.org/freepub/PDF/Land_Use/focus/traffic_safety.pdf.)

Butler, Kent, Susan Handy, and Robert Paterson (2003). *Planning for Street Connectivity: Getting from Here to There*. Chicago, IL: American Planning Association Planning Advisory Service. <www.planning.org/apastore/Search/Default.aspx?p=2426>

This APA Planning Advisory Service publication examines the debate over street connectivity, using research results from a study of efforts by 14 communities to incorporate more street connectivity in their codes. Two of the communities (Austin, Texas, and Raleigh, North Carolina) receive a more in-depth evaluation. The Appendix contains the street connectivity codes of nine communities included in the research. The purpose of street connectivity, the authors note, “is to connect spatially separated places and to enable movement from one place to another. With few exceptions, a local street network connects every place in a community to every other place in the community.... The quality of connections – the ‘connectivity’ of the street network – influences the accessibility of potential destinations in a community and has important implications for travel choice, emergency access, and more generally, quality of life.”

The Preface and Chapter 1 review (using easy to digest drawings) the history of street patterns – the origins of the rectilinear grid in the middle of the 19th century and the movement to replace the grid with a hierarchal approach toward streets after World War II (a movement furthered by Federal Housing Administration [FHA] standards in the 1930s). Now, however, the authors note, after “decades of promoting residential street networks characterized by low connectivity..., a growing number of U.S. cities are beginning to now consider the potential benefits of improved street connectivity.” Reasons for the return to greater street connectivity include improved emergency access, service efficiency, and response times; better options for non-motorized travel (walking and biking) because of more direct routes; less traffic on arterials; and more efficient and cost-effective transportation-based community services, such as trash collection.

In Chapter 2, the authors outline the debate surrounding local ordinances that would require greater connectivity in new residential subdivisions. Such ordinances, the authors observe, are often coupled with provisions that reduce required minimum street widths in order to decrease speed and traffic through residential areas, making them more desirable for walking and biking, and decreasing the amount of impervious surfaces that contribute to stormwater runoff. Provisions for narrower streets also help address developer concerns about the loss of lots that can be developed. The narrower streets compensate for an increase in linear feet of street that may be necessitated by greater connectivity.

In Chapter 3, the authors examine the practice of street connectivity in 12 communities: in Oregon (Metro Regional Government for the Portland area, Portland, Beaverton, and Eugene); Colorado (Fort Collins and Boulder); North Carolina (Cary, Huntersville, Cornelius, and Conover); Delaware (Middleton); and Florida (Orlando). Each community took a different approach to increase

connectivity and, as a result, achieved a varying degree of connectivity (a decision often influenced by the prevailing level of connectivity found in a city, the authors observe). Although there is no standard approach to street connectivity requirements because of the different contexts found in each community, the authors highlight several common practices:

- The great majority of communities (10 of those reviewed) established maximum block lengths, and all but one (Orlando) prohibited gated streets in single-family developments.
- Most communities have requirements for the frequency of bicycle and pedestrian connections, and most have instituted narrower street widths and traffic calming to reduce potential cut-through traffic and speed.
- Of those that allow cul-de-sacs (about one-half of those reviewed), the length is restricted (typically to 200 to 300 feet), and the use is limited to places where connections are impractical.

Another commonality is an important lesson learned – a two-way education system in which emergency service providers, developers, and the public learn about street connectivity (the features and benefits) and city staff learn about the needs of those same constituents.

In Chapter 4, the authors describe the experiences of Raleigh, North Carolina and Austin, Texas, which faced intense debates when considering street connectivity requirements. Their experiences highlight the importance of:

- Relevant, local, and contextual cost-benefit information to help decision-makers arrive at informed conclusions about the trade-offs of street connectivity. Raleigh, for example, focused on the public benefits and costs in four focus areas: travel efficiency and mode choice, fire response and service costs (described on the next page), water and residential trash collection costs, and environmental costs.
- Sustained political and staff leadership and clear direction on the part of the city council. In Raleigh, the city council, with strong staff support, took the initiative; in Austin, the planning commission, not the city council, was the driving force.
- A continuous dialogue among all the stakeholders affected by street connectivity decisions. The experiences of Raleigh and Austin underscore the importance of numerous meetings with all affected and the use of the Internet to share information.

The publication's Afterword introduces a number of issues that merit further consideration as connectivity efforts increase across the country: the most appropriate way to measure connectivity and the correct amount of connectivity; the best network design for achieving the desired level of connectivity (for example, the use of hybrid designs for street networks); what street connectivity means for non-automobile travel modes, how connectivity can be improved in commercial areas; and what can be done to retrofit existing networks (which, the authors note, might be the thorniest issue of all).

“In all cases, the analysis showed far greater service efficiencies for those older neighborhoods with greater street connectivity)... In sum, a fire station in the most interconnected neighborhood could provide service to more than three times as many commercial and residential units as the least connected neighborhood.” (From *Planning for Street Connectivity: Getting from Here to There*, 56-57.)

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Raleigh, North Carolina Fire and Emergency Service Costs

In November 2000, the Raleigh Transportation and Planning Departments undertook a research project to see what the comparative fire and EMS [Emergency Medical Service] service efficiencies would be in neighborhoods with varying levels of street connectivity (Howe 2003). The study calculated the total acreage and dwelling and commercial units that could be serviced within 1.5 miles of a fire station – chosen because the city’s fire response level of service standard is an access reach of 1.5 miles – for three different neighborhood types: (1) older neighborhoods with a dense urban grid and few dead-end streets, (2) an area built during the 1970s and 1980s with somewhat less street connectivity and more dead-end streets, and (3) neighborhoods from the late 1980s and early 1990s with many dead-end streets where street connectivity is quite limited. In order to stimulate build-out conditions, the study applied weighting factors to increase the total dwelling and commercial units in fire response zones that still had vacant parcels.

In all cases, the analysis showed far greater service efficiencies for those older neighborhoods with greater street connectivity. Even when discounting the density of development in these areas, the raw acreage covered in each case confirmed the greater efficiency in fire response coverage for areas with better street connectivity (Raleigh 2002b). In sum, a fire station in the most interconnected neighborhood could provide service to more than three times as many commercial and residential units as the least connected neighborhood. This finding also translated into more than twice the total acreage that could be served per station.

While comparative service efficiency numbers like these are important, they become even more valuable – and convincing – to policy makers and the public when they are translated into real budget terms. According to city estimates, building, furnishing, and staffing a fire station for a year can cost over \$1.7 million (see Table 4.1). By improving street connectivity and thereby expanding service areas, Raleigh will be able to minimize its public service expenditures on new fire stations. Because police and fire services tend to consume the largest portions of most municipal operating budgets, increased connectivity standards can help any city to minimize the number of new police and fire stations built and to ensure that those stations have maximum service coverage.

Table 4.1, City of Raleigh Fire Station Cost Estimates

<i>Capital Costs</i>	
Construction of Station	\$873,745
Furnishings of Station	\$30,000
Fire Apparatus (Engine)	\$257,910
Subtotal	\$1,161,655
<i>Operating Costs</i>	
Utilities/Year	\$6,550
Operating Costs/Year	\$13,970
Salary/Fringe/Year	\$581,850
Subtotal	\$602,370
Grand Total – Fire Station Costs	\$1,764,025

(Excerpted from *Planning for Street Connectivity: Getting from Here to There*, 56-57.)

Duany Plater-Zyberk & Company (2002). *The Lexicon of the New Urbanism*. Version 3.2. Miami, FL: Duany Plater-Zyberk & Company. <www.dpz.com/research.aspx>

The Lexicon of the New Urbanism establishes a vocabulary and set of standards that can be used to understand and organize the structure of urban form at a variety of levels. Street design is based on an interconnected network pattern designed to fit a hierarchy of places ranging from the more rural to the more urban, including the neighborhood. In the *Lexicon*, neighborhoods are “the fundamental human habitat” that offers a compact, walkable, urban mixed-use environment limited in area by walking distance (a five-minute walk from center to edge), not by density or the number of residents. Neighborhoods are structured on a fine-grained network of thoroughfares intended to shorten pedestrian routes and provide multiple routes that diffuse traffic. Those thoroughfares should be designed to provide for both pedestrian comfort – “to encourage the casual meetings that form the bonds of community” – and automobile movement. The smaller thoroughfares within the neighborhoods connect with larger ones at the edges of the neighborhood to increase permeability (the ability to move in, through, and out of a neighborhood) and further disperse traffic. Service alleys are used to provide greater connectivity and accommodate parking requirements. Corridors (which range from boulevards to rail) connect the neighborhood to the region.

***Ewing, Reid (1999). *Traffic Calming: State of the Practice*. Washington, DC: Institute of Transportation Engineers. <www.ite.org/traffic/tcstate.htm#tcsop>**

Developed by the Institute of Transportation Engineers (ITE) in partnership with the Federal Highway Administration, this publication provides an excellent review of traffic calming (in some places called neighborhood traffic management or mitigation) programs and their impacts in the U.S. and Canada. It is intended to provide balanced information about traffic calming to enable readers to make their own decisions. (Traffic calming is defined as “changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and cut-through volumes in the interest of street safety, livability, and other public purposes.”)

Information is drawn from 20 communities that were fully examined and 30 additional ones studied to a lesser degree. The publication specifically focuses on traffic calming measures for local and collector roads within established urban areas, primarily through retrofitting existing situations. This focus is consistent with the observation that, “At the local level, traffic calming responds to public concerns about speeding and cut-through traffic, particularly on neighborhood streets.... Citizens look to their elected officials for leadership in this area....” According to Ewing, one issue often raised relates to the nature of “...a street on which our children are brought up, adults live, and old people spend their last days....”

The publication’s 10 chapters cover all aspects of traffic calming. Chapter 7 specifically addresses the concerns of emergency responders (primarily as they relate to fire-rescue vehicles) and other government agencies. The biggest challenge in traffic calming, the author notes, is to strike a balance between emergency responders’ desire for a timely response and residents’ desire for slower and safer traffic conditions. Generally, fire officials’ concerns mount when they see a rapid increase in traffic calming use on local streets and the expansion of that practice to streets that serve as primary response routes. Chapter 10 contains case studies of cities that have switched to narrower street standards and lists a set of principles that produce a roadway network that disperses and naturally slows traffic.

After examining the results of the emergency response tests conducted by four communities with active traffic calming programs, the report outlines strategies that have been used to address fire-rescue concerns about traffic calming. Sample strategies include avoiding the use of traffic calming on primary emergency routes and access streets to emergency response facilities; gradually escalating traffic calming measures (for example, starting with approaches such as signage and a neighborhood speed watch and moving on to engineering measures only if needed); and employing measures designed to accommodate fire-rescue vehicles (for example, neckdowns and lowering the curb lip around traffic circles from four to two inches for easier mounting).

***Ewing, Reid, Ted Stevens, and Steven J. Brown (2007). "Skinny Streets and Fire Trucks." Washington, DC: Urban Land Institute, *Urban Land* (August), 121-123. <www.smartgrowth.umd.edu/pdf/ULI_SkinnyStreets.pdf>**

The authors examine developments in six states where local planners and citizens worked with fire departments to achieve a workable compromise that enabled narrower streets. (Hitting the east and west coasts and points in-between, the developments were in California, Florida, Georgia, Iowa, Oregon, and Virginia.) Their conclusion is that only a few feet reduction in what is considered typical street widths can make "a difference in livability and environmental impact." The authors describe several approaches and strategies that led to the approval of narrower streets (ranging from 20 feet with parking on one side to 28 feet with parking on both sides):

- Highly connected street grids, allowing fire trucks access from multiple directions.
- Areas where street parking can be restricted (such as alleys, periodic parking bays, and/or areas with off-street common parking areas), thereby freeing up space for emergency vehicle operations.
- Properly sized corner radii and parked cars set back at appropriate distances from intersections to allow for turning fire trucks.
- Sprinklers in residential units, the cost of which was offset by reduced insurance rates.
- Small gaps in on-street parking to allow space for fire truck outriggers.
- Demonstrations with fire trucks and cones and use of simulation programs such as AutoTURN to establish dimensional requirements for returning movements.

Specific fire truck dimensions are also described in the article.

***Institute of Transportation Engineers Transportation Planning Council Committee 5P-8 (1999). *Traditional Neighborhood Development Street Design Guidelines: A Recommended Practice of the Institute of Transportation Engineers*. Washington, DC: Institute of Transportation Engineers. <www.ite.org/emodules/scriptcontent/Orders/ProductDetail.cfm?pc=RP-027A>**

The Institute of Transportation Engineers (ITE) is an international educational and scientific association of transportation professionals who are responsible for meeting mobility and safety needs. Its report, *Traditional Neighborhood Development Street Design Guidelines*, was approved in 1999 as an ITE recommended practice. "Street design," the report begins, "always involves the design of some of the most important and most used public spaces. This is especially true in the case of TND design, where the designers' perspectives are broadened to include the divergent needs of pedestrians, cyclists, transit, and motor vehicles; the street's relationship to adjacent and future land uses; and where many factors

must be compared, considered, and decided to develop the final design solutions.” And, according to the authors, those factors sometimes compete.

The report contains concise descriptions of the essential traditional neighborhood development (TND) principles as they relate to street design and safety. A specific discussion of emergency vehicle access needs is presented on page nine: “Emergency vehicles must be afforded access throughout a TND neighborhood to every parcel and structure.” Important to emergency vehicle access is the highly interconnected street network of TNDs: as a result, there are always at least two access routes to any point and, typically, access to lots through rear alleys. In addition, the authors note, emergency vehicles “have the legal right to use all of the traveled portion of the street.” “In short,” the section on emergency vehicles concludes, “designers should be cognizant that emergency vehicles have greater access options and rights than other vehicles...” The effects of decisions concerning turning radii and paths, the report continues, must be made with a full understanding of the implications of such decisions on the other users of the street.

The discussion of TND review is followed on pages 13-18 by an in-depth look at traffic safety and road design. For example, the text notes that “The desired upper limit of actual motor vehicle speeds on TND streets is approximately 20 mph (29.3 ft/sec)...Rudolph Limpert, in his text *Motor Vehicle Accident Reconstruction and Cause Analysis*, states that ‘analysis of car/pedestrian accident statistics has shown that the probability of [the pedestrian] receiving fatal injuries is 3.5 percent at 15 mph, 37 percent at 31 mph, and 83 percent at 44 mph.’”

Jacobs, Allan B., Elizabeth Macdonald, and Yodan Rofé (2002). *The Boulevard Book: History, Evolution, Design of Multiway Boulevards*. Cambridge, MA: Massachusetts Institute of Technology Press. <www.amazon.com/s/ref=nb_ss_gw/102-8851299-6668124?url=search-alias%3Daps&field>

The authors focus on the multiway boulevard that is “designed to separate through traffic from local traffic and, often, to provide special pedestrian ways on a tree-lined mall.” The primary design features include a central roadway of at least four lanes that carry faster, generally nonlocal traffic, and, on either side of the roadway, tree-lined medians (which can be of varying widths) that separate it from a parallel, one-way access road for slower moving traffic. The access road generally allows parking. The advantage of such a roadway, the authors propose, is that they serve two distinctly different traffic functions (through traffic and traffic accessing land uses along the street). In a discussion of land widths (pages 224-225), the authors address the need to accommodate the access needs of emergency vehicles, particularly fire trucks, and garbage trucks. The widths of the access roads, while narrow, are not less than many residential streets that are accessible. Emergency vehicles also have the option of using the central roadway, the authors write, “without overly increasing distances to the buildings.”

***Lambert, Thomas E. (2006). “Ex-Urban Sprawl as a Factor in Traffic Fatalities and EMS Response Times in the Southeastern United States.” Lewisburg, PA: *Journal of Economic Issues* (December 1). <www.allbusiness.com/finance-insurance/4105488-1.html>**

This article lays out the correlation between the built environment (development patterns and street connectivity) and two major life-safety issues: traffic fatalities and emergency response times. It is based on an examination of fatal traffic crashes and corresponding average emergency medical services (EMS) run times (time of notification to time of arrival) to an accident site for the metropolitan areas of

Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee in 2002. The conclusion was that the more sprawled metropolitan counties had higher traffic fatality rates and longer EMS response times than those with less sprawl.

The fatal traffic crash rates and EMS response times (which used the U.S. National Highway Traffic Safety Administration's Fatal Accident Reporting System [FAR]) were divided into urban and ex-urban (new fringe residential development), as defined by the U.S. Census Bureau, unless state and local officials used a different definition. The study of the selected metropolitan areas demonstrated significantly lower fatality rates and shorter EMS response times to fatal crashes in urban areas, compared to ex-urban. The EMS times were 7.6 minutes for urban and 10.7 minutes for ex-urban from notification to time of arrival, and fatal crashes per 10,000 people averaged 2.5 for urban fatal crashes and 6.3 for ex-urban areas.

Those findings supported other studies that analyze the direct and indirect costs of sprawl. One by Ewing, Schieber, and Zegeer in 2003 concluded that, for the same part of the country (the southern metro counties), the more urbanized land areas of a county had lower fatal crashes per capita and per 10,000 residents than their ex-urban, more sprawled counterparts, which have lower population density and larger and longer blocks. The same study documented the better emergency response times that occur with more compact settlement patterns: "For every 10 percent increase in population density, there is a 10.4 percent decrease in EMS run times." According to the authors, "Shorter EMS run times correspond to more densely settled areas. Although our data came from EMS response times to traffic accidents, we see no reason why response times would be that different for other emergencies." Other studies (for example, Lucy in 2003 and Ewing, Schieber, and Zegeer in 2003) draw the same conclusion: that traffic fatality rates are higher in lower density, sprawling areas than in more densely populated ones.

"[T]he more sprawled an area becomes," the authors conclude, "the more difficult for police, fire and EMS to reach many new households and new developments, even those along existing roadways. The alternative is to build new facilities closer to the new developments, which raises the costs of public service provision."

***Local Government Commission Publications**

The Local Government Commission (LGC) has published three free fact sheets related to street design and emergency response. The first two were produced as part of a project funded by the U.S. EPA. They are based on workshops in northern and southern California that engaged planners, engineers, and fire officials in a discussion of the problems caused by excessive street width and the design solutions that produce narrower streets that are safer for drivers and pedestrians.

Street Design and Emergency Response <www.lgc.org/freepub/PDF/Land_Use/fact_sheets/er_street_design.pdf> –

This four-page fact sheet is intended for use by emergency response officials in reviewing new developments that differ from the conventional, post-war suburban street design where roads were planned with moving cars in mind, rather than creating a public environment friendly for pedestrians and bicyclists. (The LGC describes post-war suburban developments as typically having wide and disconnected streets; long blocks with wide curb radii at corners; numerous cul-de-sacs; little attention to non-motorized travel; and, by design, local traffic that funnels onto regional arterials.) The fact sheet is intended for developments that propose neighborhoods with a traditional interconnected network of

narrow streets and provide multiple access points, have shorter blocks, are generally tree-lined, and allow on-street parking.

Traffic Calming and Emergency Response

www.lgc.org/freepub/PDF/Land_Use/fact_sheets/er_traffic_calming.pdf – This four-page fact sheet describes how existing streets can be retrofitted or redesigned to slow vehicle speed “without severely limiting vehicle travel or significantly affecting emergency response.” To meet the needs of all road users (pedestrians, bicyclists, and emergency responders), a comprehensive view is needed, the publication notes. That view requires involving all affected parties (including residents and emergency responders) in examining the traffic calming solutions that meet the needs of all users and improve safety and livability. This may require “thinking that goes beyond traffic and emergency response manuals.” It also requires not making piecemeal decisions about traffic calming. Traffic calming strategies described include speed humps (which should not be used on primary response routes because they can impede speed and are hard on equipment), visual and physical roadway narrowing, bulbouts or curb extensions, pedestrian refuge islands, and roundabouts.

Emergency Response and Traditional Neighborhood Street Design

www.lgc.org/freepub/land_use/factsheets/er_streetdesign.html – This 12-page fact sheet contains case studies illustrating how local governments, emergency responders, and developers in three cities (Hercules, CA; Memphis, TN; and Seattle, WA) were able to create safe, livable, and walkable neighborhoods with the narrow (26 to 28 feet) streets found in traditional neighborhoods. The trend toward building “new neighborhoods with traditional-style streets that are narrow, tree-lined and allow on-street parking” is facing some problems, the case study author notes. Used to large subdivisions with wider streets (36 to 40 feet), long blocks, and disconnected cul-de-sacs built in the post-war period, fire departments in many places apply that standard to proposals for traditional developments that propose narrower, well-connected streets. That tendency is compounded by a move toward bigger fire-fighting equipment at a time when “[m]any fire departments report that less than 10 percent of their emergency calls are for fire....”

The street design solutions reached in the three case studies, the authors note, demonstrate the importance of a two-way exchange of information – “early and open communication with fire departments” and “a better understanding of traditional neighborhood streets by fire officials.” Examples of those street designs include the following.

- In **Seattle**, the fire department’s long-time experience with the existing traditional, residential, connected street network with 25-foot-wide streets provided an important precedent that aided in the approval of narrow, connected streets in High Point, a 1,600-unit low-impact sustainable development by the Seattle Housing Authority. Drainage permit agreements that called for narrower streets were also a factor. The street design responds to the housing authority’s goal to have narrower streets that create a safe walking environment, have less stormwater runoff, calm traffic, and promote more walking, thereby bringing residents in contact with each other. The resulting street width follows the historic 25-foot grid street pattern, and the two 32-foot streets needed in several locations because of higher densities will use traffic islands at key points to slow traffic and improve pedestrian safety. Alleys, which meet the 20-foot clear width, have 16 feet of pavement.

- In **Memphis' Harbor Town** (considered one of the country's most successful traditional neighborhood developments), project planners gave fire officials an opportunity to review plans early in the process. When concerns were raised about access routes or set-up room, planners and fire officials worked together to find solutions that did not compromise the needs of firefighters or the street design. Flexibility was required on both sides, the case study emphasizes, "but the result was safe streets and a livable neighborhood." Residential streets are 28 feet wide, have parking on both sides of the street, and are arranged in the city's historic grid pattern with short blocks.

***Mirkhah, Azarang (2008). "Claustrophobia: Is affordable housing a fire storm in the making?" Burnsville, MN: *Firehouse.com* (January 15). <[http://cms.firehouse.com/web/online/In-the-Community/Claustrophobia/9\\$57859](http://cms.firehouse.com/web/online/In-the-Community/Claustrophobia/9$57859)>**

Mirkhah, a *Firehouse.com* contributing editor and a Fire Protection Engineer for the City of Las Vegas Department of Fire and Rescue, provides a clear and succinct summary of the access concerns of many fire departments. Those concerns relate specifically to the practice of cluster-design subdivisions where houses are close together, have narrow street frontage (35 to 40 feet), and face narrow streets (20-25 feet wide) that sometimes dead-end. Cluster subdivisions, the author emphasizes, challenge fire protection concepts for residential dwellings and common sense: "After all, it is easy to figure out that on a bad fire day, lots of dry lumber piled up very close together could potentially result in much bigger fires; jeopardizing the safety of not only the occupants, but also of the responding firefighters." To support that statement, Mirkhah reviews the challenges of residential building codes and cluster subdivision design. His conclusion is that it is possible to "[h]ave your cake and eat it too" if smart growth is coupled with proactive firefighters and the highest level of fire protection and life safety for both occupants and firefighters (which should include residential fire sprinkler systems).

A principal building code challenge has to do with the International Residential Code that applies to one- and two-family dwellings that do not exceed three stories. Although in 2006 the code was changed to require that exterior walls have a one-hour fire resistive rating if they were five feet (versus the previous three) from the dwelling to the property line, 25 percent of the required one-hour fire resistive exterior wall can be unprotected openings (for example, windows and vents). That allowance for unprotected openings raises serious concerns about the increased possibility of a fire jumping from house to house (the closer the houses, the greater the risk). That situation is exacerbated by wind conditions. The installation of fire sprinklers is crucial because, according to Mirkhah, both the occupants of a house and firefighters "are better protected by residential fire sprinkler systems than the fire rating of their exterior walls."

The proximity of houses, as well as narrow streets and long dead-end streets, in cluster subdivision design presents challenges for response times and the placement of apparatus that can further "delays fire rescue and suppression efforts." The problems particularly relate to bringing in and staging ladder trucks, often needed with the three-story homes used in some cluster developments. Three-story houses in cluster developments can lead to another challenge: many suburban fire stations are not designed to accommodate fire trucks with aerials. Because of those challenges, Mirkhah states, firefighters not only need to be involved in planning commission meetings and public hearings when cluster developments are discussed, they need to come armed with the information to demonstrate the impacts on fire operation costs (fire station locations, apparatus placement, equipment, and staffing requirements).

National Association of Home Builders, American Society of Civil Engineers, Institute of Transportation Engineers, and the Urban Land Institute (2001). *Residential Streets*, 3rd Edition. Washington, DC: Urban Land Institute.
<www.uli.org/AM/Template.cfm?Section=Transportation1&template=/ECommerce/ProductDisplay>

This third edition of *Residential Streets* is based on the premise that neighborhood streets are an important organizing element of neighborhoods, and, therefore, street design cannot be treated separately from the neighborhood. In the introduction, Walter Kulash, the book's primary author, reviews the evolution of U.S. street planning from the emphasis on wider residential streets that took hold in the 1940s and 1950s to a return in more recent years to an emphasis on the "relationship between the design of residential streets and their unique function ... and the role of streets in establishing a residential community's intimate scale rather than detracting from it."

Kulash's premise is that a residential street's design should be appropriate to its functions – a street's role as part of a "residential community's living environment" and its place in a hierarchy of street uses (graduating from local streets to residential collector streets to arterial streets, where mobility is the primary purpose, and then to freeways). The recommended street designs are intended to produce one of three types of traffic flow – free, slow, and yield (where two-way traffic is not possible because parked vehicles are present, which causes a motorist to stop and yield to an oncoming vehicle) – which are illustrated and described on pages 12-14. Yield flow, the author notes, was the widely accepted norm for local streets prior to the 1960s, which is why so many local streets in the U.S. operate in that manner.

Pages 14 and 15 address emergency vehicle access. Each recommended street design, the authors write, fully accommodates emergency vehicles and recognizes that the accessibility provided by a well-connected network of streets is one of the most important street design features to emergency providers. Consequently, a street pattern should provide for at least two routes to any street within a community, thus reducing the risk that an emergency vehicle will be blocked. (A multi-access neighborhood is in contrast to the challenges presented to emergency vehicles by a street pattern featuring "a single-entry/exit street spine with all destinations located on dead-end branches of the spine.") Other options for accommodating emergency vehicles include establishing a no-parking area in selected places to open up space for vehicles to pass and set up emergency equipment, and fitting vehicles to a community's needs, not the reverse. That means not taking a "one-size-fits-all philosophy of specifying fire equipment," which can result in using larger vehicles than needed in residential areas.

***Oregon, State of, Transportation and Growth Management Program (2000). *Neighborhood Street Design Guidelines, An Oregon Guide for Reducing Street Widths: A Consensus Agreement by the Stakeholder Design Team*. Portland, OR: Neighborhood Streets Project Stakeholders.** <www.oregon.gov/LCD/docs/publications/neighstreet.pdf>

The *Oregon Guide for Reducing Street Widths* (which focuses on local streets that carry limited traffic, not collectors or arterials) provides a useful and easy-to-read primer on the reasons for and the design of narrower streets, including the practices that successfully accommodate emergency vehicles. The guidelines are endorsed by the Oregon Office of the State Fire Marshal, the Oregon Fire Chiefs Association, the Oregon Fire Marshals' Association, the Oregon Chiefs of Police Association, the Oregon Refuse and Recycling Association, the Oregon Building Industry Association, the Oregon

Chapter of the American Planning Association, the Oregon Chapter of the American Public Works Association, the Association of Oregon City Planning Directors, Livable Oregon, Inc., 1000 Friends of Oregon, the Oregon Department of Land Conservation & Development, and the Oregon Department of Transportation. As noted in the governor’s introduction letter to the guide, “This document is the result of hard work and commitment of individuals who joined in a collaborative process to reconcile the multiple uses of our neighborhood streets.”

The guide contains diagrams depicting the design of three potential scenarios (20-feet with no parking, 24-feet with parking on one side, and 28-foot-wide roads with parking on both sides) that are presented as model standards that do not preclude other options. Two-way streets less than 20 feet in width are not recommended, the guide says. If, in a special circumstance, a community allows a street less than 20 feet, “safety measures such as residential sprinklers, one-way street designations, and block lengths less than 300 feet may be needed.”

The guide provides a concise explanation of the issues surrounding the width of neighborhood streets – both the relationship to community livability and the access needs of emergency and other large vehicles. Written at the practical how-to level, it contains a recommended collaborative process for developing neighborhood street width standards (which should include looking “for ways to minimize the risk that fire apparatus will not be able to quickly access an emergency...”). An illustrated checklist of five key factors to address in designing neighborhood streets includes:

- *Queuing* (described above, “In Search of Cheap and Skinny Streets”) – with allowances for driveways or no parking areas to create periodic breaks where a 20-foot-wide clear area is available for parking and operations of fire apparatus.
- *Connected Street Network* – provides emergency service providers multiple ways to reach and access a particular location (and also multiple evacuation routes).
- *Adequate Parking* – recommends adequate on- and off-street parking when adopting narrow street standards (avoids illegal parking that may block access).
- *Parking Enforcement* – ongoing enforcement of parking requirements should be a part of adopting narrow street standards.
- *Sprinklers Not Required* – the provision of sprinklers should not diminish the need to accommodate emergency service providers, since narrow streets “still need to accommodate fire apparatus that respond to non-fire, medical emergencies.”

***Swift, Peter, Dan Painter, and Matthew Goldstein (1997). *Residential Street Typology and Injury Accident Frequency*. Longmont, CO: Swift & Associates.
<<http://massengale.typepad.com/venustas/files/SwiftSafetyStudy.pdf>>**

To better understand the impact of street design on safety, the authors compared approximately 20,000 police accident reports from the City of Longmont, Colorado (located in the growing Boulder-Denver area) to five criteria for evaluating the probability that street design contributed to the accidents.

The conclusion of the analysis, which examined 13 physical characteristics of each injury accident, was that “the most significant relationship to injury accidents was found to be street width.” “As street widths widen, accidents per mile per year increase exponentially,” the authors conclude, and “The safest residential street widths are the narrowest....” Narrow streets, the authors go on to note, improve neighborhood safety by slowing traffic and reducing the frequency and severity of vehicular crashes.

The safest streets in the study were 24 feet wide (24-foot streets had 0.32 collisions per mile per year compared to 1.21 collisions for a typical 36-foot-wide residential street).

To address public safety concerns about fire and emergency vehicle access where narrow streets were used, the authors examined service reports from the city's fire department for the eight-year study period. No fire-related injuries or accidents occurred during the eight-year period of the study. In addition, no access or response time problems were reported. According to the study, "Two structure fires occurred during the study period. The first was in a fairly new subdivision with a street width of 36 feet, and the second was in the older part of town having a street width of 24 feet and a rear alley (20' right-of-way, 12' paved surface)." According to the Longmont Fire Chief, the authors write, for the fire in the older subdivision, the attack strategy "included access from the alley and it was viewed as an advantage to have a second point of access in a narrow street environment." Therefore, the authors conclude, "because of the fire access needs, narrow streets should not be used without at least a second means of access. This can be accomplished with alleys and/or an interconnected network of streets."

***Twaddell, Hannah (2005). "Forward Motion: Making the Connections." Chicago, IL: The American Planning Association. *Planning Commission Journal*, no. 58 (spring), <www.plannersweb.com/216free.pdf>**

Twaddell documents the benefits of an interconnected street network: it shortens travel time because of more direct connections, provides a wider variety of travel choices, and enables more cost-effective public services and infrastructure. "Connected street networks," Twaddell concludes, "provide a framework for cohesive communities [T]he quality and characteristics of the street network are, quite literally, the foundation for a community's success... and [its] long-term prosperity." The features of an interconnected network that benefit residents also benefit firefighters, police, and ambulance service, Twaddell points out. Just as more direct connections shorten travel time for residents trying to reach a destination, they also shorten the travel time for emergency providers who can reach the scene of an emergency faster and serve a broader area without additional operating costs. In addition, the mobility of citizens and emergency providers is improved by creating more ways "to get from point A to point B." Cary, North Carolina, the authors note, is an example of a city that, because of the cost savings created by decreasing travel time and mileage, in 1999 adopted a street connectivity ordinance.